Bankstown Airport

PolAir Major Development Plan

Vol. 2 Appendices

May 2018

POLAIR DEVELOPMENT
Bankstown Airport Limited ABN 50 083 058 637

SYDNEY METRO AIRPORTS
BANKSTOWN & CAMDEN

Consistency with the Airports Act 1996

Appendix A

Appendix A Consistency with the Airports Act 1996

Table 1: Section 89 triggers for Major Airport Development and how they apply to the Project

Major Airport Development triggers (section 89 of the *Airports Act 1996*)	PolAir Project Comment
(a) constructing a new runway	Not applicable
(b) extending the length of a runway	Not applicable
(ba) altering a runway (other than in the course of maintenance works) in any way that significantly changes: (i) flight paths; or (ii) the patterns or levels of aircraft noise	Not applicable - no alteration of runways are proposed
(c) constructing a new building wholly or principally for use as a passenger terminal, where the building's gross floor space is greater than 500 square metres	Not applicable – the building will not be used as a passenger terminal
(d) extending a building that is wholly or principally for use as a passenger terminal, where the extension increases the building's gross floor space by more than 10%	Not applicable – the building will not be used as a passenger terminal
(e) constructing a new building, where: (i) the building is not wholly or principally for use as a passenger terminal; and (ii) the cost of construction exceeds $20 million or such higher amount as is prescribed	Yes - Value of building will exceed $20 million
(f) constructing a new taxiway, where: (i) the construction significantly increases the capacity of the airport to handle movements of passengers, freight or aircraft; and (ii) the cost of construction exceeds $20 million or such higher amount as is prescribed	New taxiways are proposed, however, the cost of construction is unlikely to exceed $20 million
(g) extending a taxiway, where: (i) the extension significantly increases the capacity of the airport to handle movements of passengers, freight or aircraft; and (ii) the cost of construction exceeds $20 million or such higher amount as is prescribed	New taxiways are proposed, however, the cost of construction is unlikely to exceed $20 million
(h) constructing a new road or new vehicular access facility, where: (i) the construction significantly increases the capacity of the airport to handle movements of passengers, freight or aircraft; and (ii) the cost of construction exceeds $20 million or such higher amount as is prescribed	Project unlikely to result in significant changes to road network
(j) extending a road or vehicular access facility, where: (i) the extension significantly increases the capacity of the airport to handle movements of passengers, freight or aircraft; and (ii) the cost of construction exceeds $20 million or such higher amount as is prescribed	Project unlikely to result in significant changes to road network
(k) constructing a new railway or new rail handling facility, where: (i) the construction significantly increases the capacity of the airport to handle movements of passengers, freight or aircraft (ii) the cost of construction exceeds $20 million or such higher amount as is prescribed	Not applicable
(l) extending a railway or rail handling facility, where: (i) the extension significantly increases the capacity of the airport to handle movements of passengers, freight or aircraft; and (ii) the cost of construction exceeds $20 million or such higher amount as is prescribed	Not applicable
(m) a development of a kind that is likely to have significant environmental or ecological impact	The Project will not likely have any significant environmental or ecological impact
(n) a development which affects an area identified as environmentally significant in the environment strategy	The Project will not affect an area which is identified as environmentally significant
(na) a development of a kind that is likely to have a significant impact on the local or regional community	The Project is likely to have a positive impact on the local and regional community, improving the capability of PolAir
(nb) a development in relation to which the Minister has given an approval under section 89A	Not applicable
(o) a development of a kind specified in the regulations	Not applicable

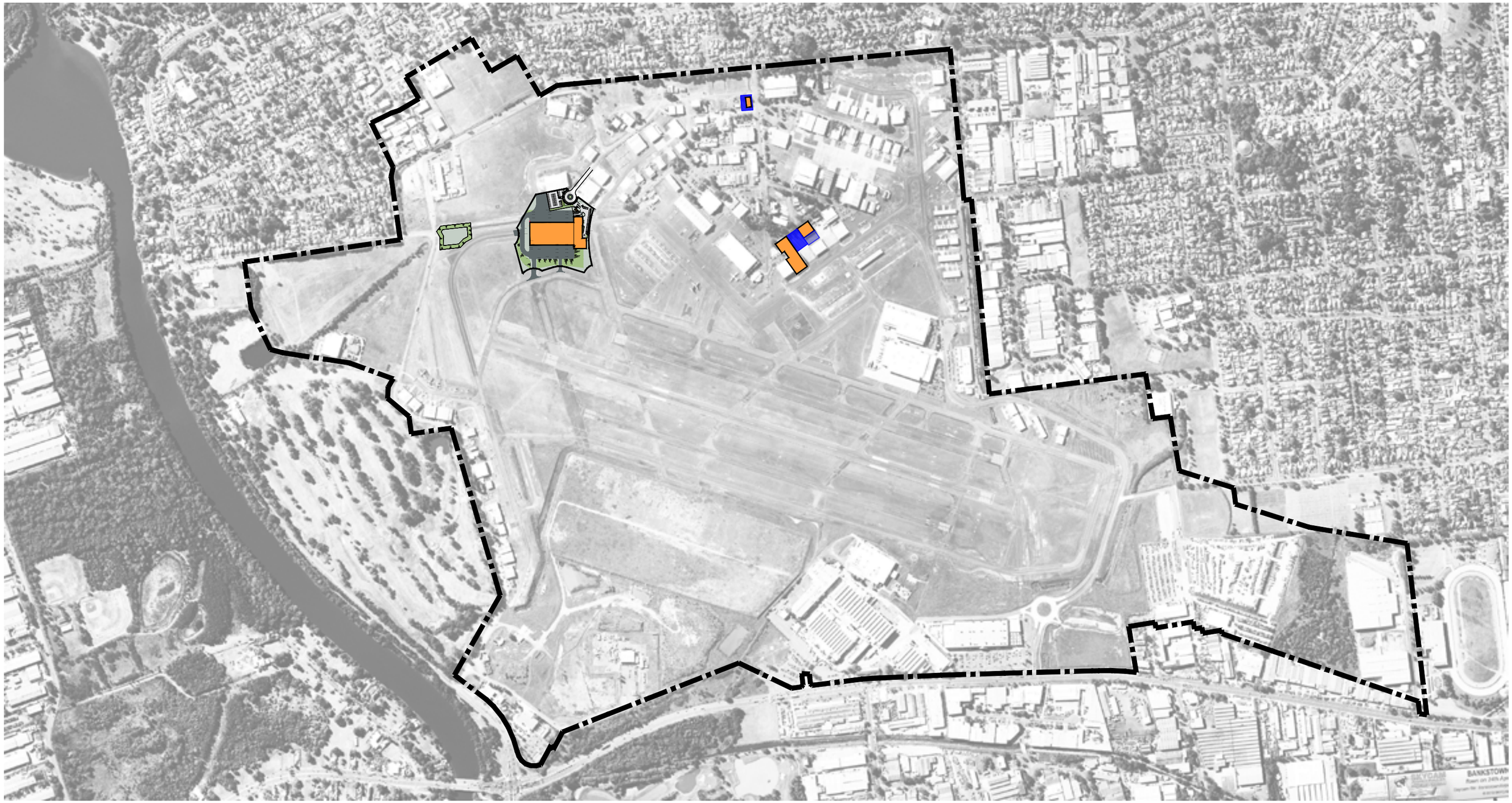
Appendix A Consistency with the Airports Act 1996

Table 2: Section 91(1) Contents of a major development plan

Major Development Plan contents (section 91(1) of the *Airports Act 1996*)	PolAir Project Comment
(a) the airport lessee company's objectives for the development; and	Refer to Chapter 4 Description of the Development
(b) the airport lessee company's assessment of the extent to which the future needs of civil aviation users of the airport, and other users of the airport, will be met by the development; and	Refer to Chapter 3 Need and Justification
(c) a detailed outline of the development; and	Refer to Chapter 4 Description of the Development
(ca) whether or not the development is consistent with the airport lease for the airport; and	Not applicable
(d) if a final master plan for the airport is in force—whether or not the development is consistent with the final master plan; and	Refer to Chapter 7 Consistency with Master Plan
(e) if the development could affect noise exposure levels at the airport—the effect that the development will be likely to have on those levels; and	Refer to Chapter 6 Impact on Airport Operations
(ea) if the development could affect flight paths at the airport—the effect that the development will be likely to have on those flight paths; and	Refer to Chapter 6 Impact on Airport Operations
(f) the airport lessee company's plans, developed following consultations with the airlines that use the airport, local government bodies in the vicinity of the airport and—if the airport is a joint user airport—the Defence Department, for managing aircraft noise intrusion in areas forecast to be subject to exposure above the significant ANEF levels; and	Refer to Chapter 6 Impact on Airport Operations
(g) an outline of the approvals that the airport lessee company, or any other person, has sought, is seeking or proposes to seek under Division 5 or Part 12 in respect of elements of the development; and	Refer to Section 2.5 Major Development Plan Approvals Process
(ga) the likely effect of the proposed developments that are set out in the major development plan, or the draft of the major development plan, on: (i) traffic flows at the airport and surrounding the airport; and (ii) employment levels at the airport; and (iii) the local and regional economy and community, including an analysis of how the proposed developments fit within the local planning schemes for commercial and retail development in the adjacent area; and	Refer to Section 3.5 Socioeconomic and Chapter 8 Ground Transport Plan
(h) the airport lessee company's assessment of the environmental impacts that might reasonably be expected to be associated with the development; and	Refer to Chapter 9 Environmental Assessment
(j) the airport lessee company's plans for dealing with the environmental impacts mentioned in paragraph (h) (including plans for ameliorating or preventing environmental impacts); and	Refer to Chapter 9 Environmental Assessment
(k) if the plan relates to a sensitive development—the exceptional circumstances that the airport lessee company claims will justify the development of the sensitive development at the airport; and	Not applicable

Architectural Plans

Appendix B



POLAIR

E.C.I. PHASE

NEW HANGARS MAINTENANCE ADMINISTRATION
TRAINING AND OPERATIONS FACILITY
BANKSTOWN AIRPORT

MAJOR DEVELOPMENT PLAN - (MDP)
NEW SOUTH WALES POLICE FORCE
AVIATION SUPPORT BRANCH - AIR WING - (ASB)

SUITE 3.01, LEVEL 3 80 MOUNT STREET
NORTH SYDNEY, NSW 2060 AUSTRALIA
ABN 56 120 779 106
NOMINATED ARCHITECTS:
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ISSUE	DATE	AMENDMENTS
F	2018.02.01	MDP REVISION ISSUE
E	2017.12.05	CONSULTANT TEAM ISSUE
D	2017.05.17	MAJOR DEVELOPMENT PLAN ISSUE - FINAL ISSUE
C	2017.05.02	REVISED SITE BOUNDARY ISSUE
B	2017.05.01	MAJOR DEVELOPMENT PLAN ISSUE 02
A	2017.04.20	MAJOR DEVELOPMENT PLAN ISSUE
01	2017.02.09	ISSUED FOR INFORMATION

NSW Police Force

CLIENT: SYDNEY METRO AIRPORTS

PROJECT: POLAIR DEVELOPMENT
NEW HANGARS MAINTENANCE ADMINISTRATION
TRAINING AND OPERATIONS FACILITY
BANKSTOWN AIRPORT

TITLE: COVER SHEET

SCALE N/A
APPROVED -
DRAWN PG
CHECKED PG
DATE DEC 2017
STATUS ECI PHASE

PROJECT NUMBER 14030

DRAWING NUMBER A000

ISSUE F

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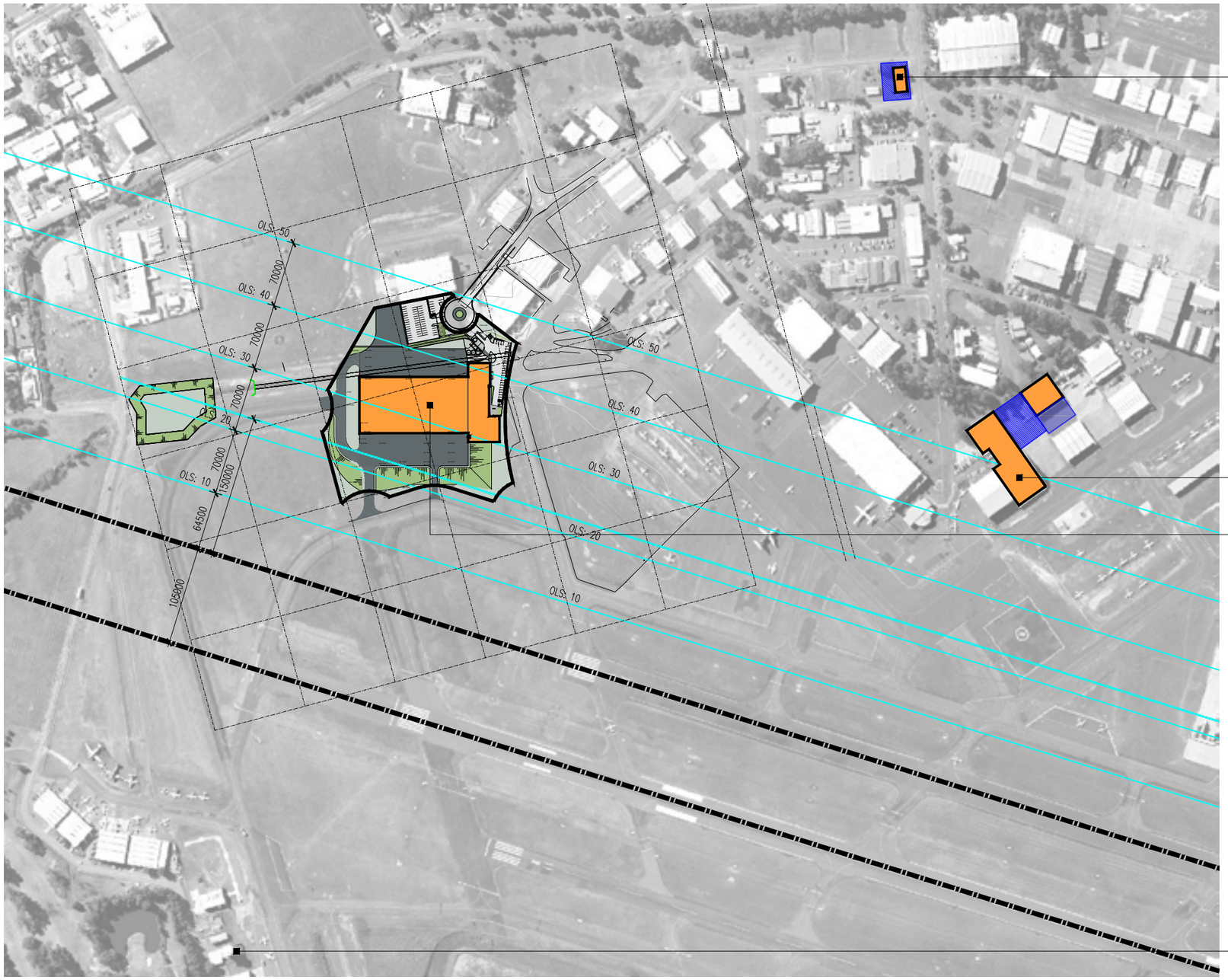

EXISTING FACILITY

EXISTING FACILITY

PROPOSED FACILITY

AIRPORT CONTROL TOWER

	DRAWINGS - MDP	
	COVER	
A001	Location plan and legend	1:2500
A002	Site plan	1:1000
A003	Taxiway adjustments	1:1000
A004	Premises plan	1:1000
	SITE	
A100	Site plan	1:500
	FLOOR PLANS	
A101	Site plan - north east	1:200
A102	Floor plan - east	1:200
A103	Floor plan - west	1:200
A104	Floor plan - first floor	1:100
	ELEVATIONS	
A300	West and east elevations	1:200
A301	North elevation	1:200
A302	South elevation	1:200
	SECTIONS	
A310	Sections A-A and G-G	1:200
A311	Section B-B	1:200
	IMAGERY	
A400	Renders - North 01	NTS
A401	Renders - North 02	NTS
A402	Renders - Entry	NTS
A403	Renders - East	NTS
A404	Renders - South	NTS
A405	Renders - Aerial	NTS

LOCKERS

Lockers	M	F
Doubles	39	7
Singles	40	16
Units	118	40
Total	158	

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ISSUE	DATE	AMENDMENTS
H	2018.02.01	MDP REVISION ISSUE
G	2017.12.05	CONSULTANT TEAM ISSUE
F	2017.05.17	MAJOR DEVELOPMENT PLAN ISSUE - FINAL DRAFT
E	2017.05.02	REVISED ISSUE
D	2017.05.01	MAJOR DEVELOPMENT PLAN ISSUE 02
C	2017.04.20	MAJOR DEVELOPMENT PLAN ISSUE
B	2016.06.21	HEADS OF AGREEMENT REVISION
A	2016.07.15	HEADS OF AGREEMENT ISSUE

NSW Police Force

CLIENT
SYDNEY METRO AIRPORTS

PROJECT
POLAIR DEVELOPMENT
NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT

TITLE
LOCATION PLAN AND LEGEND

SCALE 1:2500 @ A1
APPROVED -
DRAWN PG
CHECKED PG
DATE DEC 2017
STATUS ECI PHASE

PROJECT NUMBER 14030

DRAWING NUMBER A001

ISSUE H

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SITE DETAILS

- SITE EXTENTS
- TAXIWAY & CENTRELII
- NEW TAXIWAY
- ROAD
- EXISTING REDUCED LEVEL

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ISSUE	DATE	AMENDMENTS
Q	2018.02.01	MDP REVISION ISSUE
P	2018.01.18	NORTHERN SCHEDULING AREA EXTENTS AND ALTERNATIVE HANGAR EXPANSION QUERIES
N	2017.12.19	PARKING ADJUSTED & HIBBERTIA EXTENTS MODIFIED

NSW Police Force

CLIENT
SYDNEY METRO AIRPORTS

PROJECT
POLAIR DEVELOPMENT
NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT

TITLE
SITE PLAN

SCALE 1:1000 @ A1, 1:2000 @ A3
APPROVED -
DRAWN PG
CHECKED PG
DATE DEC 2017
STATUS ECI PHASE

PROJECT NUMBER 14030
DRAWING NUMBER A002
ISSUE Q

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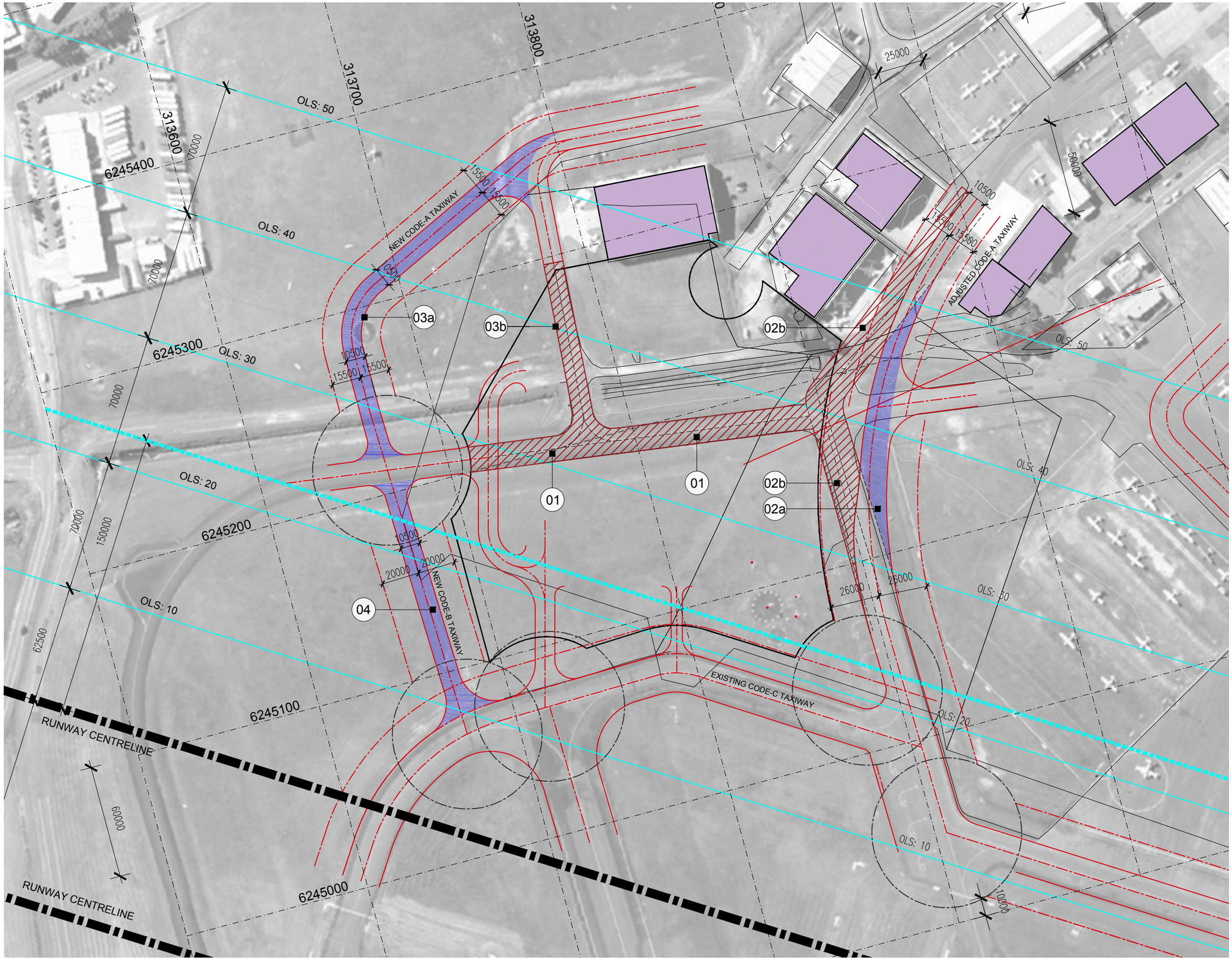

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F	2018.02.01	MDP REVISION ISSUE
E	2017.12.19	CONSULTANT TEAM ISSUE
D	2017.12.05	CONSULTANT TEAM ISSUE
C	2017.05.17	MAJOR DEVELOPMENT PLAN ISSUE - FINAL DRAFT
B	2017.05.01	MAJOR DEVELOPMENT PLAN ISSUE 02
A	2017.04.20	MAJOR DEVELOPMENT PLAN ISSUE

NSW Police Force

CLIENT
SYDNEY METRO AIRPORTS

PROJECT
POLAIR DEVELOPMENT
NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT

TITLE
TAXI ADJUSTMENTS

SCALE 1:1000 @ A1
APPROVED -
DRAWN PG
CHECKED PG
DATE DEC 2017
STATUS ECI PHASE

PROJECT NUMBER 14030
DRAWING NUMBER A003
ISSUE F

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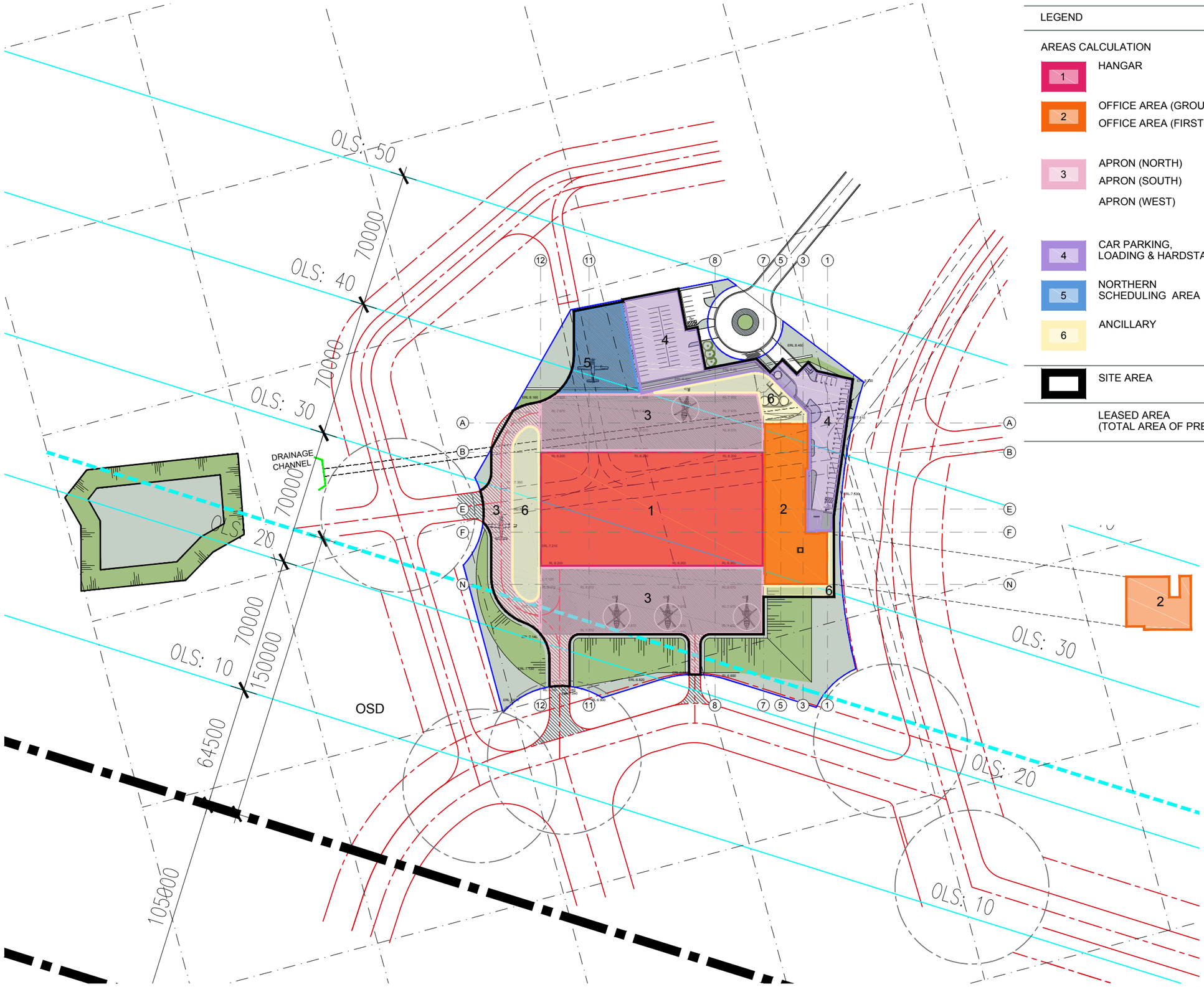

LEGEND

AREAS CALCULATION		APPROX.	APPROX.	TOTALS
1	HANGAR	7,013m2		7,013m2
2	OFFICE AREA (GROUND)	2,222m2		
	OFFICE AREA (FIRST)		849m2	3,071m2
3	APRON (NORTH)	3,450m2		
	APRON (SOUTH)	4,521m2		
	APRON (WEST)	1,434m2		9,405m2
4	CAR PARKING, LOADING & HARDSTAND	3,663m2		3,663m2
5	NORTHERN SCHEDULING AREA	1,411m2		1,411m2
6	ANCILLARY	2,335m2		2,335m2
	SITE AREA	26,049m2		
	LEASED AREA (TOTAL AREA OF PREMISES)		26,898m2	26,898m2

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G	2017.05.17	MAJOR DEVELOPMENT PLAN ISSUE - FINAL DRAFT
F	2017.05.01	MAJOR DEVELOPMENT PLAN ISSUE 02
E	2017.04.20	MAJOR DEVELOPMENT PLAN ISSUE
D	2016.09.30	REVISED CLIENT ISSUE

NSW Police Force

CLIENT: SYDNEY METRO AIRPORTS

PROJECT: POLAIR DEVELOPMENT
NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT

TITLE: PREMISES PLAN

SCALE 1:1000 @ A1
APPROVED -
DRAWN PG
CHECKED PG
DATE DEC 2017
STATUS ECI PHASE

PROJECT NUMBER 14030
DRAWING NUMBER A004
ISSUE J

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SITE DETAILS

- HIBBERTIA MANAGEMENT AREA
- SITE EXTENTS
- TAXIWAY & CENTRELINE
- NEW TAXIWAY
- ROAD
- EXISTING REDUCED LEVEL

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ISSUE	DATE	AMENDMENTS
B	2018.02.01	MDP REVISION ISSUE
A	2018.01.23	FIRST CUT - HIBBERTIA MANAGEMENT PLAN POLYGONS

NSW Police Force

CLIENT: SYDNEY METRO AIRPORTS

PROJECT: POLAIR DEVELOPMENT
NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT

TITLE: HIBBERTIA MANAGEMENT PLAN

SCALE 1:1000 @ A1, 1:2000 @ A3
APPROVED -
DRAWN PG
CHECKED PG
DATE DEC 2017
STATUS ECI PHASE

PROJECT NUMBER 14030

DRAWING NUMBER A010

ISSUE B

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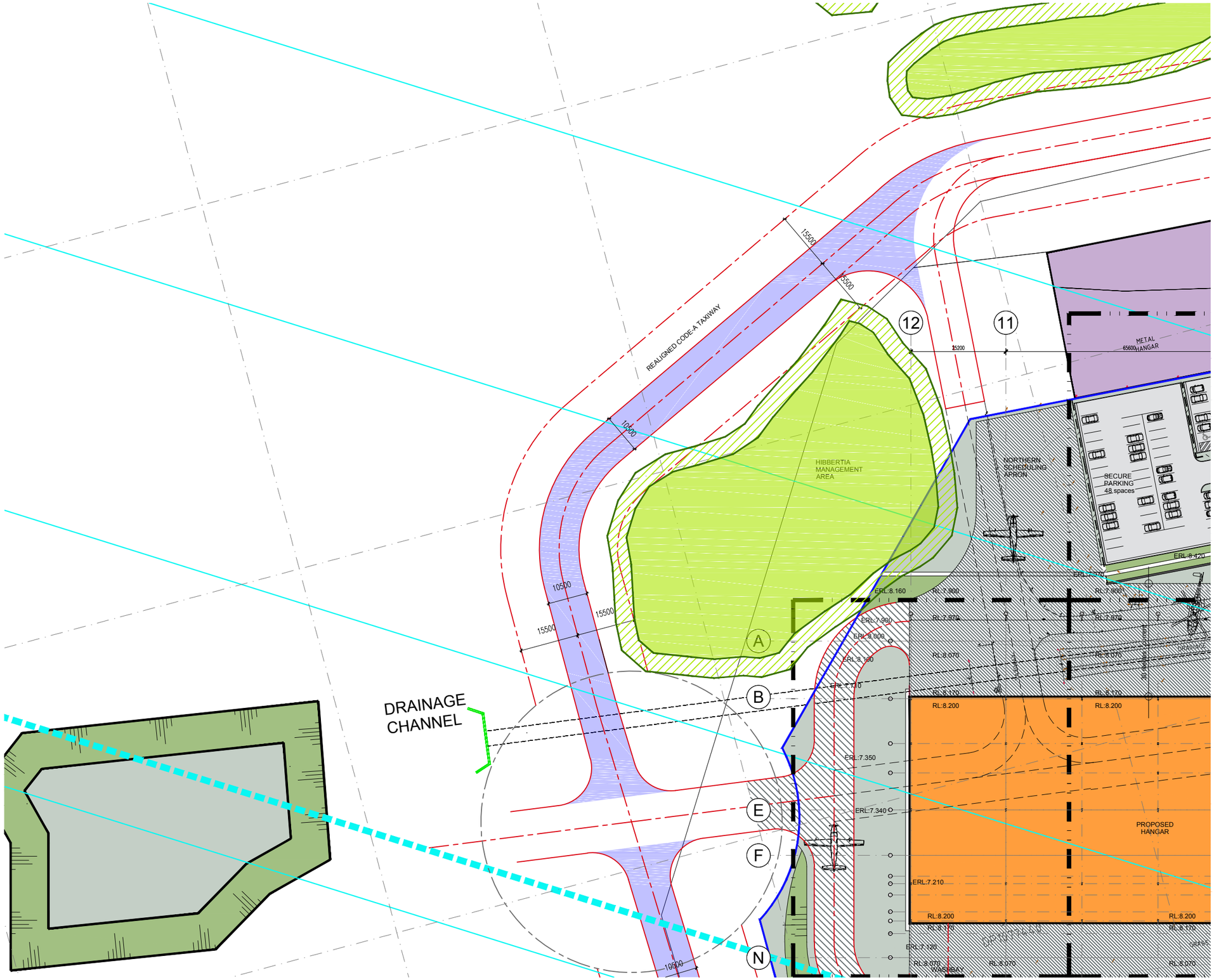


KEY

OPERATIONS

a.01	Operations room
a.02.pe	Ready Room - Personal equipment
a.02.le	Ready Room - Large equipment
a.03	Maps and planning room
a.04	Supervisor - HAAMC
a.05	Operations Manager + Opps Assist
a.06	Chief Pilot
a.07	Meeting / Interview room
a.08	Write Up and Utilities room
a.09.a	Gun store
a.09.b	Gun store - ballistics/discharge
a.10	Operations Supervisor
a.11	Working briefs pigeon holes
a.12	Crew area 01
a.13	Crew area 02
a.14	Opps general store
a.15	Opps quick response - slide
a.16	Opps quick response - stair
a.17	Tea Station
a.18	Store

OPERATIONS SUPPORT

b.01	Boardroom and Press room
b.02	Media distribution room
b.03	Media HD archiving room
b.04	Media HD archiving store
b.05	Fitness Room
b.06	Cleaners room
b.07	Archives
b.08	Accessible WC and shower
b.09	Female WC
b.10	Female Showers
b.11	Female Lockers
b.12	Male WC
b.13	Male Showers
b.14	Male Lockers
b.15	Laundry facilities
b.16	Uniform Store and Helmet workshop
b.17	Wet suit - drying room
b.17.a	Wet suit - wash down zone
b.17.b	Wet suit - in use drying location
b.18	-
b.19	GSO workstation

CIRCULATION

c.01	Entry / swipe / intercom
c.02	Waiting
c.03	Unmanned reception - Spall shield
c.04	Main Vertical circulation stair
c.05	Fire egress stairs
c.06	Lift
c.07	Corridors
c.08	

COMMAND

d.01	Commander
d.02	Commander waiting area
d.03	Compliance Integrity Manager
d.04	Quality Manager
d.05	Safety Manager
d.06	HAAMC
d.07	Air Crash Investigations Manager
d.08	Finance Manager
d.09	Conference Room
d.10	Project Work / Project Manager
d.11	Utilities / Reference Library / Store
d.12	Tea Station

ENGINEERING

e.01	General Workshop
e.02.a	NVG - Workshop / Battery Store
e.02.b	NVG - Fitting Room
e.03	Avionics Workshop
e.04	Engineers Store - Large parts - A/C
e.05	Engineers Store - Small parts - A/C
e.06	Clean workshop - Composite repair
e.07.rc	Tool Crib - Roller Cabs
e.07.ct	Tool Crib - Calibrated Tools
e.08	Paint booth
e.09	Engineers office - Avionics

KEY (Continued)

ENGINEERING (Continued)

e.10	Engineers office - MC
e.11	Engineers office - Airframe
e.12	Store persons office
e.13	First aid
e.14	Utilities
e.15	Tea Preparation
e.16	Chemical wash room
e.17	Industrial Oven
e.18	GSE Hydraulics Cart
e.19	Engineers stores - open - non.A/C
e.20	Chief Engineers office
e.21	Engineers library and layout
e.22	Engineers library secure doc store
e.23	Mezzanine Stores
e.24	Engineers amenities - male
e.25	Engineers amenities - female

TRAINING

f.01	Training room
f.02	Training room furniture store
f.03	Fixed Wing Simulator
f.04	Rotary Wing Simulator
f.05	Winch Simulator area
f.06	Winch Simulator Platform
f.07	Trainers offices
f.08	HOTC: Head of Training + Checking
f.09	Pilot Training Room (CASR Part 141)

GENERAL

g.01	Lunch room
g.02	Kitchen
g.03	Pantry
g.04.a	I.T. Police
g.04.b	I.T. General
g.05	First floor amenities - Male
g.06	First floor amenities - Female
g.07	First floor amenities - Accessible
g.08	Fatigue room - sleep
g.09	Fatigue room - rest
g.10	-
g.11	Visitor / Dignitary Common room
g.12	Outdoor deck and BBQ area

HANGARS

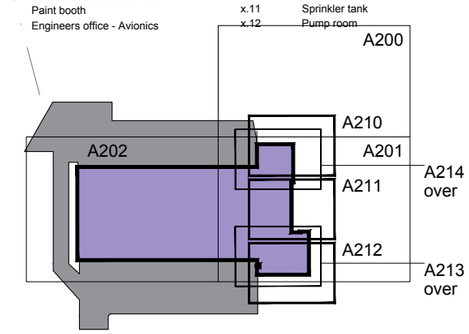
h.01	Rotary wing hangar
h.02	Fixed wing hangar
h.03	Unscheduled maintenance hangar
h.04	Maintenance hangar
h.05	Equipment stores
h.06	Wash bay equipment area
h.07	Overhead Gantry crane
h.08	Handbasin
h.09	Emergency eye wash
h.10	Power - Data - Compressed Air

BUILDING PLANT

k.01	Main switch room
k.02	Electrical Distribution Boards
k.03	Refuse and Recyling area
k.04	Loading and Delivery Docks
k.05	Building Control Room
k.06	Plant room
k.07	Roof Mounted Plant

EXTERNAL WORKS

x.01	Rotary wing Apron
x.02	Fixed wing Apron
x.03	Rotary wing Opps access
x.04.a	Car Parking
x.04.b	Motorcycle Parking
x.04.c	Staff Car Parking
x.04.d	Visitor Car parking
x.05	Loading Dock awning and RS
x.06	Loading Docks Hardstand
x.07	Fuel Trailer storage area
x.08	Dog run and kennels
x.09	Site security fence and gates
x.10	Bunded fuel compound
x.11	Sprinkler tank
x.12	Pump room



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ISSUE	DATE	AMENDMENTS
D	2018.02.01	MDP REVISION ISSUE
C	2018.01.23	CONSULTANT TEAM ISSUE
B	2017.12.05	CONSULTANT TEAM ISSUE
A	2017.12.01	CIVILS ISSUE - INCLUDING HIBBERTIA LOCATIONS

NSW Police Force

CLIENT
SYDNEY METRO AIRPORTS

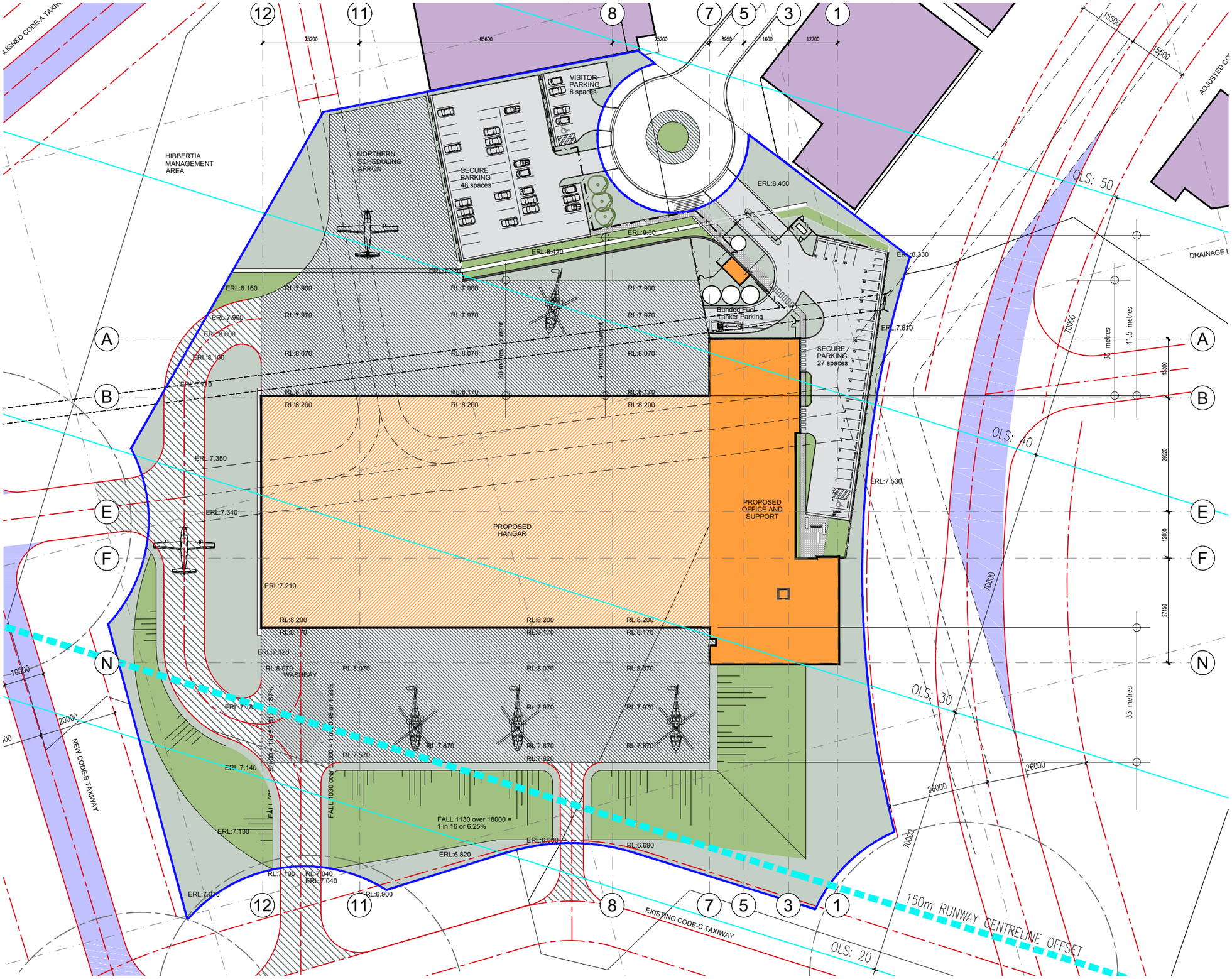
PROJECT
POLAIR DEVELOPMENT
NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT

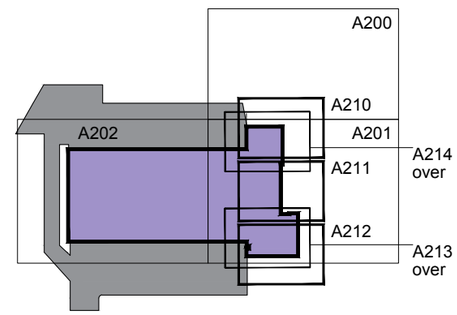
TITLE
SITE PLAN - NORTH WEST HIBBERTIA MANAGEMENT PLAN

SCALE 1:200 @ A1
APPROVED -
DRAWN PG
CHECKED PG
DATE DEC 2017
STATUS ECI PHASE

PROJECT NUMBER 14030
DRAWING NUMBER A110
ISSUE D

crawford architects





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ISSUE	DATE	AMENDMENTS
M	2018.02.01	MDP REVISION ISSUE
L	2018.01.18	NORTHERN SCHEDULING AREA EXTENTS AND ALTERNATIVE HANGAR EXPANSION QUERIES
K	2017.12.19	CONSULTANT TEAM ISSUE
J	2017.12.05	CONSULTANT TEAM ISSUE
H	2017.12.04	CASA TWY CNTRLN ADJUSTMENTS
G	2017.11.21	THREATENED SPECIES ZONE + 10m BUFFER ADDED

NSW Police Force

CLIENT: SYDNEY METRO AIRPORTS

PROJECT: POLAIR DEVELOPMENT
NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY
BANKSTOWN AIRPORT

TITLE: SITE PLAN

SCALE 1:500 @ A1
APPROVED -
DRAWN PG
CHECKED PG
DATE DEC 2017
STATUS ECI PHASE

PROJECT NUMBER 14030

DRAWING NUMBER A100

ISSUE M

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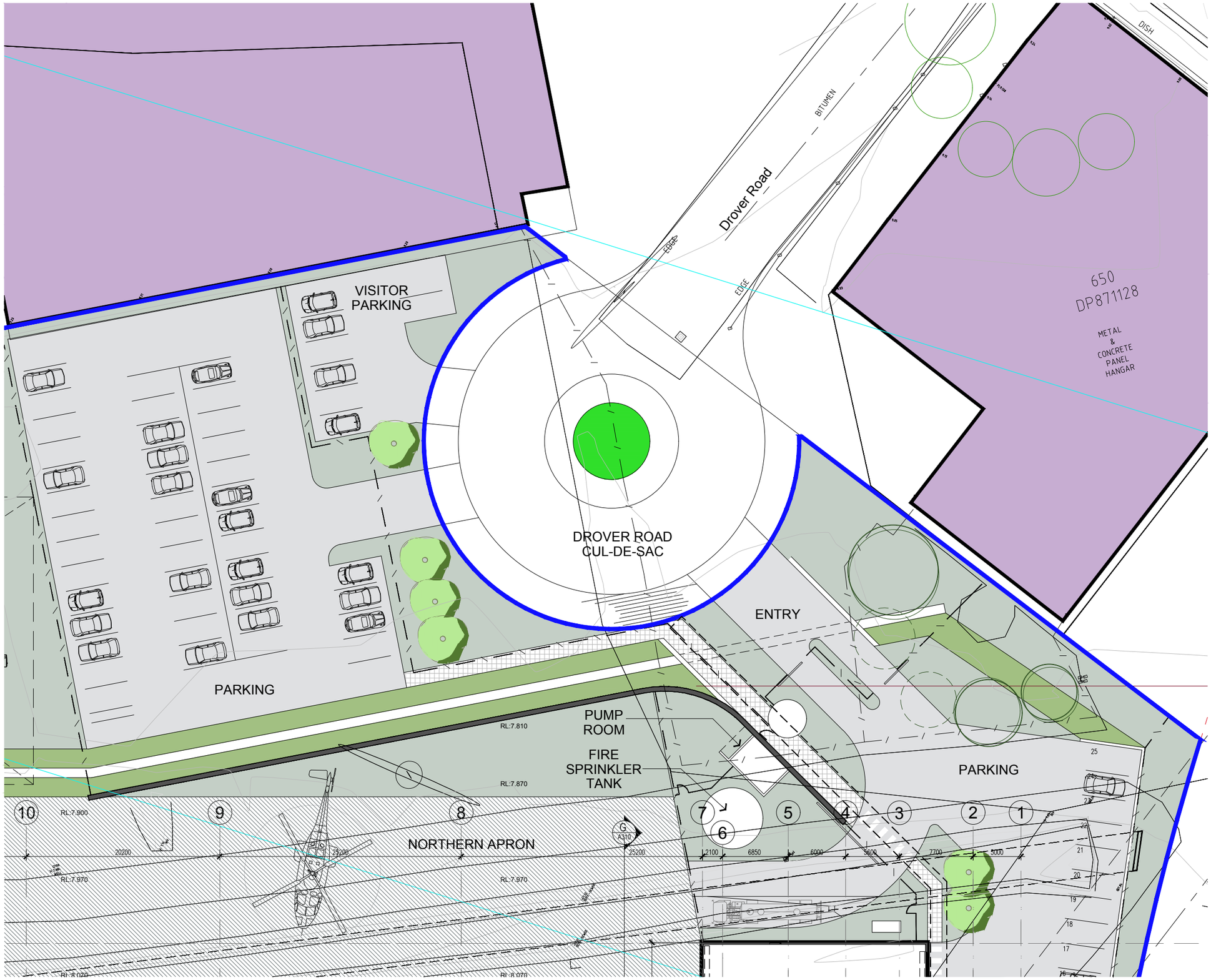

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ISSUE	DATE	AMENDMENTS
B	2017.05.17	MAJOR DEVELOPMENT PLAN ISSUE - FINAL DRAFT
A	2017.05.01	MAJOR DEVELOPMENT PLAN ISSUE 02

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CLIENT
SYDNEY METRO AIRPORTS

PROJECT
POLAIR DEVELOPMENT
NEW HANGARS MAINTENANCE ADMINISTRATION
TRAINING AND OPERATIONS FACILITY
BANKSTOWN AIRPORT

TITLE
SITE PLAN - NORTH EAST

SCALE	DRAWN	DATE	PROJECT NUMBER	DRAWING NUMBER	ISSUE NO
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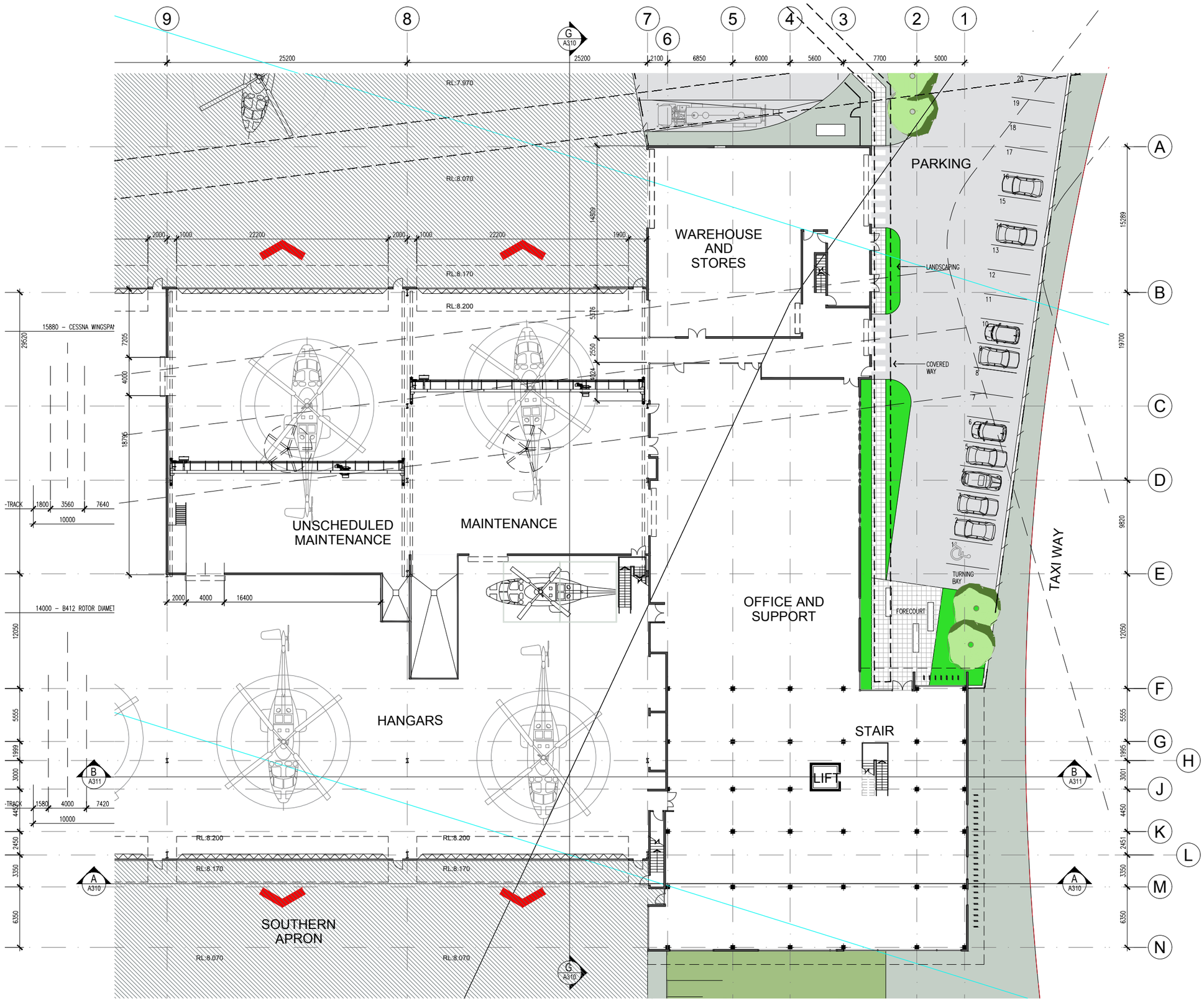

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CLIENT: SYDNEY METRO AIRPORTS	PROJECT: POLAIR DEVELOPMENT NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT	TITLE: FLOORPLAN - EAST	SCALE: 1:200 @ A1	DRAWN: PG	DATE: MAY 2017	PROJECT NUMBER: 14030	DRAWING NUMBER: A102	ISSUE NO: B
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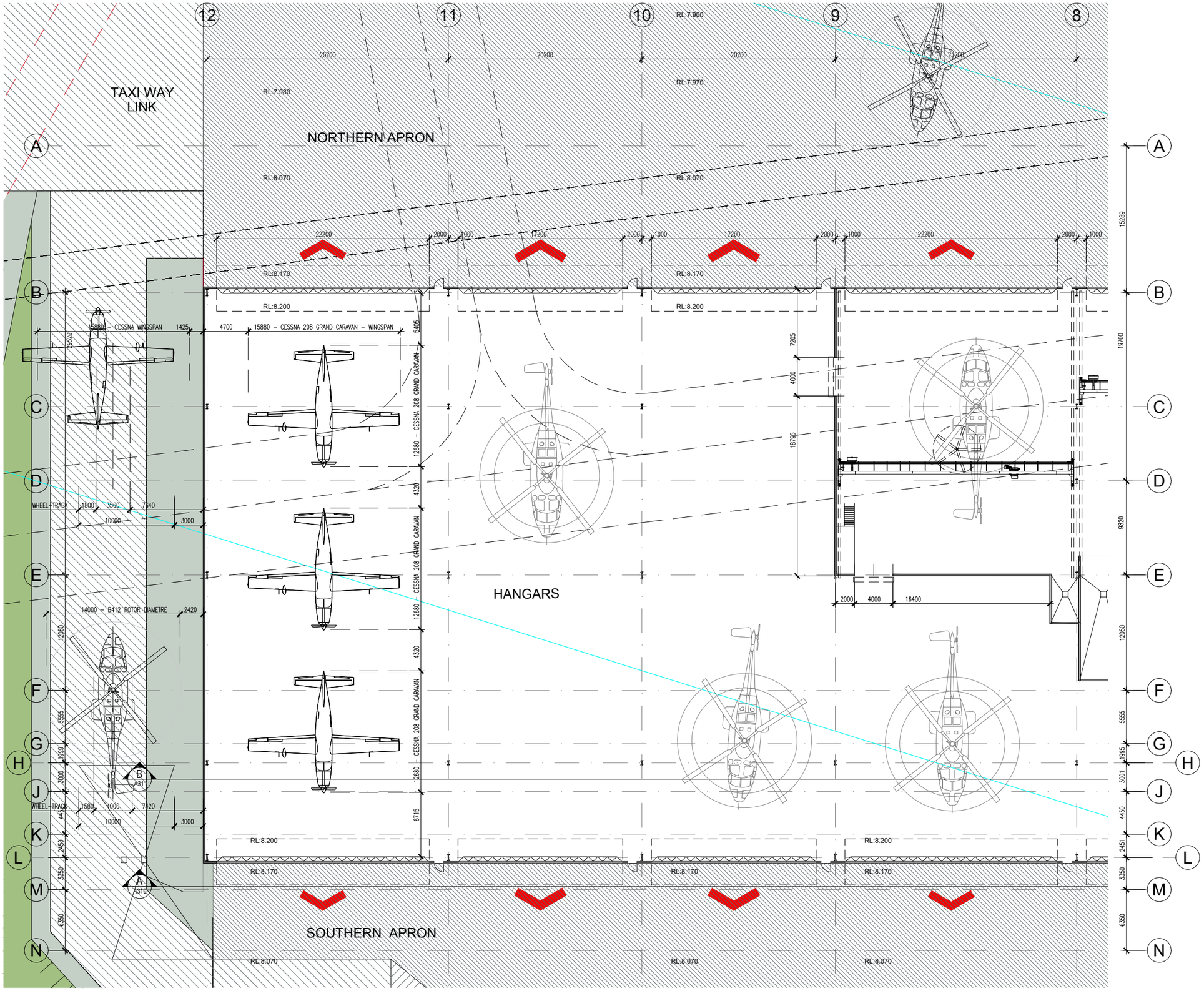

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A	2017.05.01	MAJOR DEVELOPMENT PLAN ISSUE 02

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CLIENT: SYDNEY METRO AIRPORTS	PROJECT: POLAIR DEVELOPMENT NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT	TITLE: FLOORPLAN - WEST	SCALE: 1:200 @ A1	DRAWN: PG	DATE: MAY 2017	PROJECT NUMBER: 14030	DRAWING NUMBER: A103	ISSUE NO: B
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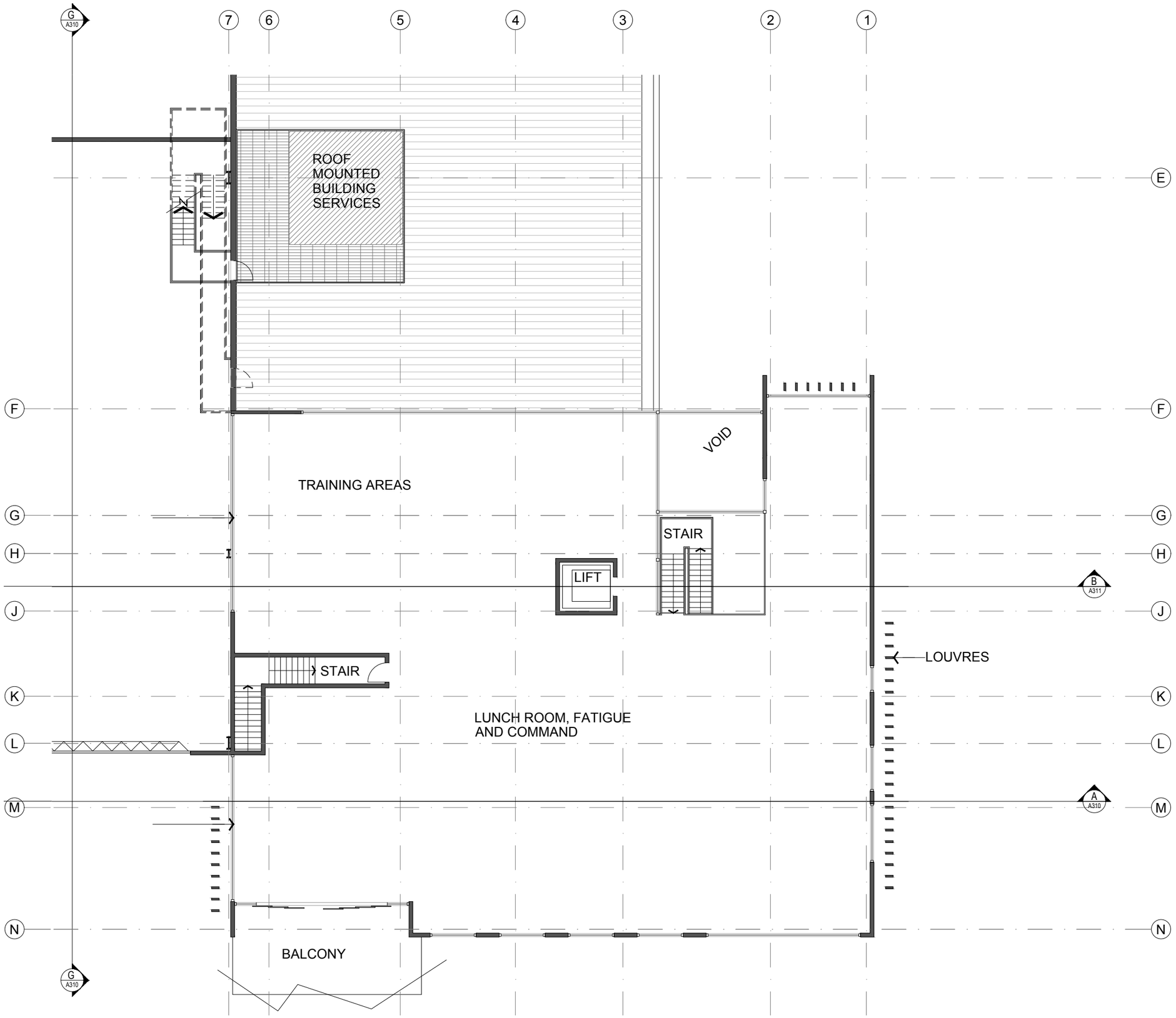

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A	2017.05.17	MAJOR DEVELOPMENT PLAN ISSUE - FINAL DRAFT

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CLIENT	SYDNEY METRO AIRPORTS
PROJECT	POLAIR DEVELOPMENT NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT
TITLE	FLOOR PLAN - FIRST FLOOR
SCALE	1:100 @ A1
DRAWN	PG
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APPROVED	PG
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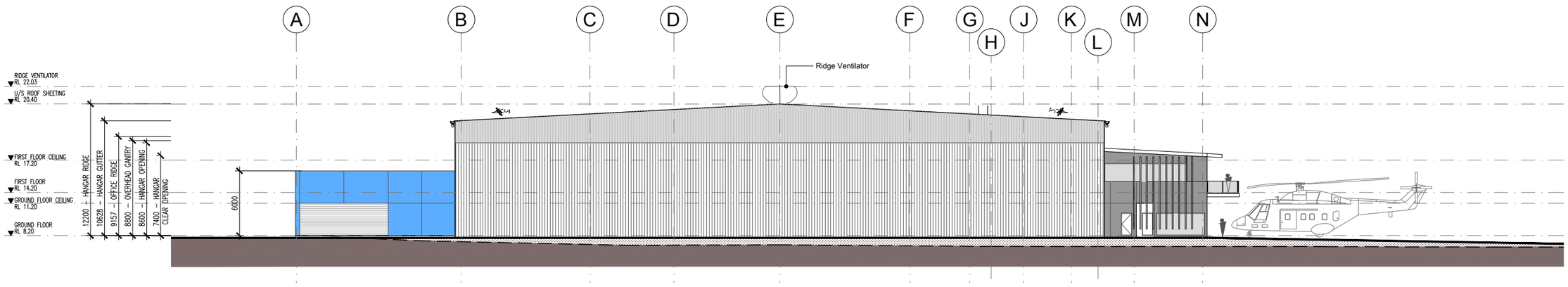
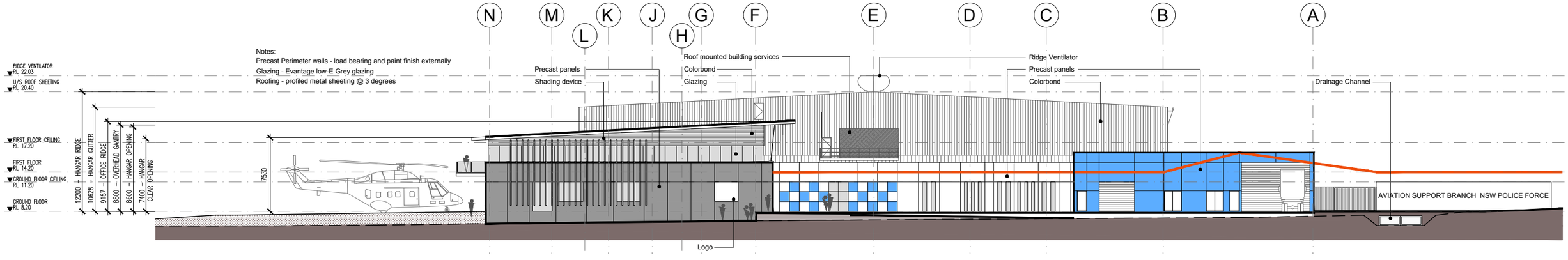
ISSUE NO	A



01 WEST ELEVATION
SCALE 1:200



02 EAST ELEVATION
SCALE 1:200

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G	2017.05.17	MAJOR DEVELOPMENT PLAN ISSUE - FINAL DRAFT	06	2016.05.24	QS/CLIENT/TENANT ISSUE
F	2017.05.01	MAJOR DEVELOPMENT PLAN ISSUE 02	05	2016.05.12	SITE 2 - REVISED ISSUE FOR MEETING
E	2017.04.20	MAJOR DEVELOPMENT PLAN ISSUE	04	2016.05.11	SITE 2 - CLIENT ISSUE
D	2017.04.13	RIDGE VENTILATOR UPDATED	03	2016.01.25	MTG 151208 ADJUSTMENTS
C	2017.04.05	REVISED ISSUE	02	2015.05.26	ELEVS ADJUSTED TO REFLECT CURRENT PLANNING
B	2016.06.21	HEADS OF AGREEMENT REVISION	01	2015.03.19	ISSUE FOR COMMENT
A	2016.07.15	HEADS OF AGREEMENT SET	ISSUE	DATE	AMENDMENTS

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CLIENT: SYDNEY METRO AIRPORTS	PROJECT: POLAIR DEVELOPMENT NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT	TITLE: ELEVATIONS- SHEET 1		SCALE: 1:200 @ A1	DRAWN:	DATE: MAY 2017	PROJECT NUMBER: 14030	DRAWING NUMBER: A300	ISSUE NO: G
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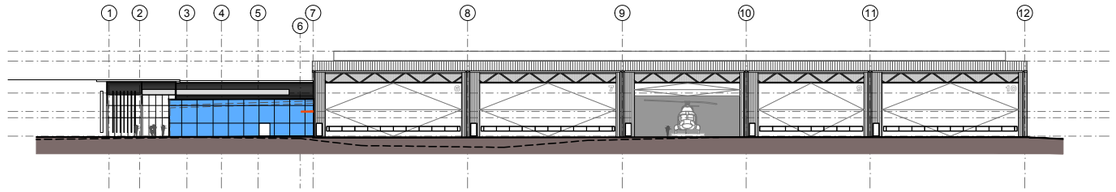

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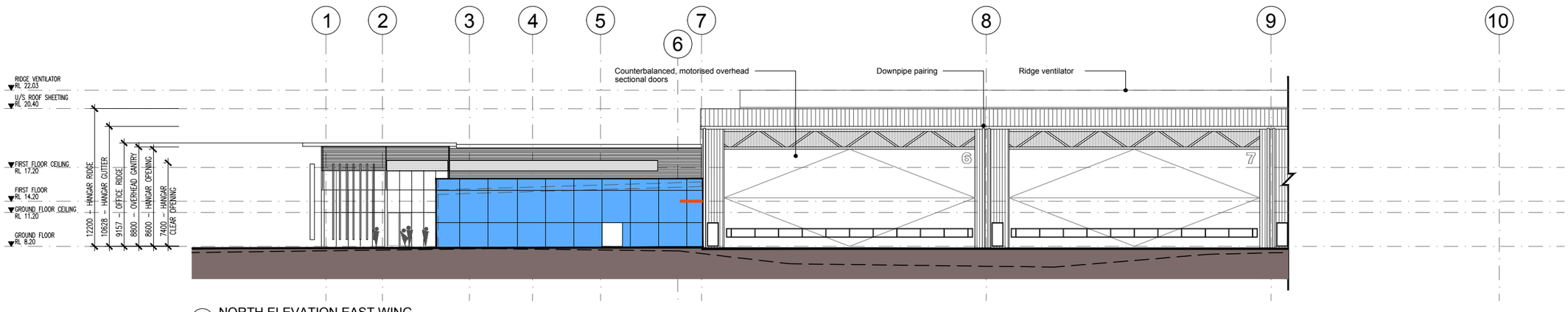
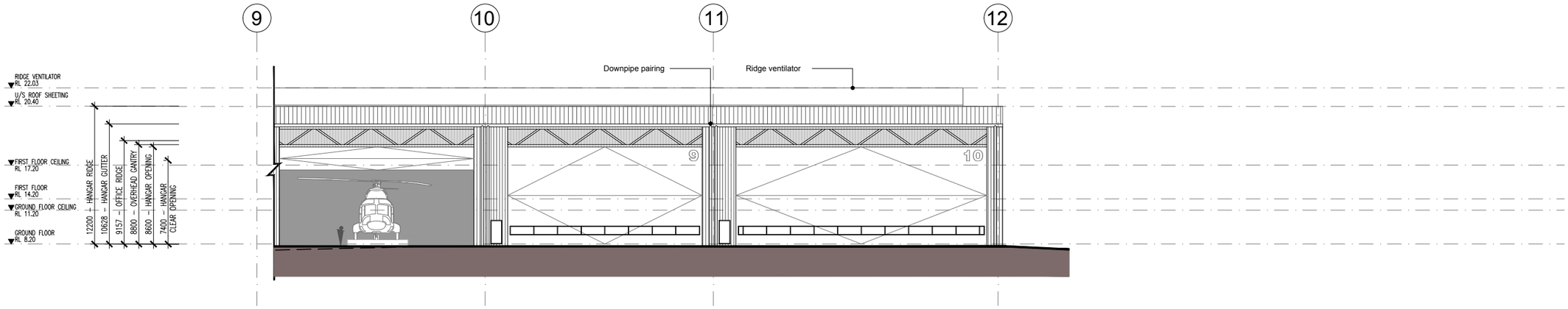
SCALE 1:500



02 NORTH ELEVATION EAST WING
SCALE 1:200



03 NORTH ELEVATION WEST WING
SCALE 1:200

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			B	2016.06.21	HEADS OF AGREEMENT REVISION
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F	2017.05.01	MAJOR DEVELOPMENT PLAN ISSUE 02	03	2016.05.12	SITE 2 - REVISED ISSUE FOR MEETING
E	2017.04.20	MAJOR DEVELOPMENT PLAN ISSUE	02	2016.05.11	SITE 2 - CLIENT ISSUE
D	2017.04.13	RIDGE VENTILATOR UPDATED	01	2016.01.25	MTG 151208 ADJUSTMENTS
C	2017.04.05	REVISED ISSUE	ISSUE	DATE	AMENDMENTS

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CLIENT	PROJECT	TITLE		SCALE	DRAWN	DATE	PROJECT NUMBER	DRAWING NUMBER	ISSUE NO
SYDNEY METRO AIRPORTS	POLAIR DEVELOPMENT NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT	NORTH ELEVATION		SCALE AS SHOWN		MAY 2017	14030	A301	G
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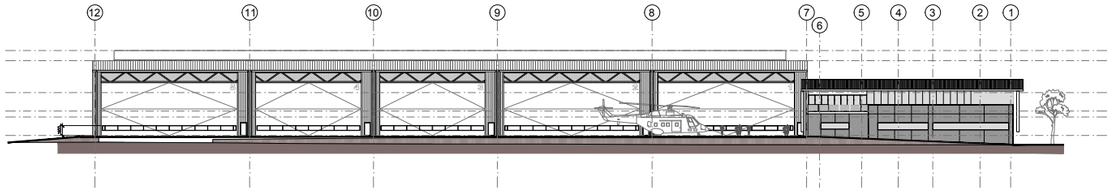

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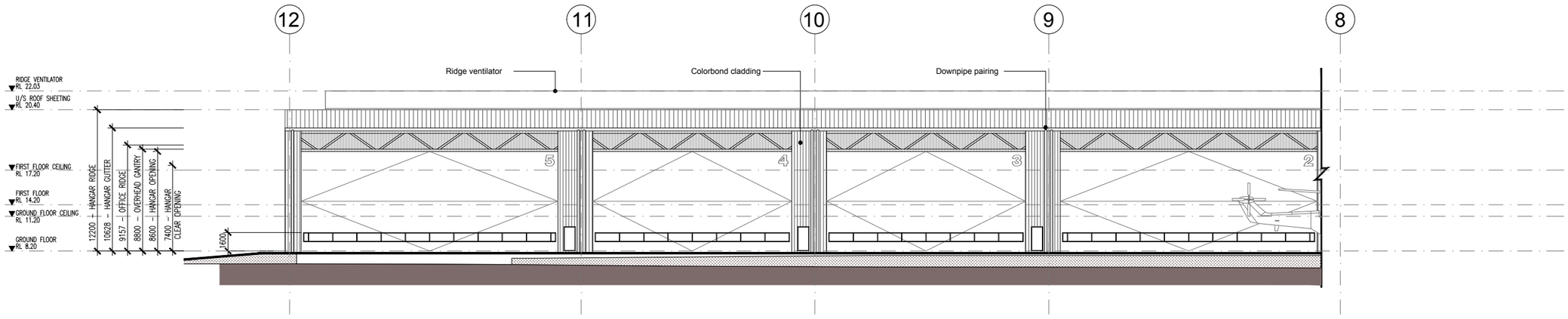

02 SOUTH ELEVATION WEST WING
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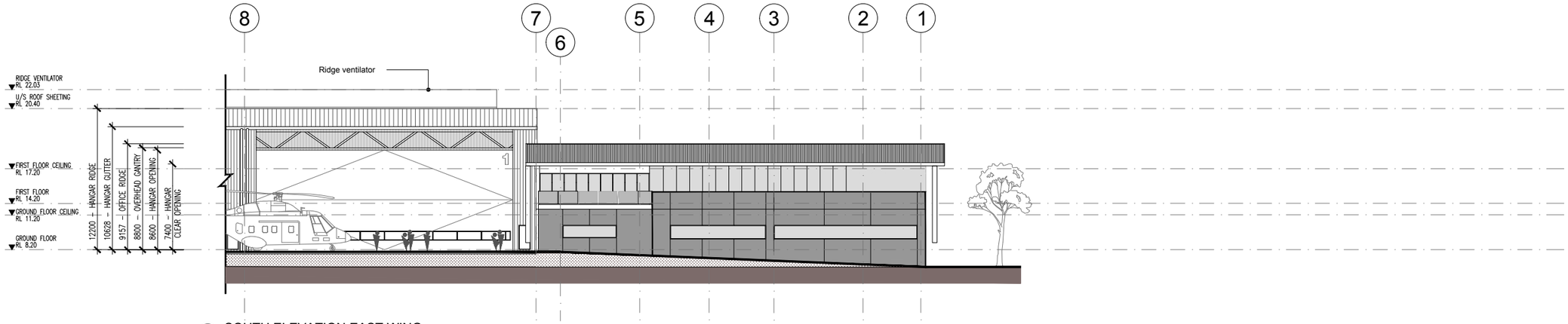

02 SOUTH ELEVATION EAST WING
SCALE 1:200

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G	2017.05.17	MAJOR DEVELOPMENT PLAN ISSUE - FINAL DRAFT
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E	2017.04.20	MAJOR DEVELOPMENT PLAN ISSUE
D	2017.04.13	RIDGE VENTILATOR UPDATED
C	2017.04.05	REVISED ISSUE
B	2016.06.21	HEADS OF AGREEMENT REVISION
A	2016.07.15	HEADS OF AGREEMENT SET
04	2016.05.24	QS/CLIENT/TENANT ISSUE
03	2016.05.12	SITE 2 - REVISED ISSUE FOR MEETING
02	2016.05.11	SITE 2 - CLIENT ISSUE
01	2016.01.25	MTG 151208 ADJUSTMENTS

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CLIENT: SYDNEY METRO AIRPORTS	PROJECT: POLAIR DEVELOPMENT NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT	TITLE: SOUTH ELEVATION		SCALE: SCALE AS SHOWN	DRAWN:	DATE: MAY 2017	PROJECT NUMBER: 14030
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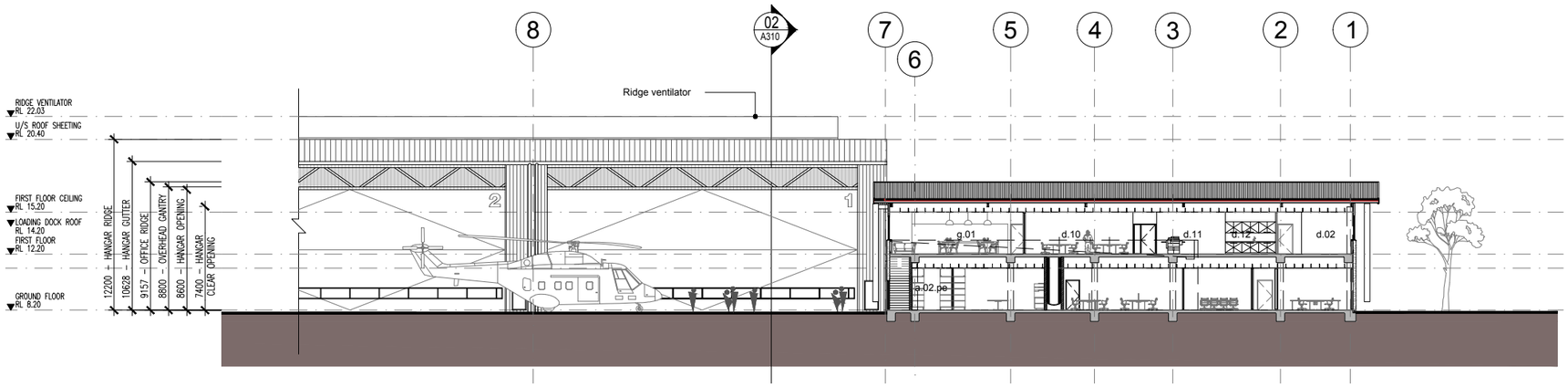
DRAWING NUMBER: A302
ISSUE NO: G



01 SECTION A-A
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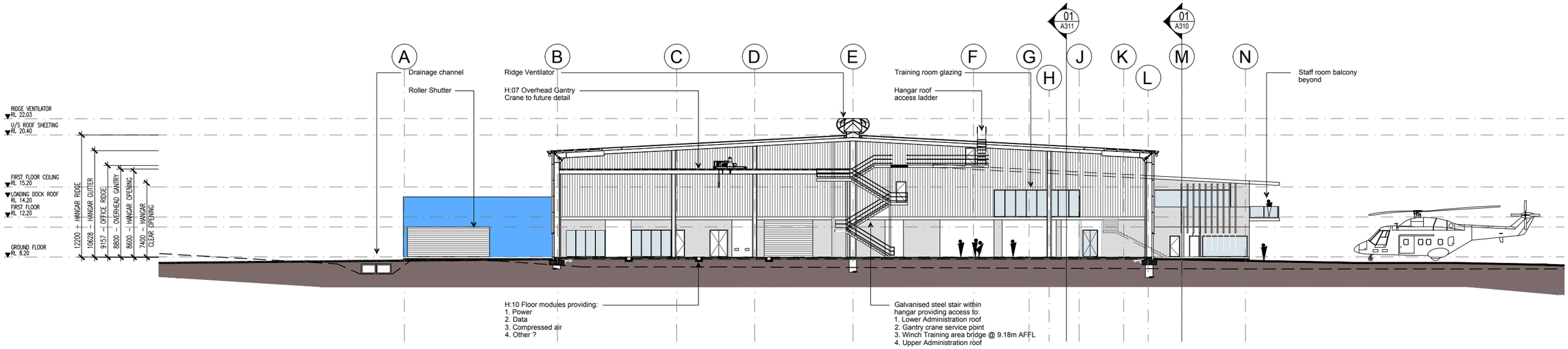

02 SECTION G-G
SCALE 1:200

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			A	2016.07.15	HEADS OF AGREEMENT SET
G	2017.05.17	MAJOR DEVELOPMENT PLAN ISSUE - FINAL DRAFT	04	2016.05.24	QS/CLIENT/TENANT ISSUE
F	2017.05.01	MAJOR DEVELOPMENT PLAN ISSUE 02	03	2016.05.12	SITE 2 - REVISED ISSUE FOR MEETING
E	2017.04.20	MAJOR DEVELOPMENT PLAN ISSUE	02	2016.05.11	SITE 2 - CLIENT ISSUE
D	2017.04.13	RIDGE VENTILATOR UPDATED	01	2016.01.25	MTG 151208 ADJUSTMENTS
C	2017.04.05	REVISED ISSUE	ISSUE	DATE	AMENDMENTS

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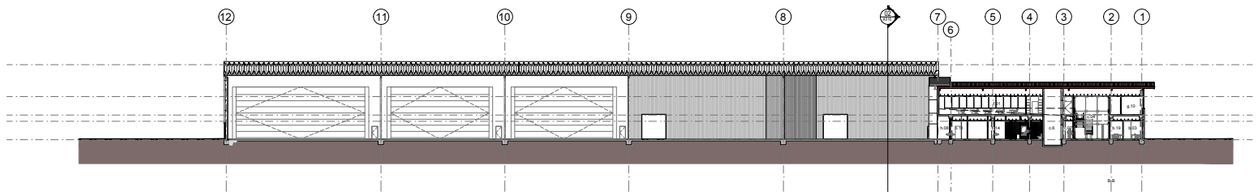

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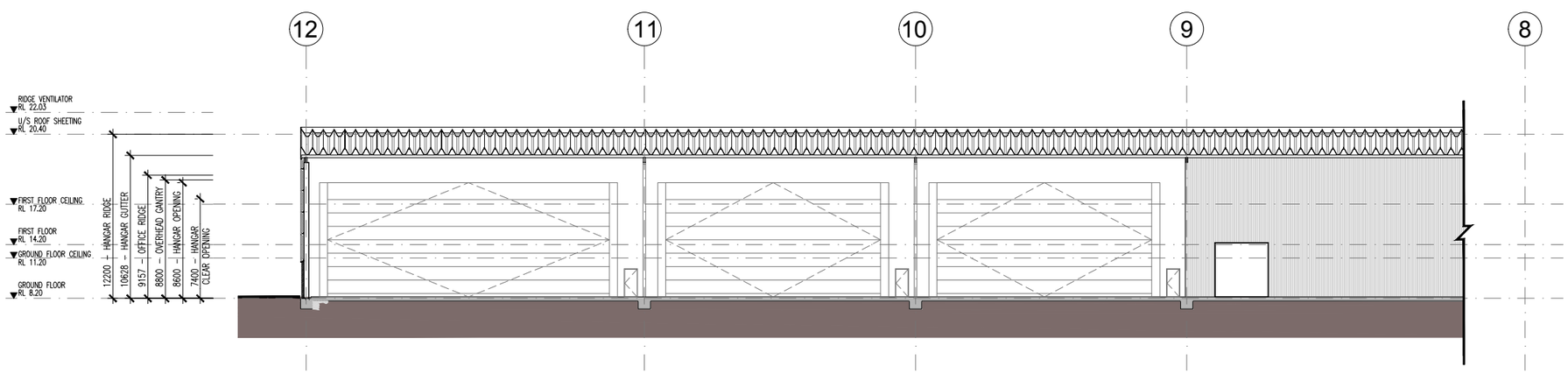

02 SECTION B-B WEST WING
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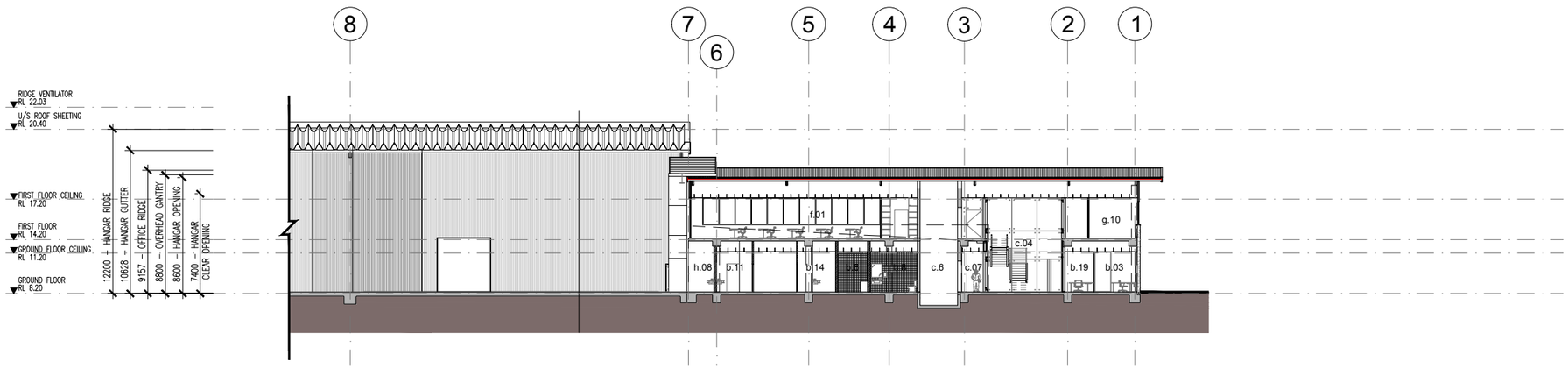

03 SECTION B-B EAST WING
SCALE 1:200

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C	2017.04.05	REVISED ISSUE
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04	2016.05.24	QS/CLIENT/TENANT ISSUE
03	2016.05.12	SITE 2 - REVISED ISSUE FOR MEETING
02	2016.05.11	SITE 2 - CLIENT ISSUE
01	2016.01.25	MTG 151208 ADJUSTMENTS

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DRAWING NUMBER	ISSUE NO
A311	D

Concept Design

Appendix C

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A	2017.04.20	MAJOR DEVELOPMENT PLAN ISSUE
01	2017.02.09	PRELIMINARY ISSUE

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01	2017.02.09	PRELIMINARY ISSUE

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CLIENT	PROJECT	TITLE		SCALE	DRAWN	DATE	PROJECT NUMBER	DRAWING NUMBER	ISSUE NO
SYDNEY METRO AIRPORTS	POLAIR DEVELOPMENT NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT	RENDERS - NORTH 02		N/A		MAY 2017	14030	A401	C
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ISSUE	DATE	AMENDMENTS
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A	2017.04.20	MAJOR DEVELOPMENT PLAN ISSUE
01	2017.02.09	PRELIMINARY ISSUE

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CLIENT SYDNEY METRO AIRPORTS	PROJECT POLAIR DEVELOPMENT NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT	TITLE RENDERS - ENTRY		SCALE N/A	DRAWN	DATE MAY 2017	PROJECT NUMBER 14030	DRAWING NUMBER A402	ISSUE NO C
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01	2017.02.09	PRELIMINARY ISSUE

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CLIENT SYDNEY METRO AIRPORTS	PROJECT POLAIR DEVELOPMENT NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY BANKSTOWN AIRPORT	TITLE RENDERS - EAST		SCALE N/A	DRAWN	DATE MAY 2017	PROJECT NUMBER 14030	DRAWING NUMBER A403	ISSUE NO C
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01	2017.02.09	PRELIMINARY ISSUE

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CLIENT
SYDNEY METRO AIRPORTS

PROJECT
POLAIR DEVELOPMENT
NEW HANGARS MAINTENANCE ADMINISTRATION TRAINING AND OPERATIONS FACILITY
BANKSTOWN AIRPORT

TITLE
RENDERS - SOUTH

SCALE	DRAWN	DATE	PROJECT NUMBER	DRAWING NUMBER	ISSUE NO
N/A		MAY 2017	14030	A404	C
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01	2017.02.09	PRELIMINARY ISSUE

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Aviation Assessment

Appendix D

17 May, 2017
Our File Ref: B17115AL001
Contact: Nick Borley

Bankstown Airport Limited
c/- Altis Property Partners
Level 14, 60 Castlereagh Street
SYDNEY, NSW 2000

Attention: Mark Crudden

RE: BANKSTOWN AIRPORT PROPOSED POLAIR FACILITY MDP AVIATION ASSESSMENT

1. INTRODUCTION

REHBEIN Airport Consulting was engaged by Bankstown Airport Limited to assess the potential impacts a proposed PolAir facility may have on airport operations. The assessment outcomes will inform and support a Major Development Plan (MDP) for the proposed development.

This letter sets out our preliminary findings with regard to the relevant safeguarding considerations. These include:

- Operational airspace comprising existing and future Obstacle Limitation Surfaces (OLS) and PANS-OPS protection surfaces;
- Existing and future Communication, Navigation and Surveillance (CNS) facilities including;
  - Runway precision approach path indicator (PAPI) lighting;
  - Wind indicator;
  - Airservices Australia and Bureau of Meteorology anemometers;
  - Compass swing bays; and
  - Ground based navigation aids;
- Impacts on helicopter operations including flight frequency as a result of the development;
- Impacts on helicopter flight paths as described in the current approved Bankstown Airport Master Plan; and
- Other Aspects of the National Airports Safeguarding Framework (NASF) guidelines and Public Safety Zones.

These matters are discussed in the following sections of this letter.

2. OPERATIONAL AIRSPACE

The *Airports (Protection of Airspace) Regulations 1996* prescribe airspace around federal leased airports, to ensure the protection of existing and future operational airspace from intrusion by obstacles. This prescribed airspace consists of the airspace defined by the airport's Obstacle Limitation Surfaces (OLS) and the PANS-OPS protection surfaces and includes those surfaces planned to accommodate future expansion or new procedures at the airport.

2.1 Obstacle Limitation Surfaces (OLS)

The existing and future OLS for Bankstown Airport in relation to the proposed development site are shown in **Figure 1** and **Figure 2** respectively.

Based on the proposed design information as supplied by Crawford Architects Pty Ltd (attached) the development will not penetrate any existing or future OLS surface.

2.2 PANS-OPS Surfaces

Airspace associated with aircraft instrument approach and departure procedures is defined by the Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) protection surfaces for an aerodrome. These surfaces are ascertained in accordance with the criteria in the International Civil Aviation Organisation (ICAO) *Procedures for Air Navigation Services – Aircraft Operations* (Doc 8168, PANS-OPS).

The existing and future PANS-OPS surfaces for Bankstown Airport over the proposed site are shown in **Figure 3** and **Figure 4** respectively.

The most critical existing PANS-OPS surface overlying the proposed development site is that associated with the current published Runway 11C Standard Instrument Departure (SID). The elevation of this surface is estimated to be 67.2m AHD. With a proposed development maximum elevation of 22.1m AHD the development will not penetrate any existing PANS-OPS surface.

However, formal verification will be provided by Airservices (or the relevant instrument procedure designer) that the proposed development does not impact on any existing procedure.

Assessment of the future PANS-OPS surfaces in relation to the proposed development indicates that the most critical surface will be the Basic ILS Surface associated with a future Instrument Landing System (ILS) approach to Runway 11C. This surface is estimated to be at an elevation of approximately 27.6m AHD over the proposed development. With a proposed development elevation of 22.1m AHD this future PANS-OPS surface will not be penetrated.

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2.3 Sydney Radar Terrain Clearance Chart (RTCC)

Air traffic controllers rely on the use of radar to facilitate the separation and flow of air traffic. Radar signals are susceptible to interference from obstacles such as terrain and buildings as they operate on a line-of-sight principle. Airservices publishes a Radar Terrain Clearance Chart (RTCC) which indicates the lowest altitude that radar information can accurately be used for air traffic purposes.

The proposed development has been assessed against the currently published Sydney RTCC[1] which forms part of the Sydney Airport prescribed airspace. The assessment indicated that the building will not be of sufficient elevation to exceed the RTCC protection surfaces and therefore should not interfere with the performance of the radar.

3. COMMUNICATION, NAVIGATION AND SURVEILLANCE FACILITIES

3.1 Precision Approach Path Indicator

Bankstown Airport has a single sided Precision Approach Path Indicator (PAPI) lighting system installed at each end of Runway 11C and 29C. The proposed development site is outside the lateral extent of the PAPI Obstacle Assessment Surface (OAS) as shown on **Figure 5**. The PAPI will therefore not be impacted by the development.

3.2 Wind Indicator and Anemometers

The proposed PolAir facility has been assessed against the clearances required in relation to wind indicators and wind speed and direction measuring equipment (Anemometer) as provided by the Bureau of Metrology (BOM). Generally, the clearance required around these facilities consists of a 100 metre radius which is free of obstacles and structures.

Figure 5 illustrates the position of these facilities and clearances that will be impacted by the development. These include:

- Primary Wind Indicator (WI) (and signal area);
- Airservices Australia Anemometer; and
- Bureau of Meteorology (BOM) Anemometer.

Since the identified facilities may require relocating should the POLAIR facility be constructed as a result of these clearances being infringed, alternative sites have been suggested for consideration in **Figure 6**. However, these alternative sites would require further technical analysis and endorsement from the responsible parties (i.e. Airservices and Bureau of Meteorology and CASA in relation to the wind indicator) in order to confirm their suitability and compliance with all relevant regulations.

[1] https://www.experiencesyd.com.au/corporate/planning-and-projects/airspace-protection-tile

3.3 Compass Swing Bay

Aircraft magnetic compasses periodically require calibrating to a known azimuth source in order to ensure their functionality for accurate navigation. Airports generally provide a compass swing bay in which this calibration task may be undertaken. CASA Advisory Circular (AC) AC139-15(0) recommends a radius of at least 200 metres free from all sources of magnetic interference as such steel hangers and high voltage powerlines.

Bankstown Airport's compass swing bay is located north of Taxiway A. The proposed POLAIR development will be outside of the recommended 200 metre radius and therefore should not interfere with the use of the swing bay.

3.4 Ground Based Navigation Aids

Ground based navigation aids generate radio signals which are interrogated by airborne aircraft and used to assist with their navigation. As these aids are radio based, protection of the signal is required to ensure signal integrity is maintained. Bankstown Airport currently has one ground based navigation aid – the Non-Directional Beacon (NDB) – which is located in a clear area of the airport south of the runway infrastructure.

The proposed development site would be outside the published Building Restricted Areas advised in relation to NDBs (per CASA MOS Part 139 and NASF Guideline G) and would not be expected to impact the performance of the NDB.

4. HELICOPTER OPERATIONS AND FLIGHT PATH IMPACTS

The proposed development is in close proximity to the main HLS (north of Taxiway A) and the western HLS (northwest precinct of the Airport).

The Aviation Related Planning Principles in the 2014 Bankstown Airport Master Plan (2014 MP) (Table 11) include for the management of rotary operations as follows:

> *The 2005 Master Plan principle of separating fixed and rotary wing operations was amended in the 2008 Minor Variation. Given that rotary operations currently account for 13.9% of all flight activity and that the MP forecasts that this level of activity is expected to be maintained, in May 2013 BAL commissioned a safety review of rotary operations on the Airport which extended to all aspects of rotary operations. The review established that current operations meet the requirements of the regulator.*

Sections 5.4.7 and 5.4.8 of the 2014 MP address the helipad facilities and the helicopter movement area respectively. In summary the 2014 MP:

- Incorporates the retention of the designated Helicopter Landing Site (HLS) on the northern side of the airfield as approved in the 2008 Minor Variation. The HLS will continue to meet the needs of the existing helicopter operators based at the

Airport and there will be no need for new operational arrangements and flight paths to be defined in association with Airservices Australia. Larger helicopter arrival and departure can also take place from the runways.

- Recognises that an area in the northwest precinct of the Airport is currently used for low altitude helicopter training and manoeuvres will be retained for aviation use; and

- Current helicopter facilities and infrastructure can manage demand for the duration of the planning period.

4.1 Helicopter Operations

BAL has advised that the proposed POLAIR development is not expected to increase traffic to the existing HLS, as the NSW police and emergency services currently operate only from Bankstown so these movements are already incorporated within the forecasts adopted for the endorsed ANEF.

Helicopters are expected to use the main HLS or the runways at night. Whilst there will be helicopter parking stands adjacent the new facility, helicopters will transit to the designated HLS to take off or land. There may be some ground based noise in the vicinity of the facility as a result of helicopters. However, such ground based noise already occurs as a result of general fixed and rotary wing movements around the aerodrome movement area. Such ground based noise is not incorporated within the ANEF so the development of the facility would not alter the ANF contours.

4.2 Helicopter Flight Paths

Both Helicopter Landing Sites utilise flight paths that are orientated to be in general alignment with the runways, so as not to create conflicts between fixed wing and rotary wing operations. The airspace associated with helicopter landing sites (HLS) on airport has not been prescribed in the Master Plan, however CASA expects that helicopter operations will be conducted on airport in accordance with the relevant standards and guidance.

4.2.1 Main HLS

The OLS associated with the western flight path for the main HLS applicable to Performance Class 1 (PC1) Category A helicopter operations by typical aeromedical transport helicopters (AW139) has been constructed based on the information contained in CASA guidance material Civil Aviation Advisory Publication CAAP 92-2(2) *Guidelines for the establishment and operation of onshore Helicopter Landing Sites* (February 2014) and are illustrated in **Figure 7**.

Assessment of these surfaces indicated that the proposed development will have no impact on helicopter operations operating PC1/Category A along these flight paths. Although the current flight path will overfly the proposed development site

the elevation of the OLS is higher than the current concept design height of the facility by approximately 16m.

4.2.2 Western HLS

The primary function the western HLS is to accommodate training operations including hover and winch/rapelling activity. The airport operator has indicated that in general, departures and arrivals from this western HLS are mainly to the north and west. Therefore, it is considered unlikely that helicopters would require to operate in PC1 / Category A over the proposed development site.

The OLS associated with the southern flight path for the western HLS applicable to Performance Class 2 (PC2) Category B helicopter operations based on CASA CAAP 92-2(2) guidance material is illustrated in **Figure 8**.

The proposed development at 22.1m will penetrate the OLS associated with performance PC2 / Category B operations by up to 5.8m. (The impact on the OLS associated with PC / Category A operations would be even greater).

If the impact on PC2 / Category B operations to the western HLS is unacceptable, there may be potential to adjust the location of the FATO slightly. **Figure 9** illustrates a brief desktop analysis of the adjustment required (approximately 50m north-north-east) whilst still maintaining the current flightpath directions. The analysis is by no means exhaustive and relies purely on providing adequate clearance between the proposed buildings and the OLS surface.

Other planning and regulatory requirements may impact on this location and confirmation would be needed as to whether a minor adjustment would trigger the need for any variation to the current approved Master Plan. This option would therefore need to be subject to a more extensive assessment, if it is deemed to be operationally necessary.

Other options which have been identified for consideration in addressing the impact of the proposed development on the western HLS are:

- Limit the approach and departure flight paths to operations only to the north-west. This would be a BAL management decision and subject to consultation with stakeholders. All south easterly departure / approaches would be conducted from the main HLS north of taxiway A or the runway.

- Alter the approach and departure paths of helicopters utilising the HLS in the north-west precinct so that such helicopters would depart to the south, before following the alignment of the runways to the south-east (and vice-versa for arrivals). This option has potential to create significant conflicts with fixed wing traffic.

- Rotate the south-easterly flight path to the north by a magnitude sufficient to provide relief of the OLS surface and the proposed PolAir development.

This would need to be verified against the other hangar development in this area (existing and proposed).

- Decommission the western HLS and direct all helicopter operations to the main central HLS or utilise the runways for approach and departure paths for large helicopters. This would be a BAL management decision and subject to consultation with stakeholders

5. NATIONAL AIRPORTS SAFEGUARDING FRAMEWORK

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

- Improve community amenity by minimising aircraft noise-sensitive developments near airports including through the use of additional noise metrics and improved noise-disclosure mechanisms; and
- Improve safety outcomes by ensuring aviation safety requirements are recognised in and use planning decisions through guidelines being adopted by jurisdictions on various safety related issues.

All Guidelines can be found at www.infrastructure.gov.au .

NASF currently consists of a set of seven guidelines, as follows. Each has been summarised for its relevance to the proposed development.

5.1 Guideline A – Measures for Managing Impacts of Aircraft Noise

NASF Guideline A can be used in the assessment of new development applications for noise sensitive uses. While the ANEF system is recognised by a number of jurisdictions in land use planning decisions the 20 and 25 ANEF zones The proposed development straddles the currently published ANEF 30 contour, and therefore aircraft noise impacts from will need to be considered. Australian Standard AS2021-2015 provides building site acceptability based on ANEF zones. As such, commercial buildings can be conditionally accepted within the 25 to 35 ANEF. For 'conditionally acceptable' land uses, consideration of aircraft noise attenuation is required in accordance with AS2021-2015.

Given the location of the site in close proximity to two HLSs and runways, and it's proposed use, the proponent will need to consider the acoustic treatment of the proposed building to ensure it is fit for the use of the intended occupants.

5.2 Guideline B – Managing the Risk of Building Generated Windshear and Turbulence at Airports

The purpose of this Guideline is to assist land use planners and airport operators in their planning and development processes to reduce the risk of building generated windshear and turbulence at airports near runways.

Applicability of this guideline is initially determined by the location of the building relative to defined assessment envelopes around the runway, which cover the areas:

- 1200m or closer perpendicular to the runway centreline; or
- 900m or closer in front of runway threshold; or
- 500m or closer from the runway threshold along the runway.

The PolAir development site is approximately 300m to the north of the Runway 11C / 29 C centreline and within the building generated windshear assessment envelope for Runways 11L/29R, 11C/29C and 11R/29L.

In line with the guidance provided in NASF Guideline B, Bankstown Airport Limited referred the proposed PolAir facilities design to Synergetics Environmental Engineering (Synergetics) for further modelling and assessment of windshear impacts.

The findings of the assessment are provided in Synergetics *Draft report: PolAir building wind shear and turbulence impact assessment* prepared for Bansktown Airport Ltd 28 April 2017.

5.1 Guideline C - Managing the Risk of Wildlife Strikes in the Vicinity of Airports

The purpose of Guideline C is to inform the land use planning decisions and the way in which existing land use is managed in the vicinity of airports with respect to the attraction of wildlife, particularly birds.

NASF Guideline C should be considered with any development on the site such as landscaping and waste management.

5.2 Guideline D: Managing the Risk to Aviation Safety of Wind Turbine Installations (Wind Farms)/Wind Monitoring Towers

NASF Guideline D provides general information and advice in relation to wind farms and turbines and their hazards to aviation. Guideline D is not relevant to the proposed development.

5.3 Guideline E – Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports.

NASF Guideline E provides guidance on the risk of distractions to pilots of aircraft from lighting and light fixtures near airports.

The CASA *Manual of Standards Part 139 Aerodromes* Section 9.21: Lighting in the Vicinity of Aerodromes sets out the restrictions and degree of interference ground lights can cause as a pilot approaches and provides advice to lighting suppliers on the general requirements, fittings coloured lights and information and correspondence. The proposed development is within the light control zone

A as illustrated in **Figure 10.** Lighting associated with the development should therefore meet the restrictions associated with Zone A, with a maximum intensity of light sources above 3 degrees above the horizontal of 0 cd.

The design of lighting for the development should also take into consideration NASF Guideline E to ensure there is no conflict from light fittings, coloured lights or glare cause by reflective surfaces and/or mitigations measures to be put in place. The lighting designer will need to ensure that the lights meet the requirements prescribed in the CASA *Manual of Standards Part 139 Aerodromes.*

It should be noted that solar panel installation is a particular consideration in relation to glare/reflectivity affecting aircraft in various stages of flight as well as ATC operations. If any solar panels are proposed (such as a roof-mounted panel array), whether as part of the initial construction or subsequently, the proponent may need to complete a solar glare hazard analysis to satisfy CASA that the safety of aircraft and ATC operations will not be affected.

5.4 Guideline F – Managing the Risk of Intrusions into the Protected Airspace of Airports

NASF Guideline F is designed to address the issue of intrusions into the operational airspace of airports by tall structures, such as buildings and cranes as well as trees in the vicinity of airports. The Guideline also addresses activities that could cause air turbulence that could affect the normal flight of aircraft operating in the prescribed airspace and/or emissions of steam, other gas, smoke, dust or other particulate matter that could affect the prescribed airspace in accordance with Visual Flight Rules (VFR).

This Guideline has been considered in this assessment of the proposed development throughout **Section 2**.

Any associated structures, such as roof-mounted antennae and light poles, will need to be designed to ensure they remain below all existing and future operational airspace.

With more detailed plans for the development NASF Guideline F and the attendance prescribed airspace should be considered for activities that relate to construction (such as cranes), or which could cause air turbulence and/or emissions of dust or other particulate matter (including gaseous plumes). These activities should be subject to a separate controlled activity application in accordance with the *Airports (Protection of Airspace) Regulations 1996*.

5.5 Guideline G: Protecting Aviation Facilities – Communication, Navigation and Surveillance (CNS)

NASF Guideline G provides land use planning guidance for the protection of CNS facilities which support the systems and processes in place by Airservices, the Department of Defence or other agencies under contract with the Australian

Government, to safely manage the flow of aircraft into, out of and across Australian airspace.

This Guideline has been considered in the assessment of the proposed development throughout **Section 3** and in particular with respect to the NDB as discussed in **Section 3.4**.

6. CONCLUSION

This assessment makes the following conclusions;

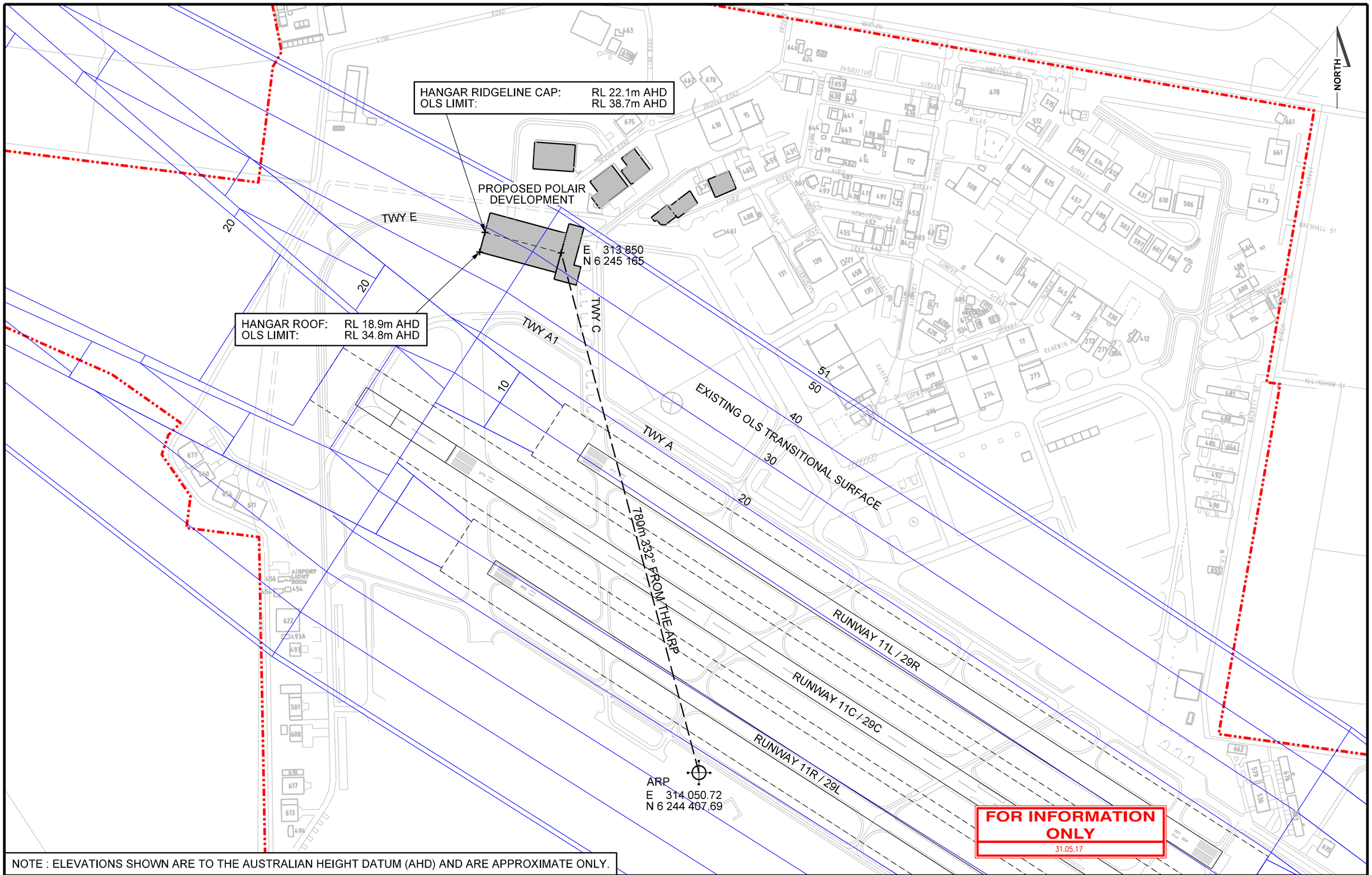
- The proposed POLAIR development will not penetrate the existing or future Obstacle Limitation Surfaces associated with Bankstown Airport;
- The proposed POLAIR development will not penetrate the existing or future PANS-OPS surfaces associated with Bankstown Airport (however, formal verification would be required by Airservices);
- The development will not impact on PC1 or PC2 helicopter operations from the main Helicopter Landing Site located north of taxiway alpha;
- The development will have an impact on the south eastern flightpath for both PC1 and PC2 helicopter operations to/from the north western HLS however, PC1 operations are unlikely to be conducted from this site. If the impact on PC2 operations is not acceptable, there appears to be scope for a minor adjustment of the FATO location to address this. This (and other options for mitigating the impact) would be subject to further analysis if required;
- The primary Wind Indicator and signal area will be impacted by the proposed development and will be required to be relocated to an alternative site;
- Both the Airservices and the Bureau of Meteorology anemometers will require relocating as a result of the proposed development;
- No other CNS facility or prescribed airspace will be impacted as a result of the proposed development;
- The proponent should consider the use of suitable acoustic materials in design and construction in order to protect personnel from potential noise exposure;
- Modelling and assessment of windshear and turbulence impacts have been undertaken by other parties; and
- External lighting and building design aspects in relation to the attraction of wild life should be considered in the design phase in accordance with NASF guidelines C and E.

For further information in relation to this matter please contact the undersigned.

Yours faithfully
For and on behalf of
LAMBERT & REHBEIN (SEQ) PTY LTD

N.J BORLEY
PRINCIPAL AVIATION CONSULTANT

Enc: Figures 1 – 10
Crawford Architects Pty Ltd Drgs



NOTE : ELEVATIONS SHOWN ARE TO THE AUSTRALIAN HEIGHT DATUM (AHD) AND ARE APPROXIMATE ONLY.

Project:
PROPOSED POLAIR DEVELOPMENT
BANKSTOWN AIRPORT

Client: BANKSTOWN AIRPORT LIMITED

Title: EXISTING OBSTACLE LIMITATION SURFACES

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Rev	Date
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Figure No: FIGURE 1

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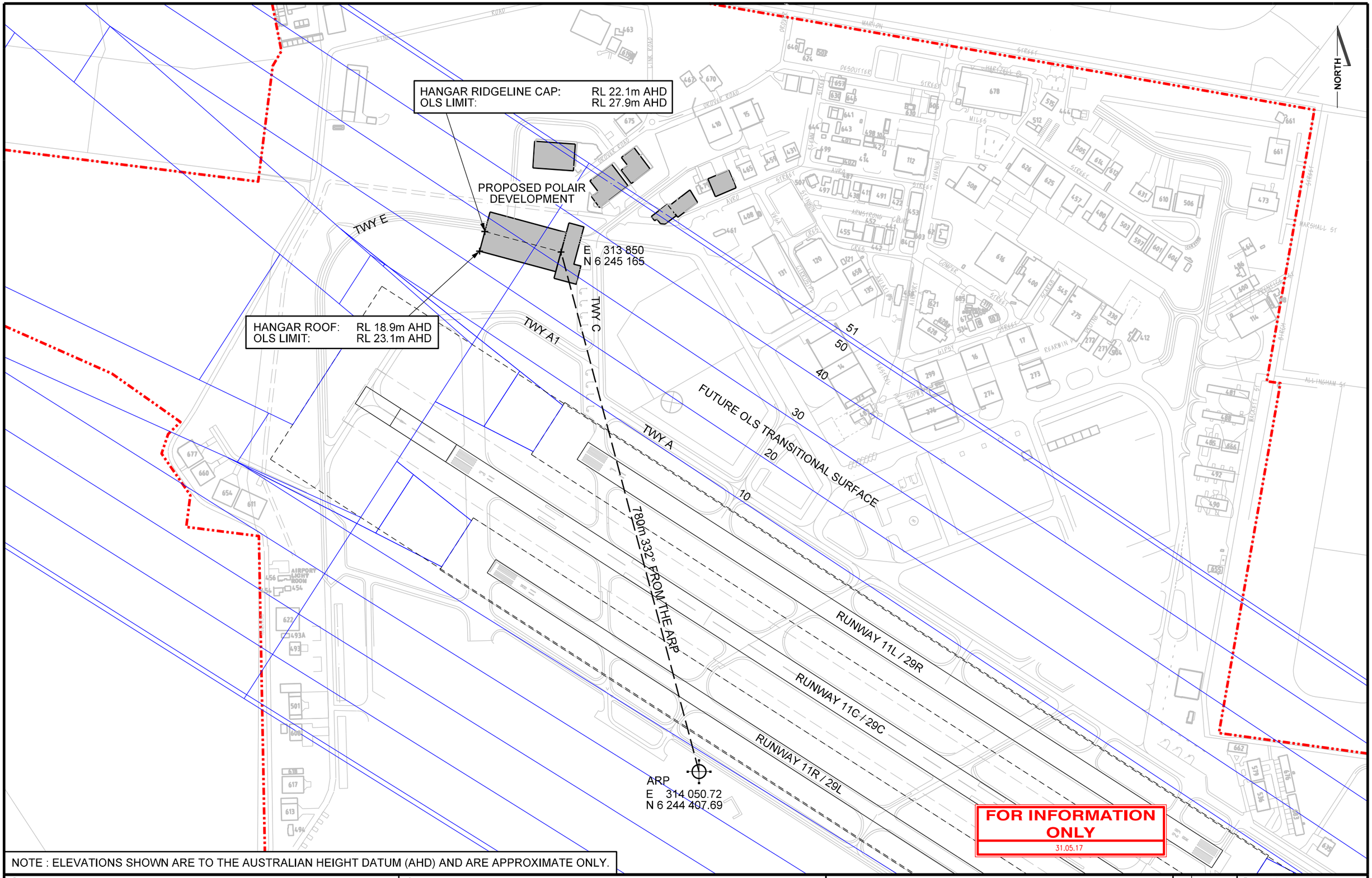

NOTE : ELEVATIONS SHOWN ARE TO THE AUSTRALIAN HEIGHT DATUM (AHD) AND ARE APPROXIMATE ONLY.

Project:
PROPOSED POLAIR DEVELOPMENT
BANKSTOWN AIRPORT

Client: BANKSTOWN AIRPORT LIMITED

Title: FUTURE OBSTACLE LIMITATION SURFACES

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Rev 0 | Date 31.05.17

Figure No: FIGURE 2

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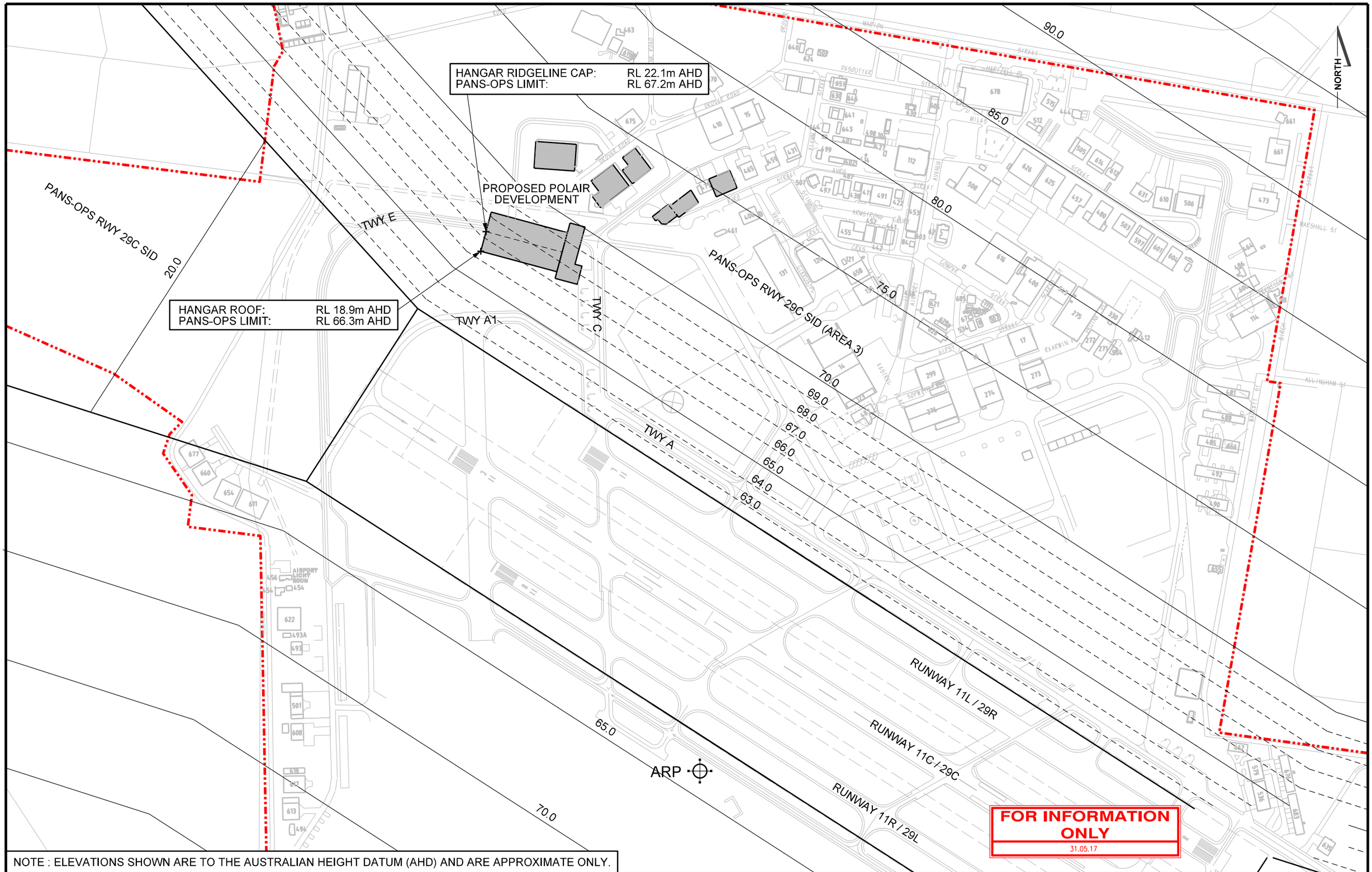

NOTE : ELEVATIONS SHOWN ARE TO THE AUSTRALIAN HEIGHT DATUM (AHD) AND ARE APPROXIMATE ONLY.

Project:
PROPOSED POLAIR DEVELOPMENT
BANKSTOWN AIRPORT

Client: BANKSTOWN AIRPORT LIMITED

Title: EXISTING PANS-OPS SURFACES

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Figure No: FIGURE 3

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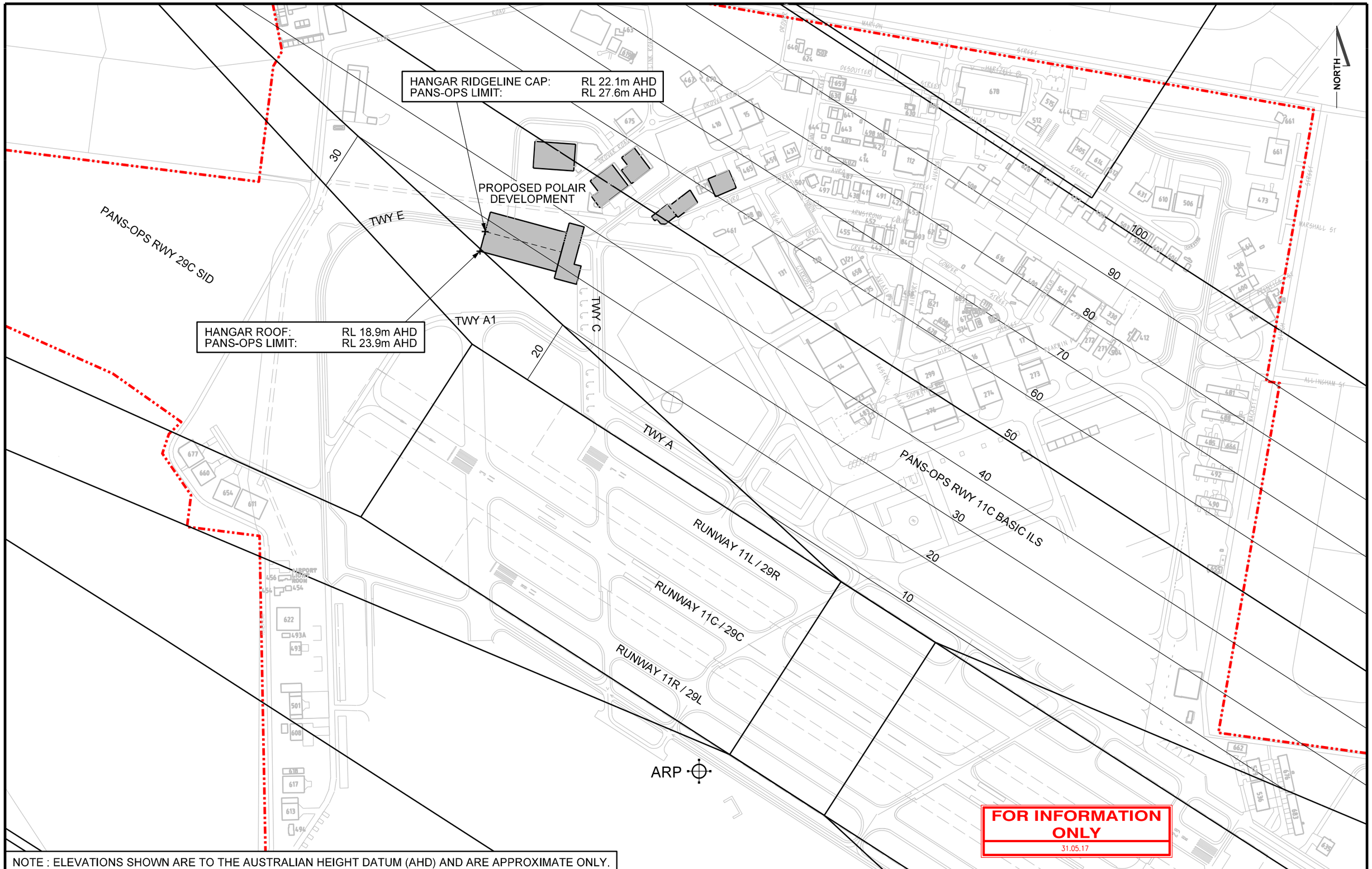

NOTE : ELEVATIONS SHOWN ARE TO THE AUSTRALIAN HEIGHT DATUM (AHD) AND ARE APPROXIMATE ONLY.

Project:
PROPOSED POLAIR DEVELOPMENT
BANKSTOWN AIRPORT

Client: BANKSTOWN AIRPORT LIMITED

Title: FUTURE PANS-OPS SURFACES

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Rev 0 | Date 31.05.17

Figure No: FIGURE 4

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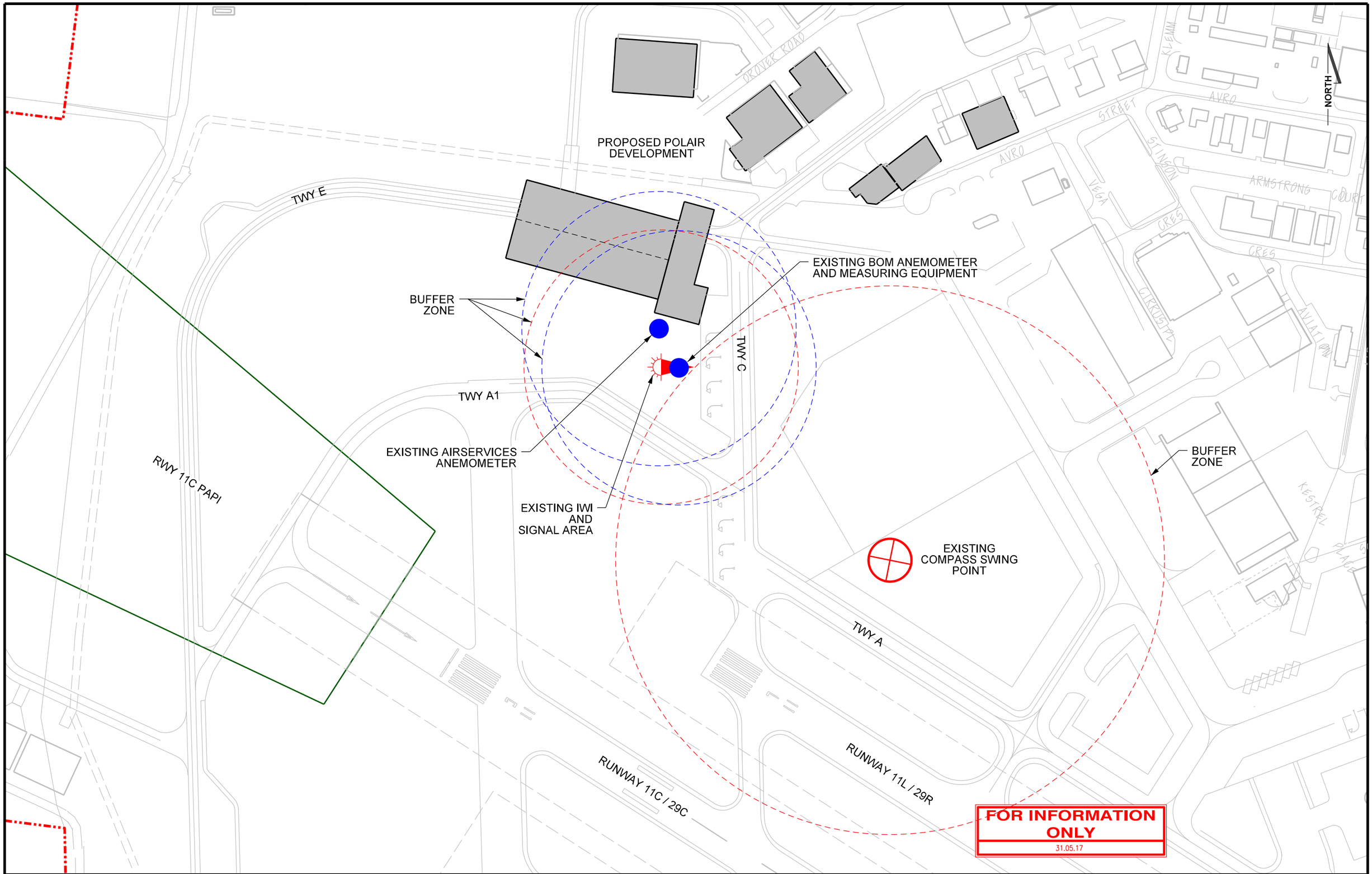
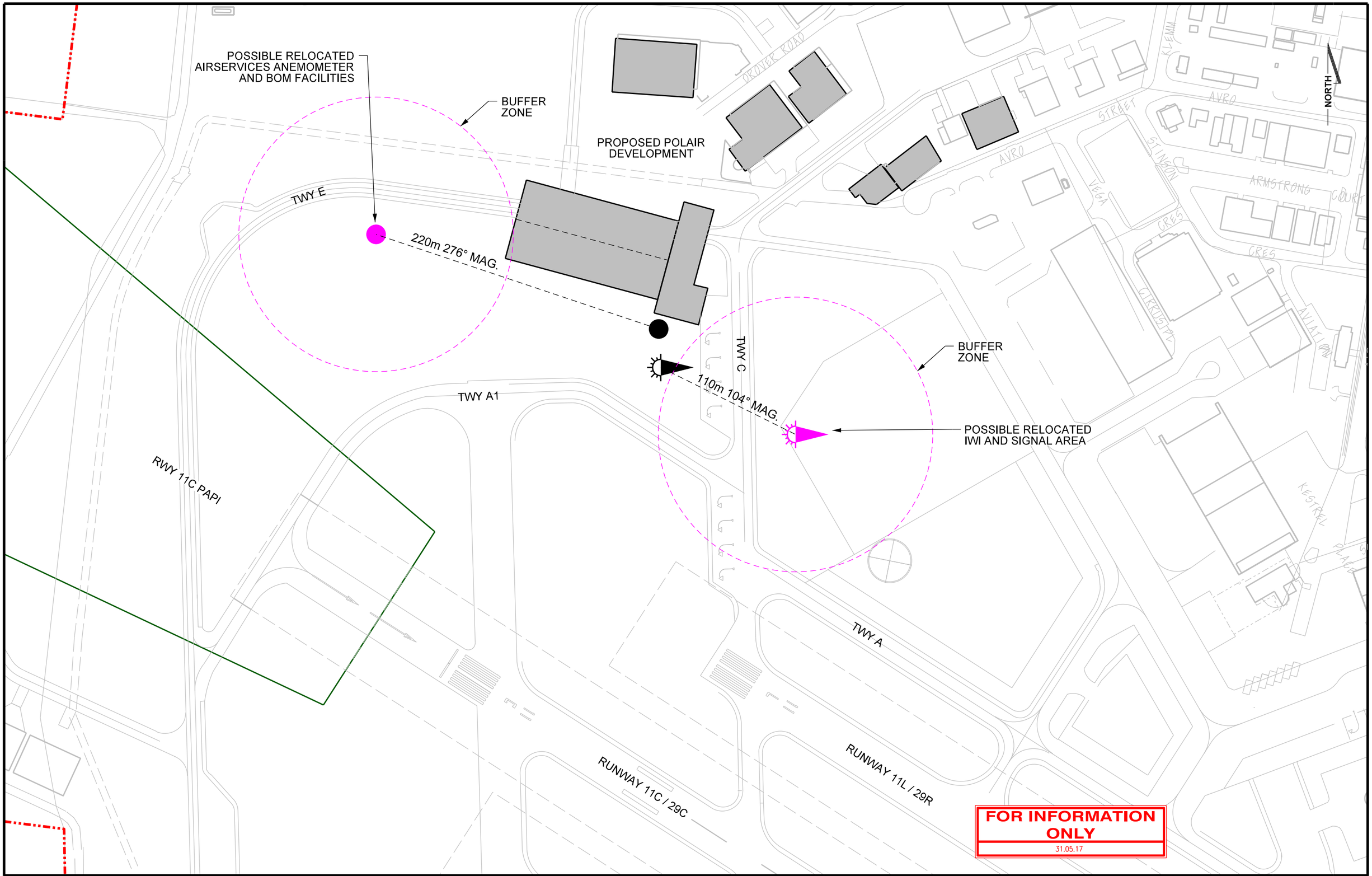
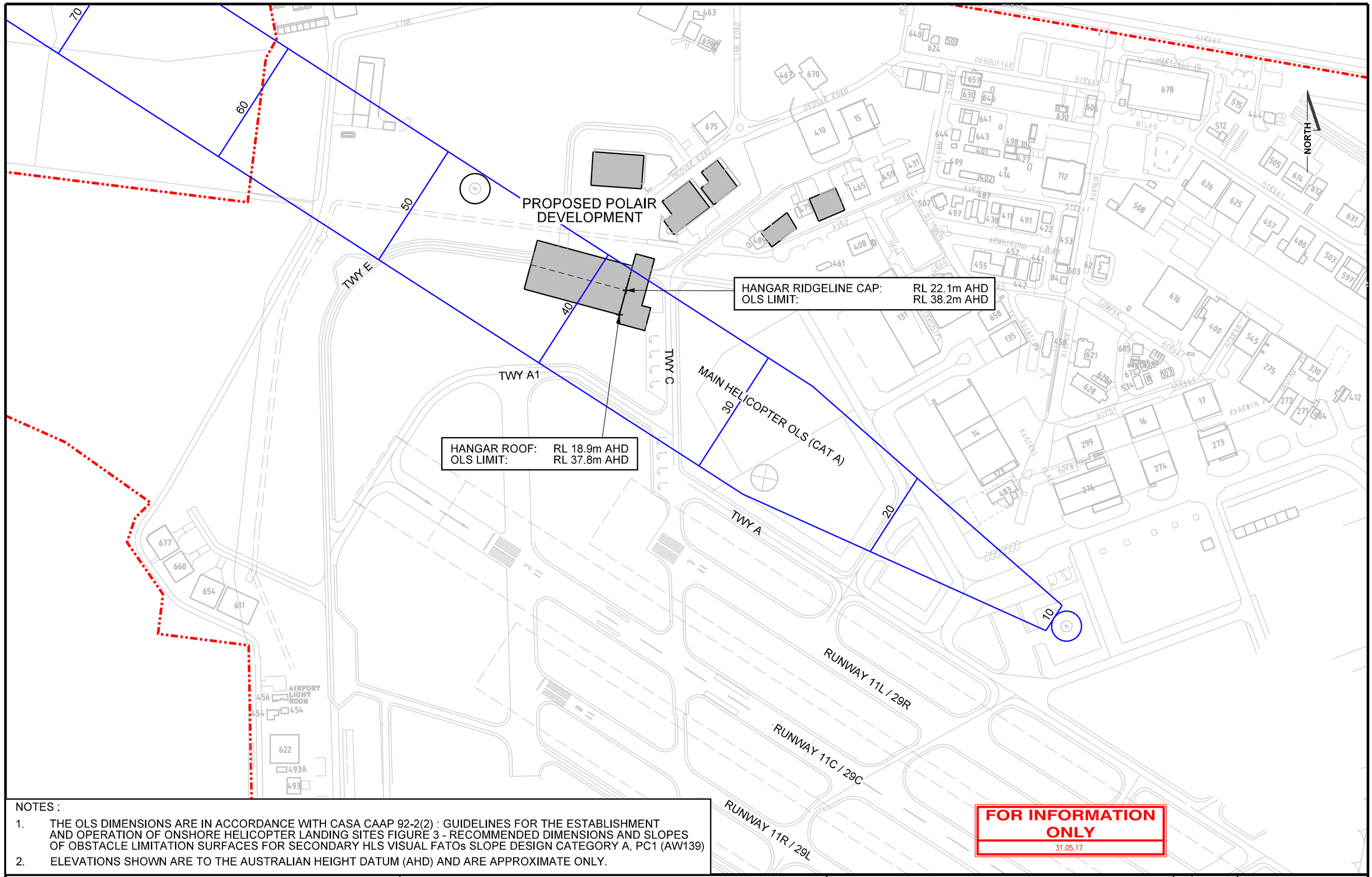


Project: PROPOSED POLAIR DEVELOPMENT BANKSTOWN AIRPORT	Client: BANKSTOWN AIRPORT LIMITED	REHBEIN Airport Consulting The Association of Consulting Engineers Australia CBD HOUSE, Level 3 120 WICKHAM STREET FORTITUDE VALLEY QLD 4006 A C N 126 939 768 TELEPHONE (07) 3250 9000 FACSIMILE (07) 3250 9001 EMAIL mail@lar.net.au	Figure No: FIGURE 5
	Title: EXISTING COMMUNICATIONS, NAVIGATIONAL AND SURVEILLANCE AIDS (CNS)	Drawn: CMF · Checked: NB · Approved: BJH	Rev 0 · Date 31.05.17 · Scale 1:2500 · A3 · File Ref: B17115



Project: PROPOSED POLAIR DEVELOPMENT BANKSTOWN AIRPORT	Client: BANKSTOWN AIRPORT LIMITED	REHBEIN Airport Consulting	Figure No: FIGURE 6
	Title: POSSIBLE RELOCATED COMMUNICATIONS, NAVIGATIONAL AND SURVEILLANCE AIDS (CNS)	The Association of Consulting Engineers Australia	Scale: 1:2500 A3
		CBD HOUSE, Level 3 120 WICKHAM STREET FORTITUDE VALLEY QLD 4006 A C N 126 939 768 TELEPHONE (07) 3250 9000 FACSIMILE (07) 3250 9001 EMAIL mail@lar.net.au	File Ref: B17115 Sheet Size
		Drawn: CMF / Checked: NB / Approved: BJH	Rev: 0 Date: 31.05.17



NOTES :

1. THE OLS DIMENSIONS ARE IN ACCORDANCE WITH CASA CAAP 92-2(2) : GUIDELINES FOR THE ESTABLISHMENT AND OPERATION OF ONSHORE HELICOPTER LANDING SITES FIGURE 3 - RECOMMENDED DIMENSIONS AND SLOPES OF OBSTACLE LIMITATION SURFACES FOR SECONDARY HLS VISUAL FATOs SLOPE DESIGN CATEGORY A, PC1 (AW139)
2. ELEVATIONS SHOWN ARE TO THE AUSTRALIAN HEIGHT DATUM (AHD) AND ARE APPROXIMATE ONLY.

FOR INFORMATION ONLY
31.05.17

Project:
PROPOSED POLAIR DEVELOPMENT
BANKSTOWN AIRPORT

Client:
BANKSTOWN AIRPORT LIMITED

Title:
MAIN HELICOPTER
OBSTACLE LIMITATION SURFACES (CAT A)

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Rev	Date
0	31.05.17

Figure No: FIGURE 7
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File Ref: B17115
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HANGAR ROOF: RL 18.9m AHD
OLS LIMIT: RL 14.0m AHD

HANGAR RIDGELINE CAP: RL 22.1m AHD
OLS LIMIT: RL 16.3m AHD

PROPOSED POLAIR DEVELOPMENT

WEST HELICOPTER OLS (CAT B)

8.0
10
20
27.6
30
40
50
60
70
80
90
100
110
120
130
140
150
160
160.4

TWY E
TWY A1
TWY C
TWY A
RUNWAY 11L / 29R
RUNWAY 11C / 29C
RUNWAY 11R / 29L

AIRPORT LIGHT ROOM

NORTH

NOTES :

1. THE OLS DIMENSIONS ARE IN ACCORDANCE WITH CASA CAAP 92-2(2) : GUIDELINES FOR THE ESTABLISHMENT AND OPERATION OF ONSHORE HELICOPTER LANDING SITES FIGURE 3 - RECOMMENDED DIMENSIONS AND SLOPES OF OBSTACLE LIMITATION SURFACES FOR SECONDARY HLS VISUAL FATOs SLOPE DESIGN CATEGORY B, PC 2
2. ELEVATIONS SHOWN ARE TO THE AUSTRALIAN HEIGHT DATUM (AHD) AND ARE APPROXIMATE ONLY.

FOR INFORMATION ONLY
31.05.17

DRAFT
00 MMM, YYYY - 00:00am

Project:
PROPOSED POLAIR DEVELOPMENT
BANKSTOWN AIRPORT

Client:
BANKSTOWN AIRPORT LIMITED

Title:
WEST HELICOPTER
OBSTACLE LIMITATION SURFACES (CAT B)

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Figure No: FIGURE 8
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File Ref: B17115

PROPOSED POLAIR DEVELOPMENT

46m 20°Mag.

8.0
10

20

27.6
30
40
50
60
70
80
90
100
110
120
130
140
150
160
160.4

WEST HELICOPTER OLS (CAT B)

HANGAR ROOF: RL 18.9m AHD
OLS LIMIT: RL 18.9m AHD

TWY E
TWY A1
TWY C
TWY A
RUNWAY 11L / 29R
RUNWAY 11C / 29C
RUNWAY 11R / 29L

AIRPORT LIGHT ROOM

NORTH

FOR INFORMATION ONLY
31.05.17

NOTES :

1. THE OLS DIMENSIONS ARE IN ACCORDANCE WITH CASA CAAP 92-2(2) : GUIDELINES FOR THE ESTABLISHMENT AND OPERATION OF ONSHORE HELICOPTER LANDING SITES FIGURE 3 - RECOMMENDED DIMENSIONS AND SLOPES OF OBSTACLE LIMITATION SURFACES FOR SECONDARY HLS VISUAL FATOs SLOPE DESIGN CATEGORY B, PC 2
2. ELEVATIONS SHOWN ARE TO THE AUSTRALIAN HEIGHT DATUM (AHD) AND ARE APPROXIMATE ONLY.

Project:
PROPOSED POLAIR DEVELOPMENT
BANKSTOWN AIRPORT

Client:
BANKSTOWN AIRPORT LIMITED

Title:
POSSIBLE RELOCATED WEST HLS
OBSTACLE LIMITATION SURFACES (CAT B)

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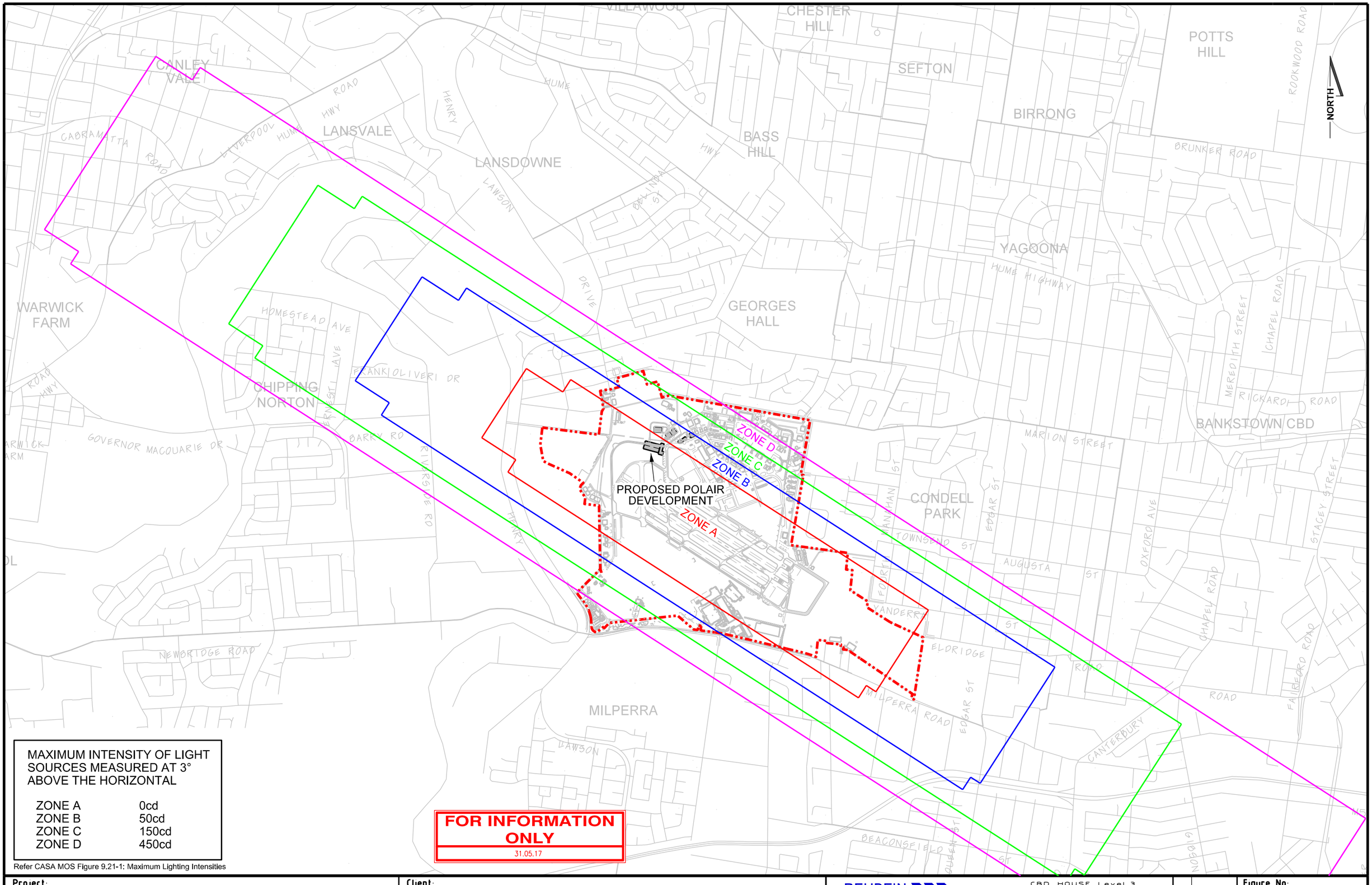
Rev 0 | Date 31.05.17

Figure No:
FIGURE 9

Scale: 1:4000 | Sheet Size: A3

File Ref: B17115



MAXIMUM INTENSITY OF LIGHT SOURCES MEASURED AT 3° ABOVE THE HORIZONTAL

ZONE A	0cd
ZONE B	50cd
ZONE C	150cd
ZONE D	450cd

Refer CASA MOS Figure 9.21-1: Maximum Lighting Intensities

FOR INFORMATION ONLY
31.05.17

Project:
PROPOSED POLAIR DEVELOPMENT
BANKSTOWN AIRPORT

Client: BANKSTOWN AIRPORT LIMITED

Title: NASF - GUIDELINE E
MAXIMUM LIGHTING INTENSITY ZONES

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Rev 0 | Date 31.05.17

Figure No: FIGURE 10

Scale: 1:25,000 | A3 Sheet Size

File Ref: B17115

Windshear and Turbulence Assessment

Appendix E

PolAir building wind shear and turbulence impact assessment

prepared for

Bankstown Airport Ltd

12 May 2017

SYNERGETICS

PolAir building wind shear and turbulence impact assessment
for

Bankstown Airport Ltd

Report version	Date	Prepared by	Reviewed by
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SYNERGETICS Bankstown Airport Ltd

17014 POLAIR windshear and turbulence assessment F01

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Executive summary

Bankstown Airport have proposed the construction of a new building, referred to as the PolAir building, on a site approximately 250m north of the northern end of runway 11L/29R.

This building falls within the region that requires a wind shear and turbulence assessment as per paragraph 10 in *National Airports Safeguarding Framework, Guideline B (NASF Guideline B) - Managing the risk of building generated windshear and turbulence at airports*. Bankstown Airport have requested that Synergetics assess the proposed building, in accordance with the:

- *existing* NASF Guideline B wind shear assessment criterion (DIRD, 2012); and
- *proposed* draft NASF Guideline B wind shear and turbulence assessment criteria (DIRD, 2016).

Computational Fluid Dynamics (CFD) simulations of building induced wind shear and turbulence were conducted for the proposed PolAir building at Bankstown Airport. Results were assessed against both the existing and proposed draft assessment criteria referenced above.

The existing guideline does not specify where the assessment should take place, while the draft guideline guidance notes state that the assessment should be conducted along the runway centreline. To resolve potential impacts or both typical and atypical aircraft trajectories, wind shear and turbulence were assessed along the runway centrelines, and along an offset plane located between the PolAir building and runway 11L/29R.

Wind impacts were found to be low, with very high crosswind speeds of 47 knots required to exceed the existing criterion, and 42 knots for the proposed criteria, on the closest runway centreline. Results on the offset plane demonstrated that crosswind speeds of 27 knots were required to exceed the existing criterion and 23 knots for the proposed criteria.

An examination of historical Bureau of Meteorology (BoM) wind data from the site suggests that these very high crosswind speeds are rare events, with >=23 knot crosswind gusts expected to occur during approximately three hours per year, and >=27 knot crosswind gusts expected to occur for less than one hour per year.

1 Introduction

Bankstown Airport have proposed the construction of a new building, referred to as the PolAir building, on a site approximately 250m north of the northern end of runway 11L/29R, as shown in Figure 1 and Figure 2.

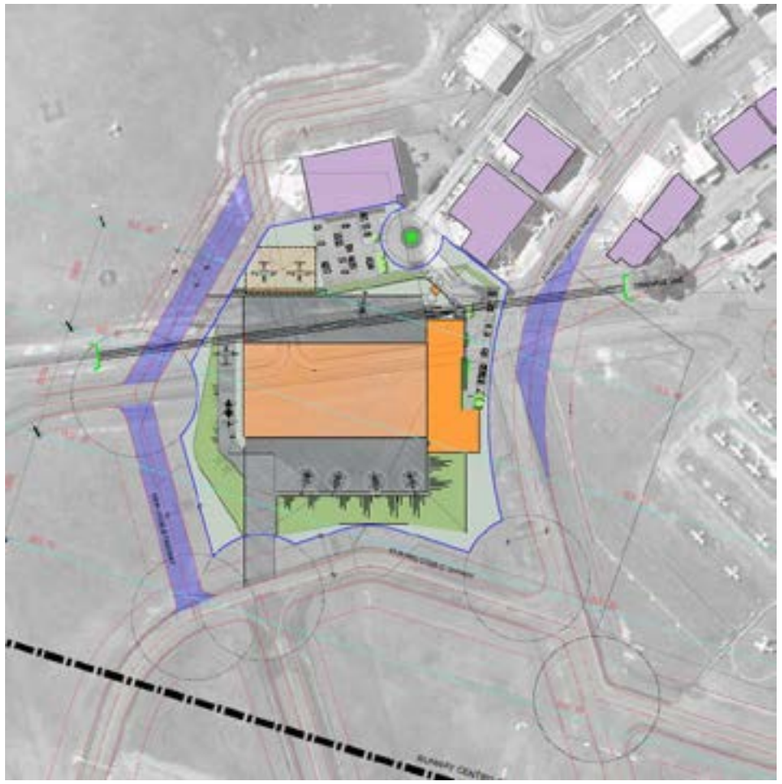


Figure 1 - Plan view Bankstown Airport showing the location of existing buildings and the proposed PolAir building. Reproduced from plans provided by Crawford Architects.

Figure 2 - Rendered image of the proposed building. Reproduced from plans provided by Crawford Architects.

Buildings that are proposed to be located within the regions defined by Paragraph 10 in *National Airports Safeguarding Framework, Guideline B (NASF Guideline B) - Managing the risk of building generated windshear and turbulence at airports* (DIRD, 2012), as shown in Figure 2, require an assessment in accordance with NASF B. This assessment is required to ensure that building induced wind shear and turbulence in the wake of a proposed building do not cause unsafe impacts on aircraft.

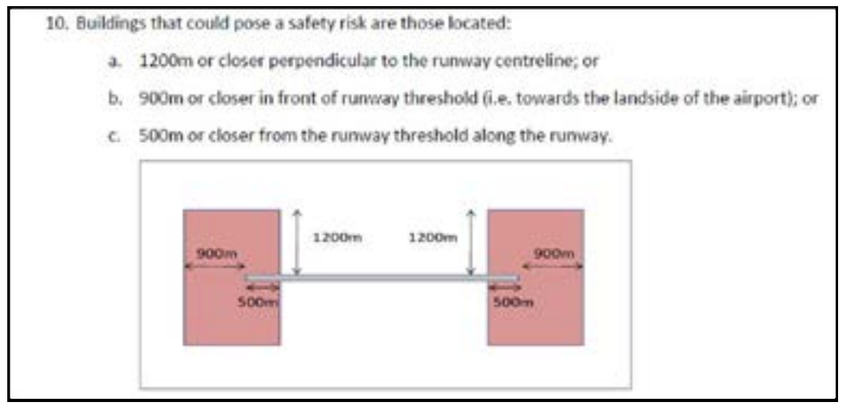


Figure 3 - Extract from Paragraph 10 in NASF Guideline B (DIRD 2012).

NASF Guideline B is currently under review, and a draft update to NASF Guideline B was released for comment in 2016 by the Department of Infrastructure and Regional Development (DIRD). The draft update to NASF Guideline B includes proposed changes to both the wind shear and turbulence assessment criteria. At the time of writing, DIRD are yet to determine whether the proposed changes will be adopted in the next version of NASF Guideline B. Considering the uncertain nature of the future NASF Guideline B assessment criteria, Bankstown Airport have requested that Synergetics assess the proposed building against both the current NASF Guideline B assessment criteria and the proposed draft assessment criteria.

2 Site description

2.1 Building design and location

The proposed PolAir building consists of a hanger and associated offices, located near the north western end of the runways at Bankstown Airport, as shown in Figure 4. The building will be surrounded with a hardstand on three of its four sides, and fitted with large louvres in several locations, including the south east corner, as shown in Figure 5

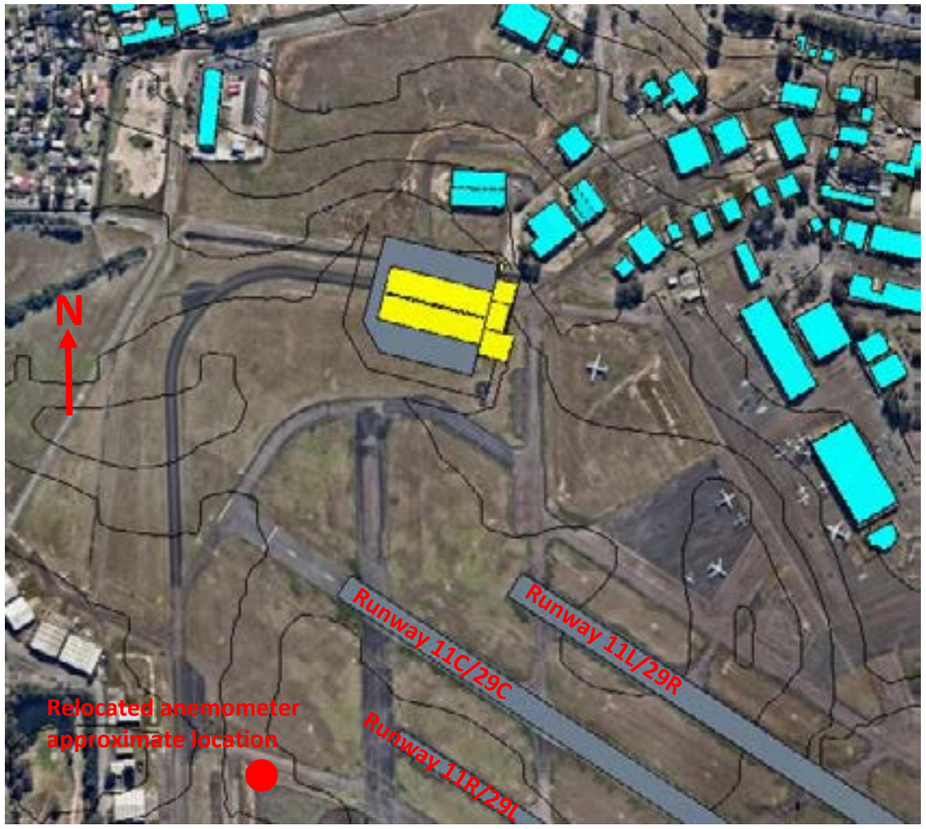


Figure 4 - Location of the proposed PolAir building (yellow). North is orientated to the top of the page, and the hardstand and runways are shown in grey. Nearby buildings are coloured blue. Aerial image reproduced from Nearmap 2017.

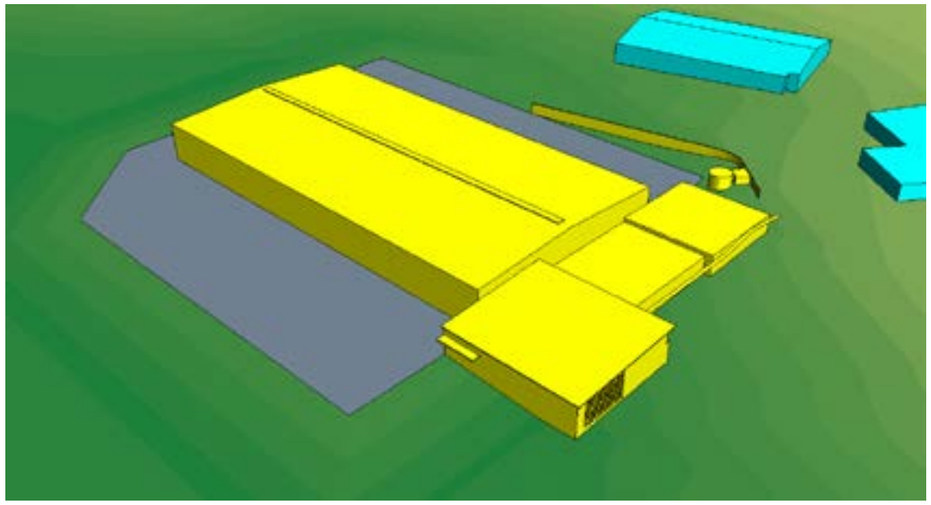


Figure 5 - A close up rendered image of the proposed PolAir geometry, as modelled, showing the louvres and barrier wall on the northern side of the hardstand. The contours on the ground show the slight elevation changes.

2.2 Meteorology

The Bankstown Airport site is subject to moderate winds, with winds parallel to the runway more common than those normal to the runway, as shown in Appendix A. For this study, three wind directions were considered that are expected to generate the most significant wind impacts for aircraft landing or taking off. These directions are:

- Wind direction 1 (WD1), normal to the proposed building, approximately northerly;
- Wind direction 2 (WD2), normal to the runways, approximately north northeasterly; and
- Wind direction 3 (WD3), at a 45˚ angle to the proposed building, approximately northeasterly.

The existing anemometer at Bankstown Airport is in close proximity to the PolAir building. Synergetics were advised that the anemometer will be relocated to the southern side of the runways as part of the PolAir building development. As such, wind speeds reported in this study are based on a likely relocated anemometer location outside the building wakes, shown in Figure 4.

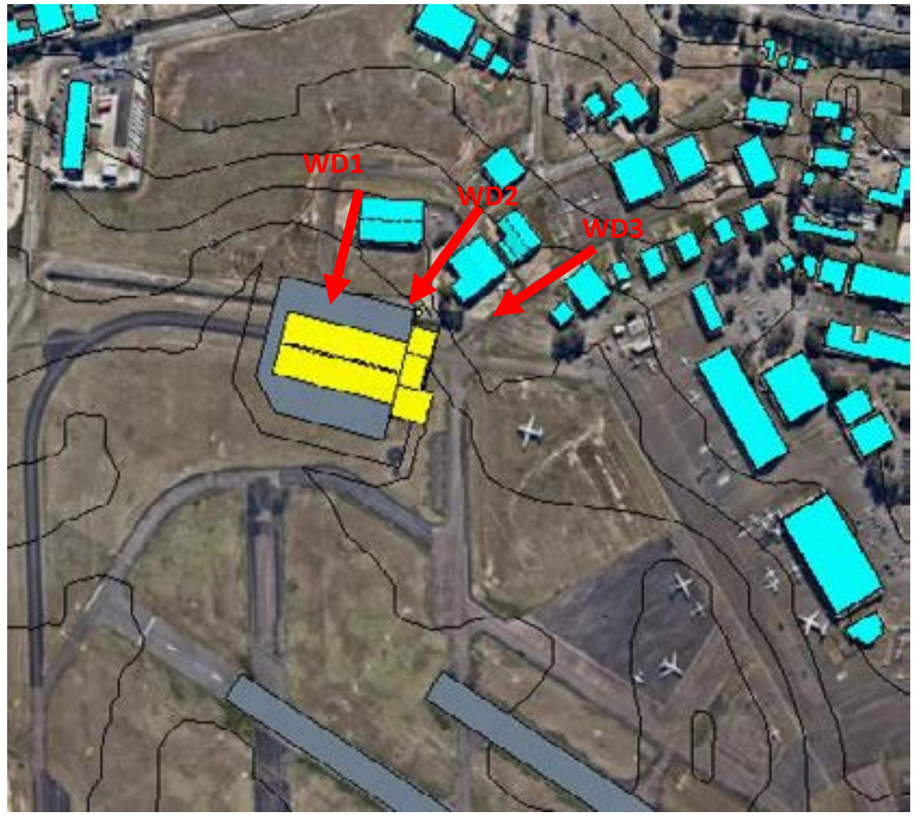


Figure 6 - Aerial image of the PolAir site, with the three assessed wind directions marked in red.

3 Assessment criteria

This report includes an assessment against both the currently active version of NASF Guideline B (DIRD, 2012) and the proposed version (DIRD, 2016) currently undergoing review. The 2016 draft is a major overhaul, with new and different assessment criteria, and therefore requires a different assessment methodology.

3.1 Existing NASF Guideline B (2012) assessment criterion

Guidelines for assessment of the effects of a building generated windshear and turbulence at airports is addressed by "National Airports Safeguarding Framework, Guideline B, Managing the risk of building generated windshear and turbulence at airports, 2012" (DIRD 2012), commonly referred to as NASF Guideline B. The assessment criterion included in this guideline is as follows:

34.	The variation in mean wind speed due to wind disturbing structures must remain below 7 knots along the aircraft trajectory at heights below 200ft. The speed deficit change of 7 knots must take place over a distance of at least 100m
35.	This criterion will apply in Australia.

The guidelines provide a range of assessment methodologies described as Cases A, B1 and B2, as shown in Table 1. For the proposed PolAir building, the relevant methodology is described by Case C.

In accordance with the methodology associated with Case C, the approval of a building design requires that the 7-knot deficit guideline is either:

- never exceeded; or
- is only exceeded several times per year and a Building Wake Management Plan is implemented to prevent planes being affected by these exceedances.

Table 1 - NASF Guideline B (2012) assessment methodologies (DIRD, 2012).

Category	Building Description	Assessment Methodology
Case A	**Building Shape:** Any Shape The building height satisfies the 1:35 rule, i.e. the horizontal distance of the building's closest point from the edge of the runway is more than 35 times the height of the building	In this instance, the building is deemed acceptable and no further assessment is required.
Case B1	**Building Shape:** Single, Regular Shape, e.g. Rectangular Buildings **Prevailing Wind Building Angle:** Perpendicular to Building Facades	In this instance, all available techniques, including a Qualitative (Desktop) Study, could be used to address the acceptability of the proposal. The mean velocity deficit data provided in **Table 1** could be used in conjunction with the building height and local wind rose information to identify the potential (if any) for adverse cross wind conditions.
Case B2	**Building Shape:** Single, Regular Shape, e.g. Rectangular Buildings **Prevailing Wind-Building Angle:** Oblique to Building Facades	In this instance, a safety margin would need to be added to the mean velocity deficit data provided in **Table 1** in conjunction with the building height and local wind rose information to identify the potential (if any) for adverse cross wind conditions. The safety margin might be in the form of an increase in perceived distance downstream of the order of at least 25%.
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).

3.2 Proposed NASF Guideline B (2016) assessment criteria

The draft update to NASF Guideline B includes changes to the wind shear criteria, as well as an additional turbulence criterion, as follows:

45. The variation in mean wind speed due to wind disturbing structures must remain below:
    - 7 knots along the aircraft trajectory at heights below 200ft. The speed deficit change of 7 knots must take place over a distance of at least 100m.
    - 6 knots across the aircraft trajectory at heights below 200ft. The speed deficit change of 6 knots must take place over a distance of at least 100m.

46. The standard deviation of wind speed must remain below 4 knots at heights below 200ft.

The standard deviation criteria is based on the 4 knot RMS turbulence recommendation by the Netherlands Aerospace Centre (NLR, 2010). However, the NLR (2010) recommendation explicitly applies to the horizontal component of turbulent velocity fluctuations. As such, the turbulent velocity results reported in this report are computed based on the horizontal component of velocity fluctuations.

The supporting guidance notes for (DIRD, 2016) are in an early draft format, however they recommend that the wind speed fluctuations should be resolved to include all fluctuations with a period of at least one or two seconds.

4 Methodology

Computational fluid dynamics (CFD) is listed as an approved assessment methodology in NASF Guideline B (2012 & 2016) and was employed for this assessment.

To resolve the turbulent velocity fluctuations assessed under (DIRD, 2016) an unsteady solver is required. For this study, the Spalart-Allmaras formulation of the detached eddy simulation (DES) was selected. This formulation is widely used for flow around buildings, and is well validated for such flows (Dadioti & Rees, 2016).

For the wind conditions addressed in this report, the airport is more than 3 km downstream from the ocean and the associated coastal meteorology, with the upwind land covered with stand-alone residential buildings typical of urban suburbs. For these reasons an urban wind profile was considered the most appropriate selection for the vertical wind speed profile. The vertical wind speed profile was set using a logarithmic law profile, given by:

$$u(z) = \frac{u^*}{\kappa}\ln(\frac{z+z_0}{z_0}),$$

where $u(z)$ is the velocity at height z above the ground, u^* is the friction velocity, κ is the von Karman constant, and z_0 is the surface roughness. This log-law is widely used in atmospheric fluid dynamics as it provides good agreement with measured velocity profiles. The land for several kilometres to the north and east of the airport is predominantly residential with some 1-2 storey mixed landuse. A representative surface roughness of 1.0 m was adopted to represent this upwind fetch. The combination of an appropriate inlet profile, together with the modelling of the surrounding features and roughness, provides a representative wind exposure for the target buildings, and ensures appropriate boundary layer propagation, as shown in Appendix B.

Inlet turbulence was specified using turbulent viscosity, μ_t, given by:

$$\mu_t = 0.09\frac{\rho k^2}{\varepsilon},$$

where ρ is fluid density and turbulence kinetic energy, *k*, and turbulence dissipation rate, ε were set based on equations from (Richards & Hoxey, 1993):

$$k(z) = \frac{u^{*2}}{\sqrt{0.09}},$$

$$\varepsilon(z) = \frac{u^{*3}}{\kappa(z+z_0)}.$$

Surface roughness was set to a "sand grain" value of 10 mm, for the ground on the runways, and surrounding grassy areas, which is a mathematical representation of surface roughness appropriate for well-kept grassy areas such as the land surrounding the runway.

To minimise any potential blockage issues, a large domain was used, with a width of 1500 m, an upstream fetch of 1000 m and extending 1400 m downstream. The domain height was set to approximately 1250 m to mitigate blockage errors due to the topography.

Unstructured polyhedral cells were used to create an efficient mesh with high resolution near the building, throughout the upstream fetch and in the building wake. Mesh coarsening was applied in the far field for computational efficiency without compromising modelling accuracy. Prism layers were added over the building and ground surfaces around the runways, with the

prism layer height set such that the non-dimensionalised wall normal distance, *y+*, was less than 300. The final mesh density was selected following a mesh independence study, outlined in Appendix C. The surface mesh around the PolAir building is shown in Figure 7.

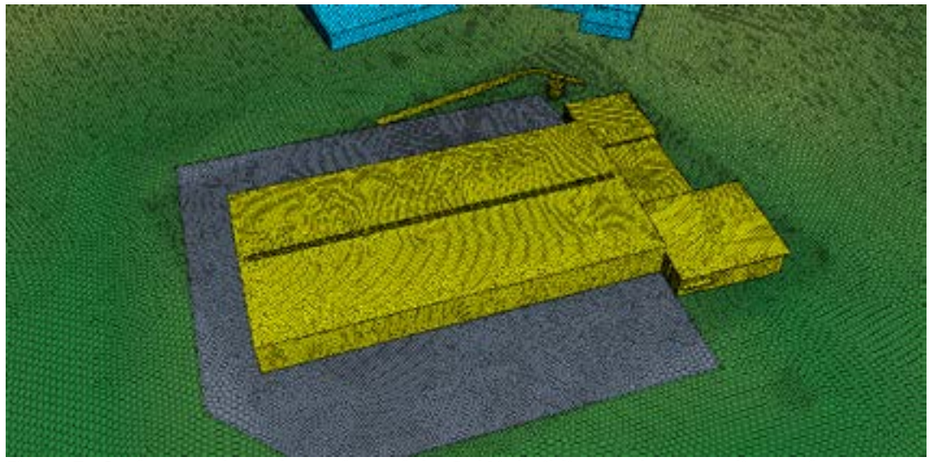


Figure 7 - Surface mesh on the surface of the PolAir building, and surrounding surfaces.

Unsteady simulations were run until transient fluctuations had reached a periodic state, and then were run for a period of 300 s of simulated time, with the results sampled every 0.2 seconds. More rapid sampling times were investigated, but had no significant impact on the results. The 300 s sampling period allows sufficient time for the oscillations in the flow field to be smoothed out and to resolve any transient flow structures that are small enough to present themselves as turbulent fluctuations during landing. The data was processed to remove any high frequency noise with a period of less than one second using a 6th order Butterworth filter with a cut-off frequency of 1 Hz.

For each wind direction, simulations were run for:

- the baseline case, i.e., without the new development and nearby buildings; and
- the completed PolAir development.

Mean wind speed deficits were calculated by subtracting the mean wind speeds for the PolAir building simulations from the baseline results in accordance with the assessment criteria outlined in Section 3:

$$wind\ speed\ deficit = baseline\ wind\ speed - \ POLAIR\ wind\ speed.$$

Turbulence was measured by computing the standard deviation of the turbulent velocity fluctuations over the 300 s sampling window.

Results were extracted along a series of vertical measurement planes aligned with the runway centreline, as shown in Figure 8 and Figure 9. The planes extend along the centreline of each runway and extending beyond the threshold with a glide slope of 3˚, as recommended in the guidance notes for (DIRD, 2016). An additional offset measurement plane was included to assure conservative results by resolving impacts for aircraft deviating away from runway 11L/29R toward the PolAir building. This plane was based on the obstacle limitation surface (OLS) for the nearest runway (11L/29R) and extends vertically from the inner edge of the transitional surface up to the start of the take-off climb surface (TOCS). From the take-off climb surface the plane turns to follow the northern most edge of the TOCS, climbing with a glide slope of 3˚. The

measurement planes for wind direction 1 are shown in Figure 9, and the measurement planes for the other wind directions are included in Appendix D.

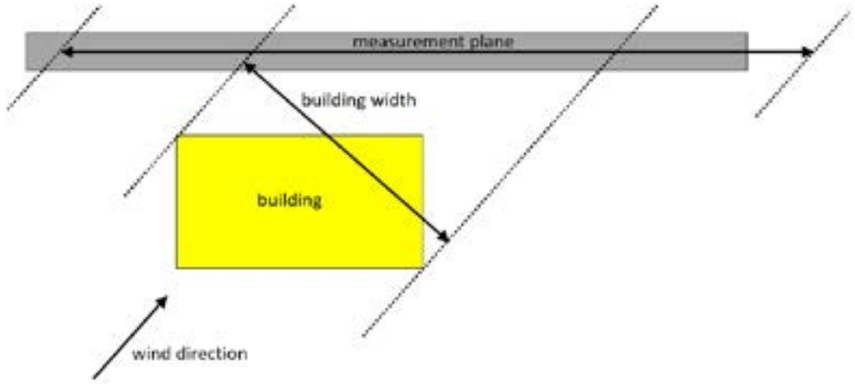


Figure 8 - Plan view schematic showing location of runway centreline measurement planes relative to the building. The length of the measurement plane is 3x the building width (with a minimum length of 500 m).

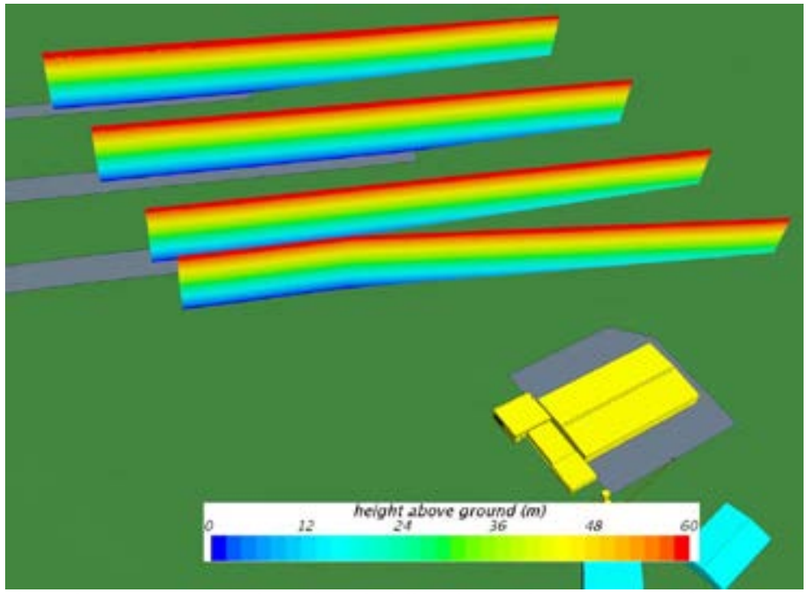


Figure 9 - Measurement planes for wind direction 1. The worst case offset measurement plane is located between runway 11L/29R and the PolAir building and follows the inner edge of the transitional surface and the northern edge of the TOCS.

5 Results

5.1 NASF Guideline B (2012) assessment

Wind speed deficits based on the criteria of (DIRD, 2012) for the three assessed wind directions are shown in Figure 10, Figure 11 and Figure 12, with the results tabulated in Table 2 and Table 3.

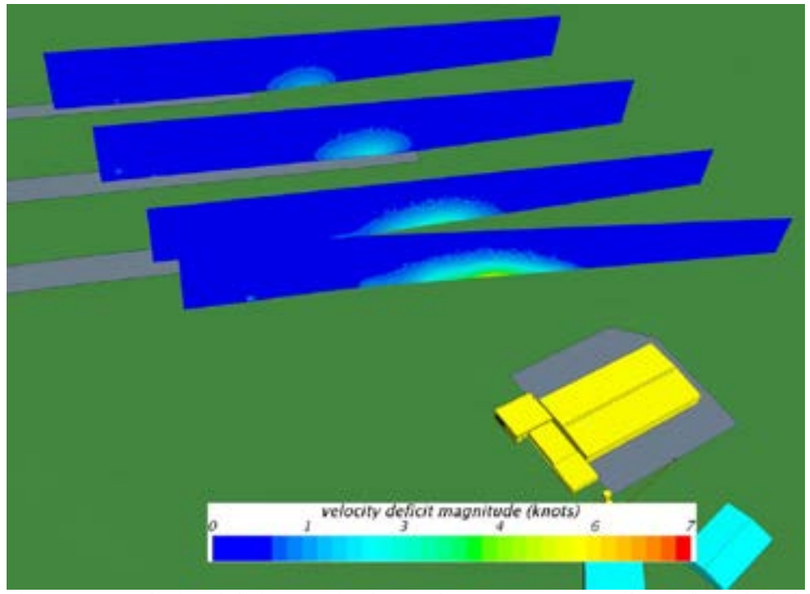


Figure 10 - Velocity deficit magnitude on the measurement planes for winds blowing from wind direction 1 with a 20 knot crosswind component.

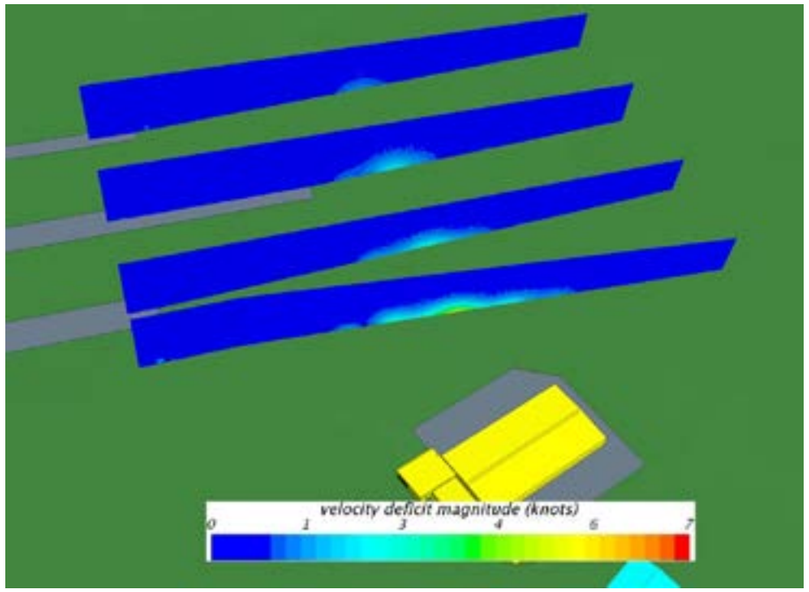


Figure 11 - Velocity deficit magnitude on the measurement for winds blowing from wind direction 2 with a 20 knot crosswind component.

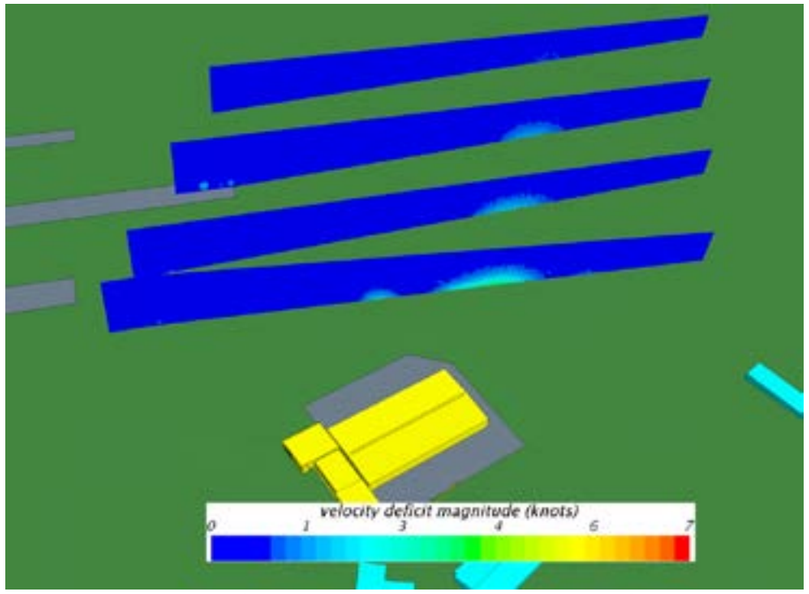


Figure 12 - Velocity deficit magnitude on the measurement for winds blowing from wind direction 3 with a 20 knot crosswind component.

Table 2 – Peak wind shear deficit (knots) with a 20 knot crosswind.

	Measurement plane			
Wind direction	**Runway 11L/29R**	**Runway 11C/29C**	**Runway 11R/29L**	**Offset**
Wind direction 1	1.6	2.2	3.0	5.0
Wind direction 2	1.4	2.3	2.7	5.2
Wind direction 3	1.4	1.7	1.9	3.8

Table 3 - Wind speed (knots) required to reach (DIRD, 2012) wind shear criteria. Value in brackets is the crosswind component of the wind speed.

	Measurement plane			
Wind direction	**Runway 11L/29R**	**Runway 11C/29C**	**Runway 11R/29L**	**Offset**
Wind direction 1	94(89)	68(64)	50(47)	29(28)
Wind direction 2	99(99)	60(60)	52(52)	27(27)
Wind direction 3	>100(98)	94(84)	82(74)	41 (37)

5.2 Draft NASF Guideline B (2016) assessment

Wind speed deficits based on the across track and along track criteria of (DIRD, 2016) for the three assessed wind directions are shown in Figure 13 to Figure 18 , with the results tabulated in Table 4, Table 5 and Table 6.

The standard deviation of wind speed deficits based on the criteria of (DIRD, 2016) for the three assessed wind directions are shown in Figure 19, Figure 20 and Figure 21, with the results tabulated in Table 7 and Table 8.

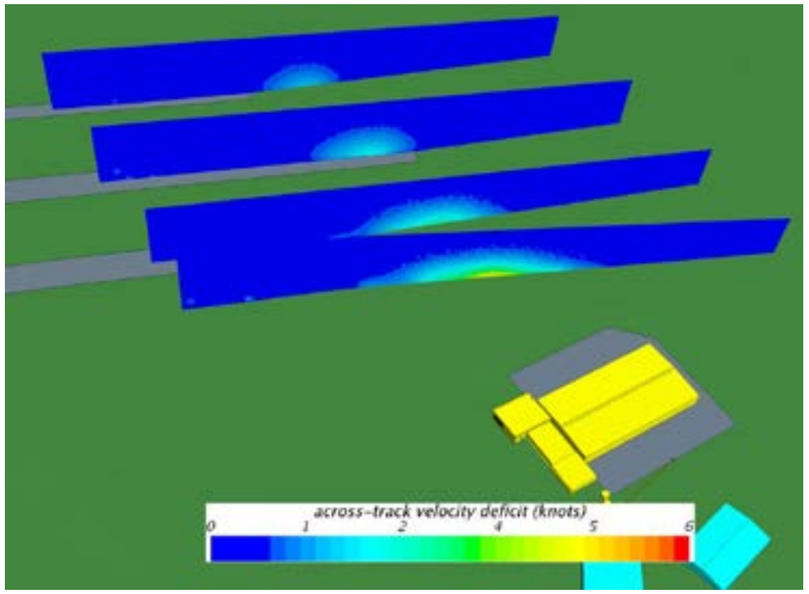


Figure 13 – Across track wind speed deficit on the measurement planes for winds blowing from wind direction 1 with a 20 knot crosswind component.

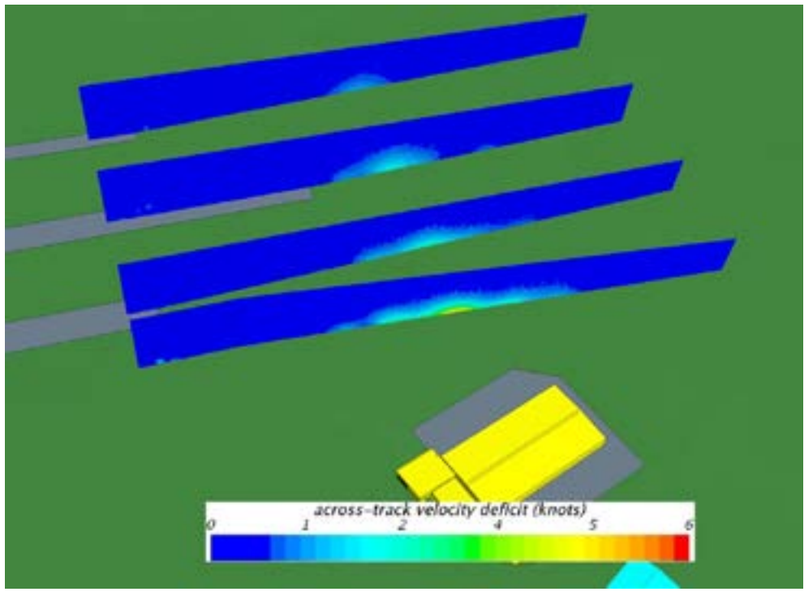


Figure 14 - Across track wind speed deficit on the measurement planes for winds blowing from wind direction 2 with a 20 knot crosswind component.

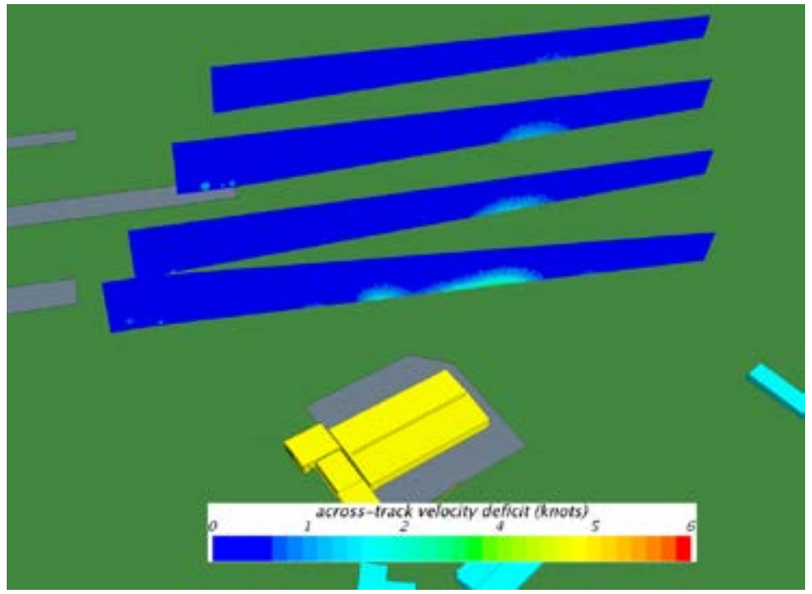


Figure 15 – Across track wind speed deficit on the measurement planes for winds blowing from wind direction 3 with a 20 knot crosswind component.

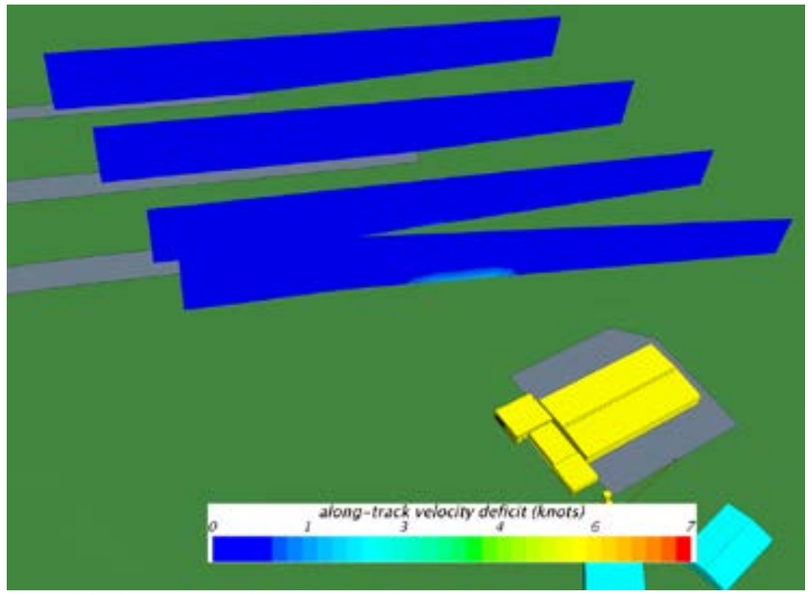


Figure 16 - Along track wind speed deficit on the measurement planes for winds blowing from wind direction 1 with a 20 knot crosswind component.

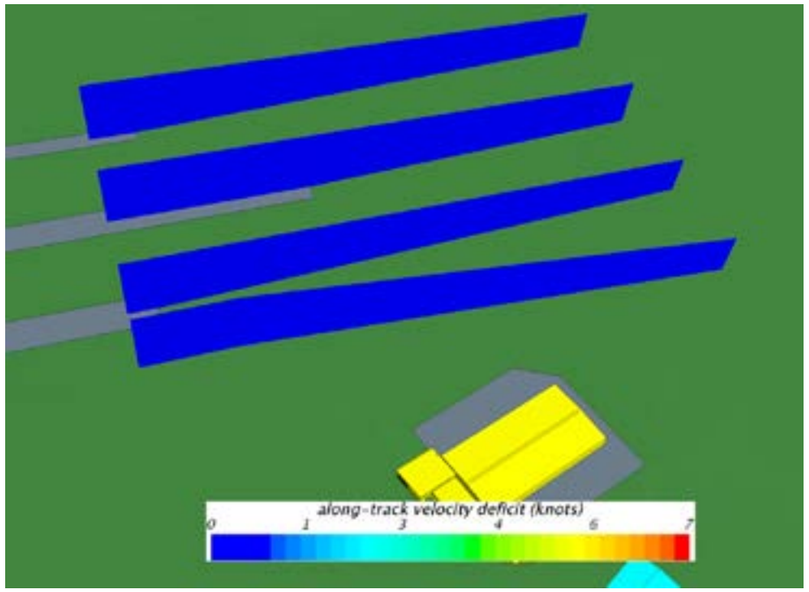


Figure 17 - Along track wind speed deficit on the measurement planes for winds blowing from wind direction 2 with a 20 knot crosswind component.

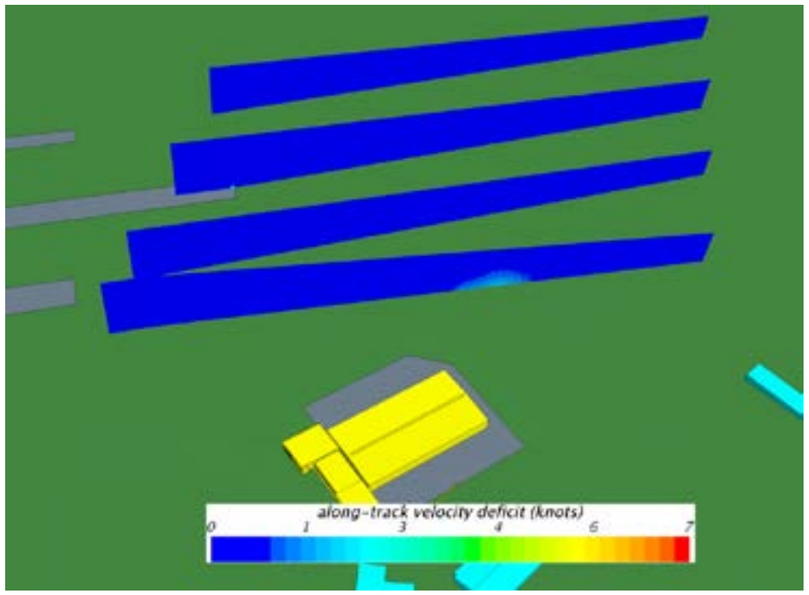


Figure 18 – Along track wind speed deficit on the measurement planes for winds blowing from wind direction 3 with a 20 knot crosswind component.

Table 4 - Peak across track wind shear deficit (knots) with a 20 knot crosswind.

	Measurement plane			
Wind direction	**Runway 11L/29R**	**Runway 11C/29C**	**Runway 11R/29L**	**Offset**
Wind direction 1	1.5	2.1	2.8	4.7
Wind direction 2	1.4	2.3	2.7	5.3
Wind direction 3	1.3	1.5	1.7	3.4

Table 5 - Peak along track wind shear deficit (knots) with a 20 knot crosswind.

	Measurement plane			
Wind direction	**Runway 11L/29R**	**Runway 11C/29C**	**Runway 11R/29L**	**Offset**
Wind direction 1	0.51	0.75	1.00	1.7
Wind direction 2	0.13	0.27	0.26	0.66
Wind direction 3	0.40	0.57	0.85	1.8

Table 6 - Wind speed (knots) required to reach (DIRD, 2016) wind shear criteria. Value in brackets is the crosswind component of the wind speed.

	Measurement plane			
Wind direction	**Runway 11L/29R**	**Runway 11C/29C**	**Runway 11R/29L**	**Offset**
Wind direction 1	84(79)	61(58)	45(42)	27(25)
Wind direction 2	85(85)	52(52)	45(45)	23(23)
Wind direction 3	>100(95)	88(78)	78(70)	40(36)

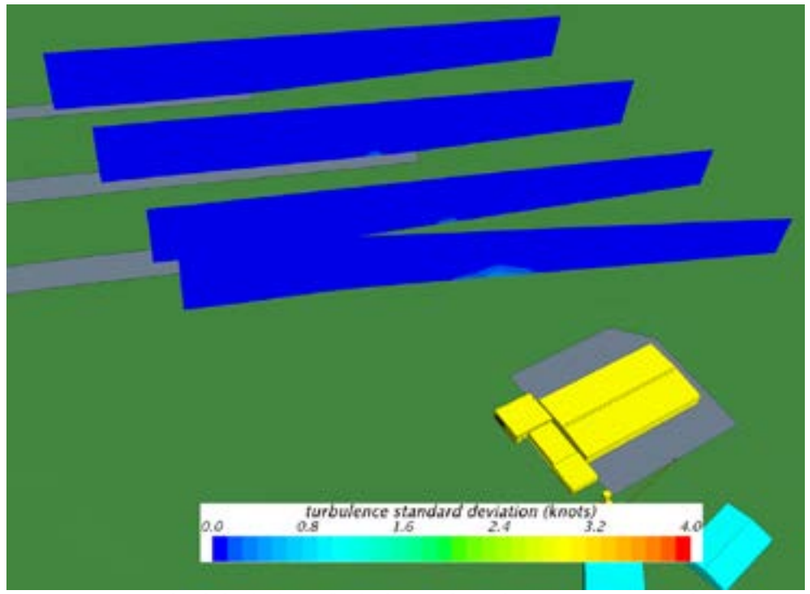


Figure 19 - Standard deviation of wind speed on the measurement planes for winds blowing from wind direction 1 with a 20 knot crosswind component.

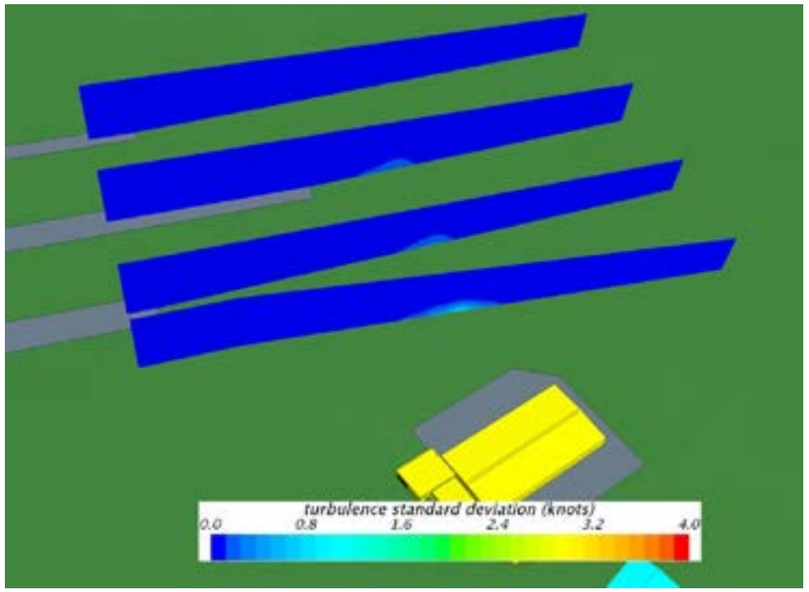


Figure 20 - Standard deviation of wind speed on the measurement planes for winds blowing from wind direction 2 with a 20 knot crosswind component.

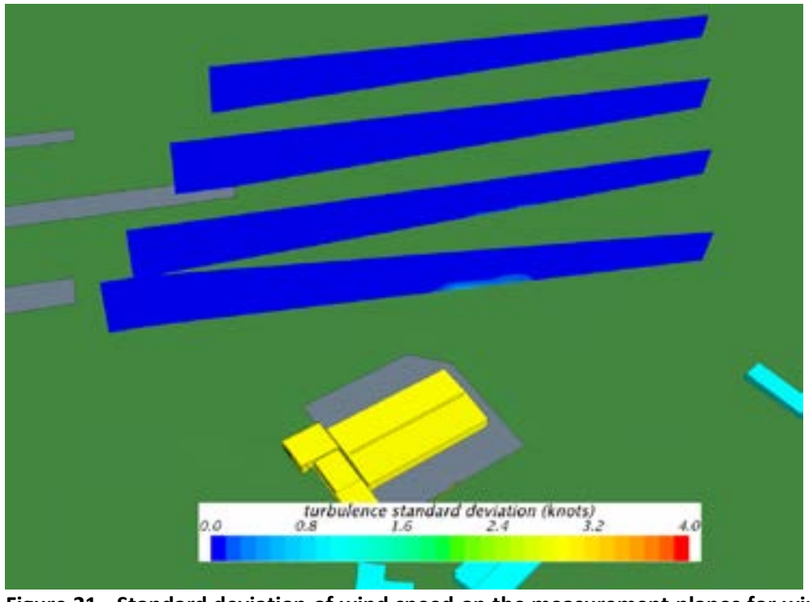


Figure 21 - Standard deviation of wind speed on the measurement planes for winds blowing from wind direction 3 with a 20 knot crosswind component.

Table 7 - Maximum standard deviation of wind speed with a 20 knot crosswind component.

	Measurement plane			
Criteria	**Runway 11L/29R**	**Runway 11C/29C**	**Runway 11R/29L**	**Offset**
Wind direction 1	0.08	0.17	0.19	0.44
Wind direction 2	0.10	0.27	0.34	0.91
Wind direction 3	0.06	0.14	0.16	0.65

Table 8 - Wind speed (knots) required to reach (DIRD, 2016) standard deviation of wind speed criteria. Value in brackets is the crosswind component of the wind speed.

	Measurement plane			
Criteria	**Runway 11L/29R**	**Runway 11C/29C**	**Runway 11R/29L**	**Offset**
Wind direction 1	>100(>100)	>100(>100)	>100(>100)	>100(>100)
Wind direction 2	>100(>100)	>100(>100)	>100(>100)	88(88)
Wind direction 3	>100(>100)	>100(>100)	>100(>100)	>100(>100)

5.3 Frequency of exceeding NASF Guideline B criteria

To assess the likelihood of occurrence of the wind speeds presented in Table 3, Table 6 and Table 8, historical meteorological records for the Bankstown Airport Bureau of Meteorology station were examined.

Wind gust speed records from a ten year period from 1 January 2005 to 31 December 2014 were assessed. From this analysis the average number of hours per year during which gusts will result in the NASF Guideline B wind criteria exceedance was estimated. These results are presented in Table 9, and indicate that exceedances will occur infrequently, particularly above the runway centrelines, where exceptionally strong winds will be required.

Table 9 - Predicted average number of hours per year during which gusts will result in criteria being exceeded, based off historical wind records.

	Measurement plane			
Criteria	**Runway 11L/29R**	**Runway 11C/29C**	**Runway 11R/29L**	**Offset**
NASF Guideline B (2012) wind shear	<1	<1	<1	<1
NASF Guideline B (2016) wind shear	<1	<1	<1	3
NASF Guideline B (2016) standard deviation	<1	<1	<1	<1

6 Conclusions

CFD simulations of building induced wind shear and turbulence were conducted for the proposed PolAir building at Bankstown Airport. Results were assessed against both the existing NASF Guideline B (DIRD, 2012) assessment criterion and the proposed assessment criteria (DIRD, 2016).

Wind shear and turbulence were assessed along an offset plane located between the PolAir building and runway 11L/29R, in addition to the runway centrelines, to assure that the assessment is conservative.

Wind impacts were found to be low, with very high crosswind speeds of 47 knots required to exceed the existing criterion, and 42 knots for the proposed criteria, on the closest runway centreline. Results on the offset plane demonstrated that crosswind speeds of 27 knots were required to exceed the existing criterion and 23 knots for the proposed criteria.

An examination of historical Bureau of Meteorology (BoM) wind data from the site suggests that these very high crosswind speeds are rare events with >=23 knot crosswind gusts expected to occur during approximately three hours per year, and >=27 knot crosswind gusts expected to occur for less than one hour per year.

7 References

Dadioti, R., & Rees, S. (2016). Validation of a Detached Eddy Simulation (DES) Model in Complex Urban Environment. *Athens Journal of Sciences*.

DIRD. (2012). *National Airports Safeguarding Framework, Guideline B, Managing the risk of building generated windshear and turbulence at airports.* Department of Infrastructure and Regional Development.

DIRD. (2016). *Draft National Airports Safeguarding Framework Guideline B - Managing the Risk of Building Generated Wind Shear and Turbulence.* Canberra.

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

Richards, P., & Hoxey, R. (1993). Appropriate boundary conditions for computational wind engineering models using the k-e turbulence model. *Journal of Wind Engineering and Industrial Aerodynamics*, 145-153.

Appendix A. Wind roses

Rose of Wind direction versus Wind speed in km/h (01 Jul 1968 to 30 Sep 2010)

Custom times selected, refer to attached note for details

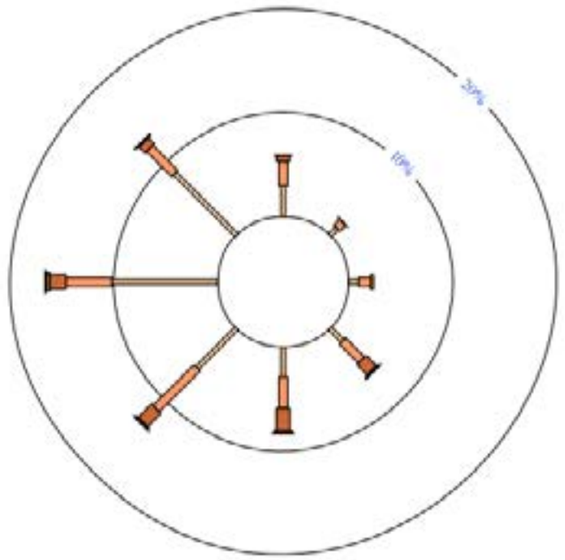
BANKSTOWN AIRPORT AWS

Site No: 066137 • Opened Jan 1968 • Still Open • Latitude: -33.9181° • Longitude: 150.9864° • Elevation 6.m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.

9 am
15131 Total Observations

Calm 32%



Rose of Wind direction versus Wind speed in km/h (01 Jul 1968 to 30 Sep 2010)

Custom times selected, refer to attached note for details

BANKSTOWN AIRPORT AWS

Site No: 066137 • Opened Jan 1968 • Still Open • Latitude: -33.9181° • Longitude: 150.9864° • Elevation 6.m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.

3 pm
13376 Total Observations

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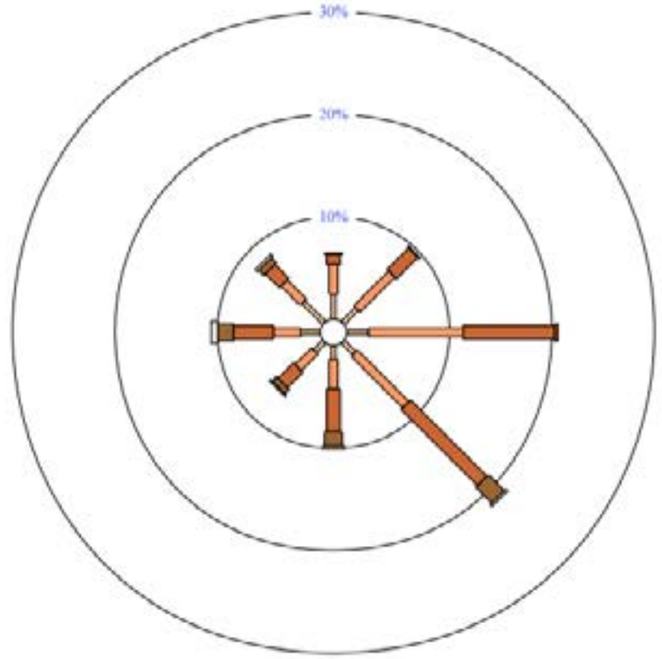

Appendix B. Boundary layer propagation

The propagation of the atmospheric boundary layer throughout the domain is shown in Figure 22.

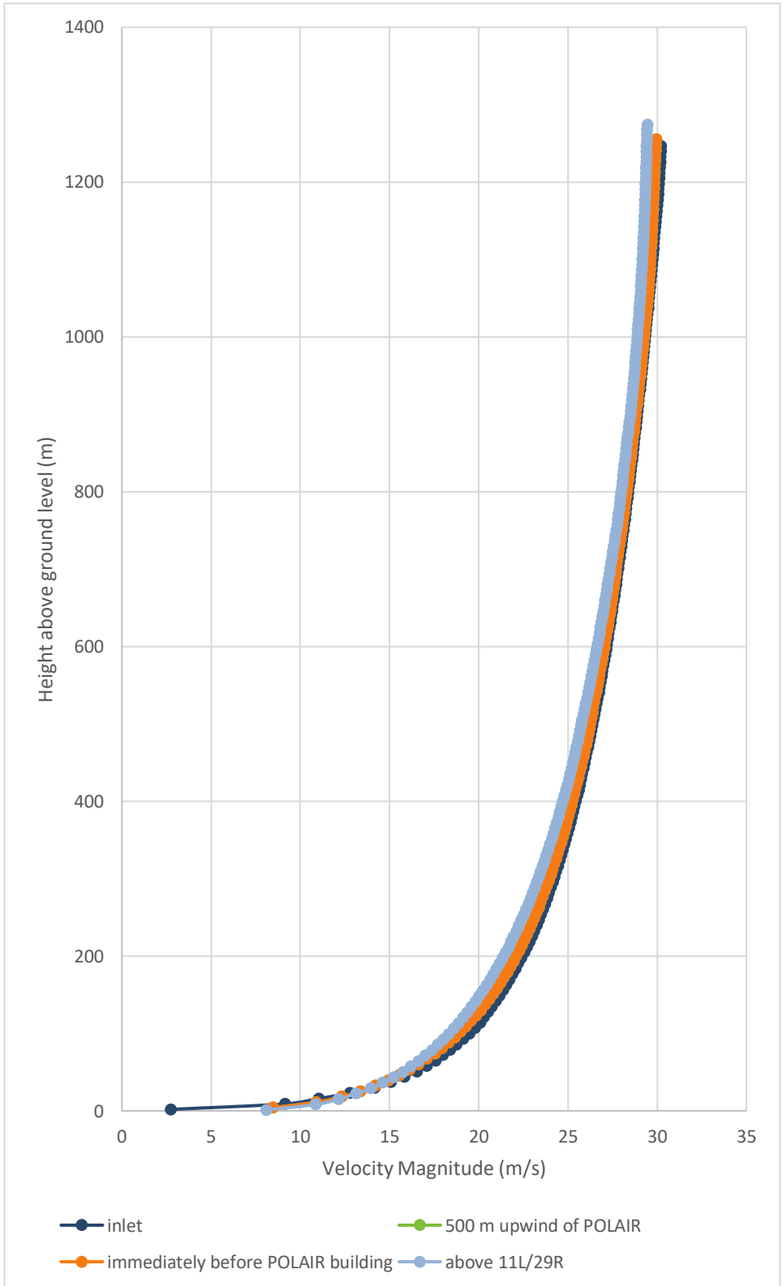

Figure 22 - Velocity profiles for 4 different locations throughout the domain.

Appendix C. Mesh independence

The mesh for a CFD simulation needs to be adequately fine so that it can resolve both the features of the geometry and the flow structures. Under-resolving flow features can lead to increased numerical dissipation and inaccurate results. Increasing mesh refinement will resolve flow features more accurately, but requires additional computation time and resources. Therefore, a mesh independence study has been conducted to optimally select a level of mesh refinement that accurately resolves flow features while minimising computational requirements.

Three different meshes were considered, each with different levels of refinement. Each mesh was controlled with regions of refinement and coarsening applied to maximise the resolution in areas of interest and coarsen it in the far field. The thick atmospheric boundary layer resulted in acceptable boundary layer resolution, however prism layers over the ground and buildings were also implemented as a means to improve the result quality. Outside these prism layers the remaining cells were polyhedral elements. A summary of each mesh is provided in Table 10.

Results were assessed using two methods. Firstly, contours of average velocity magnitude were examined visually to confirm that flow structures matched expectations without significant dispersion. Secondly, the cross-sections the standard deviation of wind speed, on the offset measurement plane, were assessed. The mesh independence results presented here are focused on the standard deviation, as the mean wind speed has a significantly lower dependence on mesh refinement and averaging period. The results are shown in Table 10, and plotted in Figure 23, Figure 24 and Figure 25. The wind speed was assessed over an averaging window of 300 seconds. Based on this assessment it was determined that the medium mesh was sufficient to resolve the flow field at this site, provided that a sufficiently long averaging period of 300 seconds was adopted.

Table 10 – Mesh independence results.

Mesh	Number of cells	Peak standard deviation (knots)
Coarse	4,470,000	0.51
Medium	7,240,000	0.44
Fine	12,900,000	0.47

The mesh independence study was conducted for the northerly wind direction, for the other wind directions mesh sizes are similar.

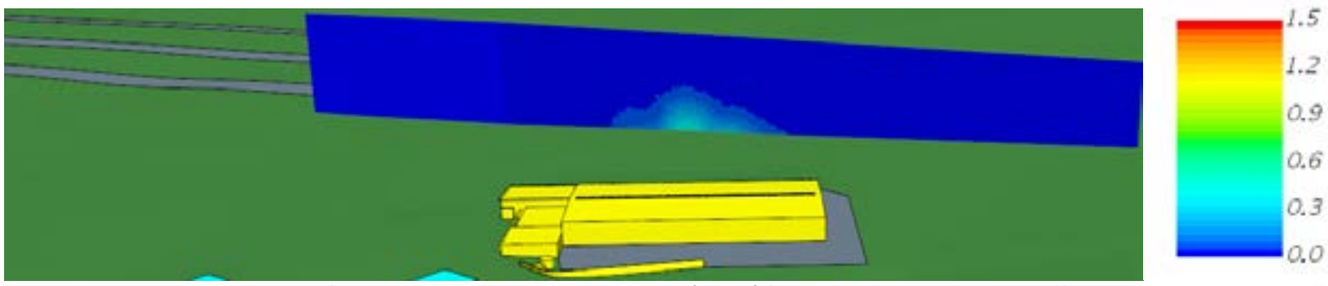

Figure 23 – Standard deviation of wind speed in the horizontal plane (knots) for the coarse mesh on the offset measurement plane. The building wake is clearly marked by the increased variation in wind speeds.

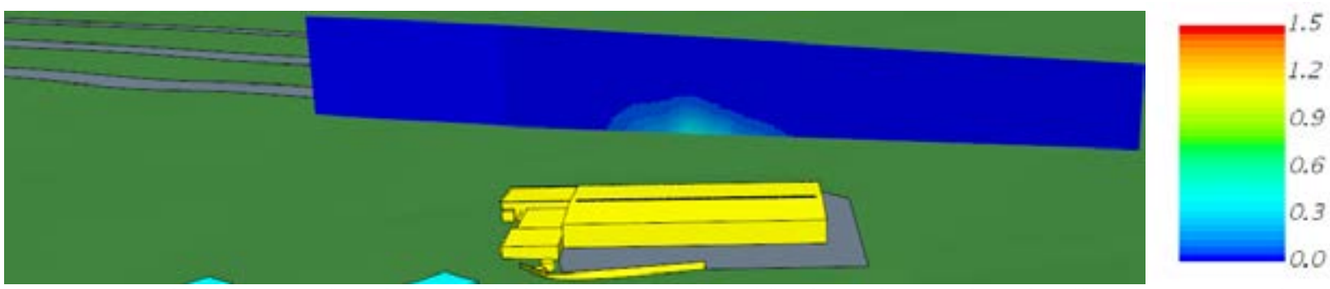

Figure 24 – Standard deviation of wind speed in the horizontal plane (knots) for the medium mesh on the offset measurement plane. The building wake is clearly marked by the increased variation in wind speeds.

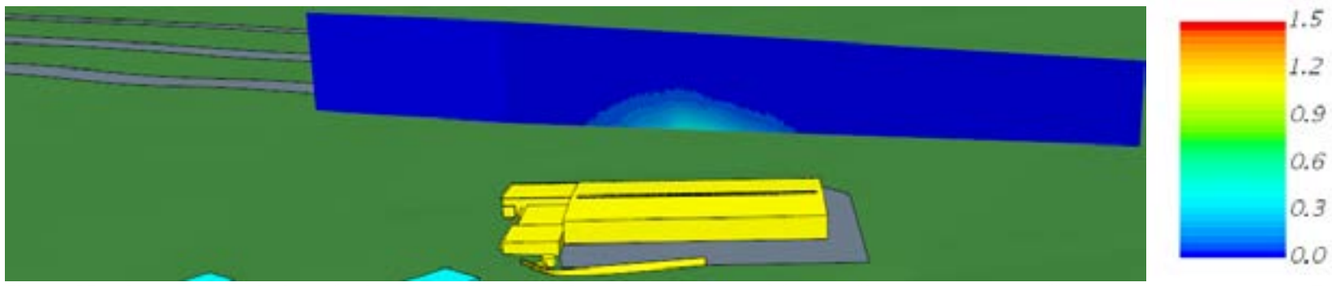

Figure 25 – Standard deviation of wind speed in the horizontal plane (knots) for the fine mesh on the offset measurement plane. The building wake is clearly marked by the increased variation in wind speeds.

Appendix D. Measurement planes

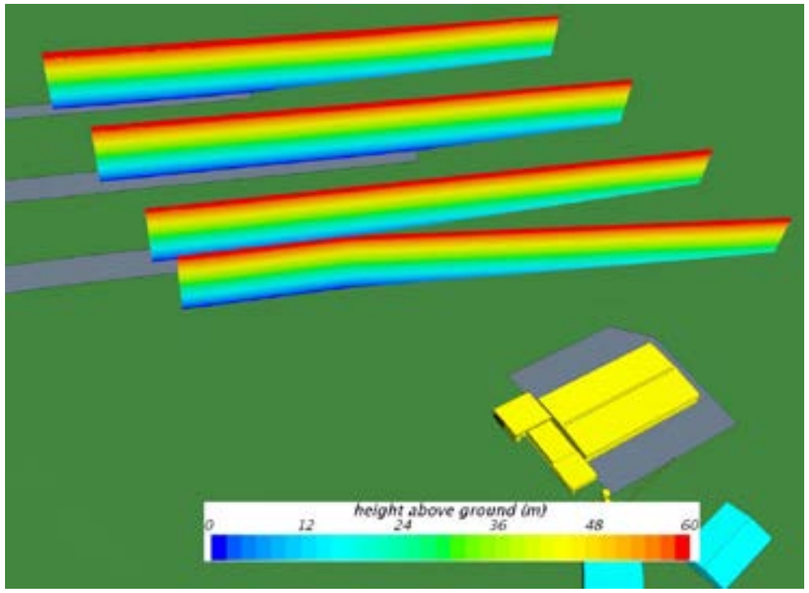

Figure 26 - Measurement planes for wind direction 1.

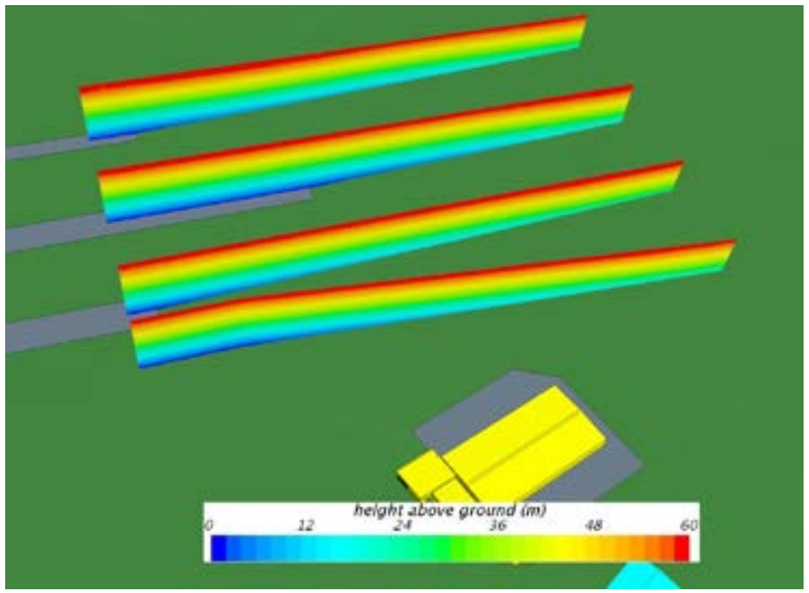

Figure 27 - Measurement planes for wind direction 2.

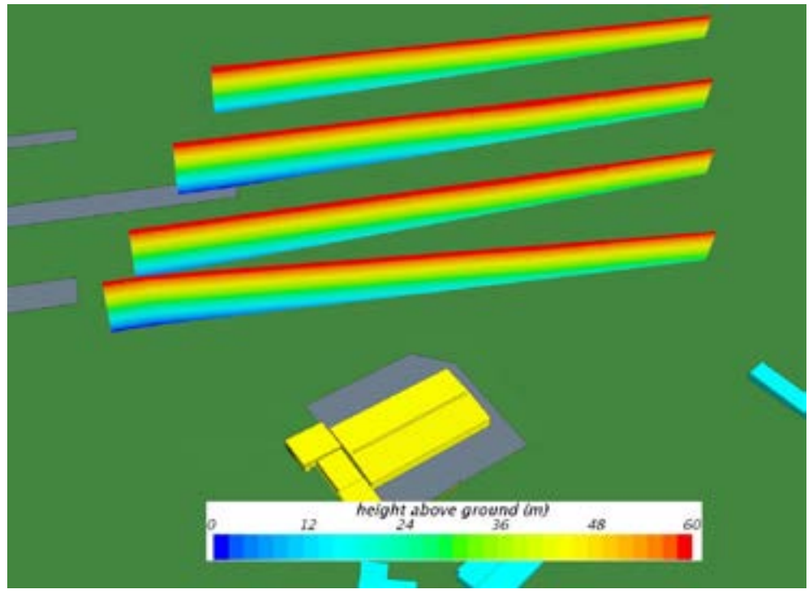

Figure 28 - Measurement planes for wind direction 3.

SYNERGETICS

21 September 2017

Mark Crudden
Bankstown Airport Limited
3 Avro Street
Bankstown Airport
NSW

RE: PolAir building wind shear and turbulence impact assessment – Response to follow up *questions from DIRD*

Introduction

This letter provides responses to the following questions raised by DIRD in relation to our report *PolAir building wind shear and turbulence impact assessment F01*, dated 12 May 2017 (Synergetics 2017).

1. Synergetics to confirm that the proposal is unlikely to generate building induced wind effects that would affect the safety of aircraft operations
2. Synergetics to provide comments to guide BAL in preparing the following:
    a. BAL's wind shear mitigation measures
    b. BAL's management plan to mitigate the risk to aviation users during crosswind gust exceedance periods
3. Synergetics to provide wind data for Airservices review.

Response to question 1

As detailed in our report (Synergetics 2017), windshear and turbulence impacts due to the PolAir building, over the three runways at Bankstown airport are expected to be below both the 2012 and 2016 NASF Guideline B criteria under most wind conditions.
The predicted crosswind speed components required to exceed the criteria are summarised in Table 1. The crosswind speed component is the wind speed in the direction perpendicular to the runways, as illustrated in Figure 1. Along the runway centrelines very high crosswind components are required to exceed each of the NASF Guideline B criteria.

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www.synergetics.net.au and www.positiveenergyplaces.com.au

Table 1 - Crosswind speed component (in knots) required to exceed criteria.

	Measurement plane			
Criterion	**Runway 11L/29R centreline**	**Runway 11C/29C centreline**	**Runway 11R/29L centreline**	**Offset[1]**
NASF Guideline B (2012) wind shear	89	60	47	27
NASF Guideline B (2016) wind shear	79	52	42	23
NASF Guideline B (2016) standard deviation	>100	>100	>100	88

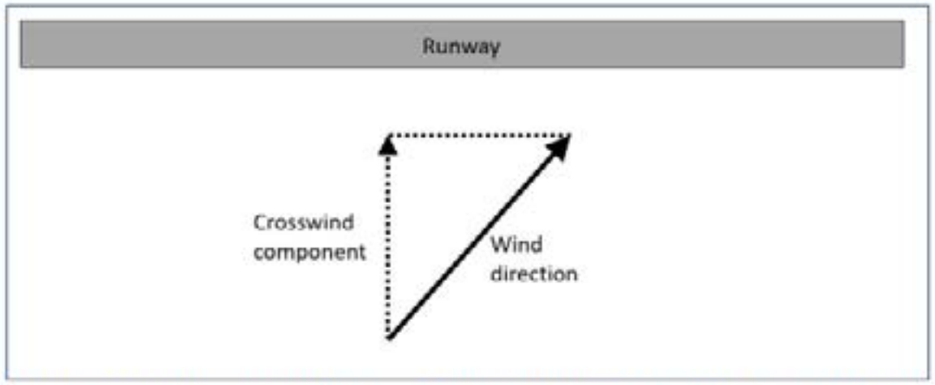

Figure 1 - Schematic showing the crosswind speed component relative the actual wind direction.

As detailed in our full report (Synergetics 2017), the predicted number of hours per year in which wind speeds will exceed the threshold crosswind components has been calculated based on historical meteorological data collected by the Bureau of Meteorology (BoM). This calculation is described in more detail below under *Wind data*. The predicted number of hours per year of exceedances is summarised in Table 2.

[1] NASF Guideline B (2012) does not define the aircraft trajectories that should be assessed. The NASF Guideline B (2016) draft advises that only centreline trajectories should be assessed. Synergetics understands that DIRD has received submissions regarding NASF Guideline B (2016) recommending that off-centreline trajectories should also be considered. As such, Synergetics have also assessed wind shear and turbulence along an "offset measurement plane" to assure conservative results by resolving impacts for aircraft deviating away from runway 11L/29R toward the PolAir building. This measurement plane is vertical and is aligned with the inner edge of the transitional surface and up to the take-off climb surface (TOCS) for the runway nearest to the PolAir building (11L/29R). From the TOCS the plane turns to follow the northern most edge of the TOCS, climbing with a glide slope of 4%.

Table 2 - Predicted average number of hours per year during which gusts will result in criteria being exceeded, based off historical wind records.

	Measurement plane			
Criteria	**Runway 11L/29R centreline**	**Runway 11C/29C centreline**	**Runway 11R/29L centreline**	**Offset**
NASF Guideline B (2012) wind shear	<1	<1	<1	<1
NASF Guideline B (2016) wind shear	<1	<1	<1	3
NASF Guideline B (2016) standard deviation	<1	<1	<1	<1

The wind shear and turbulence impacts generated by the PolAir building will occur within the wake of the building, i.e. immediately downwind of the building. Aircraft operating from the eastern end of the runways, i.e. outside of the building wake, will not be significantly impacted by windshear and turbulence generated by the PolAir building.

Response to question 2 - Guidance for wind shear mitigation and management plan

Bankstown airports operational guidance for pilots and management plan can be updated to accommodate potential wind shear and turbulence impacts generated by the PolAir building. An updated management plan could consider:

- The crosswind speed components that are predicted to cause exceedances of the NASF Guideline B assessment criteria (outlined in Table 2).
- The likelihood of exceeding the crosswind speeds outlined in Table 2.
- The frequency and magnitude at which aircraft trajectories deviate from the runway centreline.
- Directing pilots to avoid flying along trajectories that pass through the wake of the PolAir building.
- Restricting operations on affected runways under high crosswinds.
- Advising pilots of the potential for high wind shear, and providing advice based on pilot experience level.

Response to question 3 - Wind data

The wind data used for Synergetics' calculation of exceedance hours per year (outlined in Table 2) has been summarised in Figure 2. The raw data was sourced from the BoM Bankstown Airport site for the period from 1 January 2005 to 31 December 2014. The processing procedure is as follows:

1. Identify the wind gust data. This data provides the highest wind gust speed measured in the last ten minutes of each half hour period (48 measurements per day).
2. Convert the wind gusts from km/h to knots.
3. Calculate the crosswind component of the wind, based on the wind direction recorded for each half hour, and the orientation of the runways.
4. Count the number of half hour periods over ten years where gusts with a crosswind component exceeding a given wind speed were recorded.
5. Divide by 20 (10 years x 2 half hours per hour) to arrive at hours per year.

SYNERGETICS

James Brett
BE(Hons) BSc MEngSc PhD
Lead Modelling Engineer

SYNERGETICS

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References

Synergetics 2017, *PolAir building wind shear and turbulence impact assessment F01*, 12 May 2017, Synergetics Consulting Engineers, Positive Energy Places, 490 Spencer Street, Melbourne, 3003

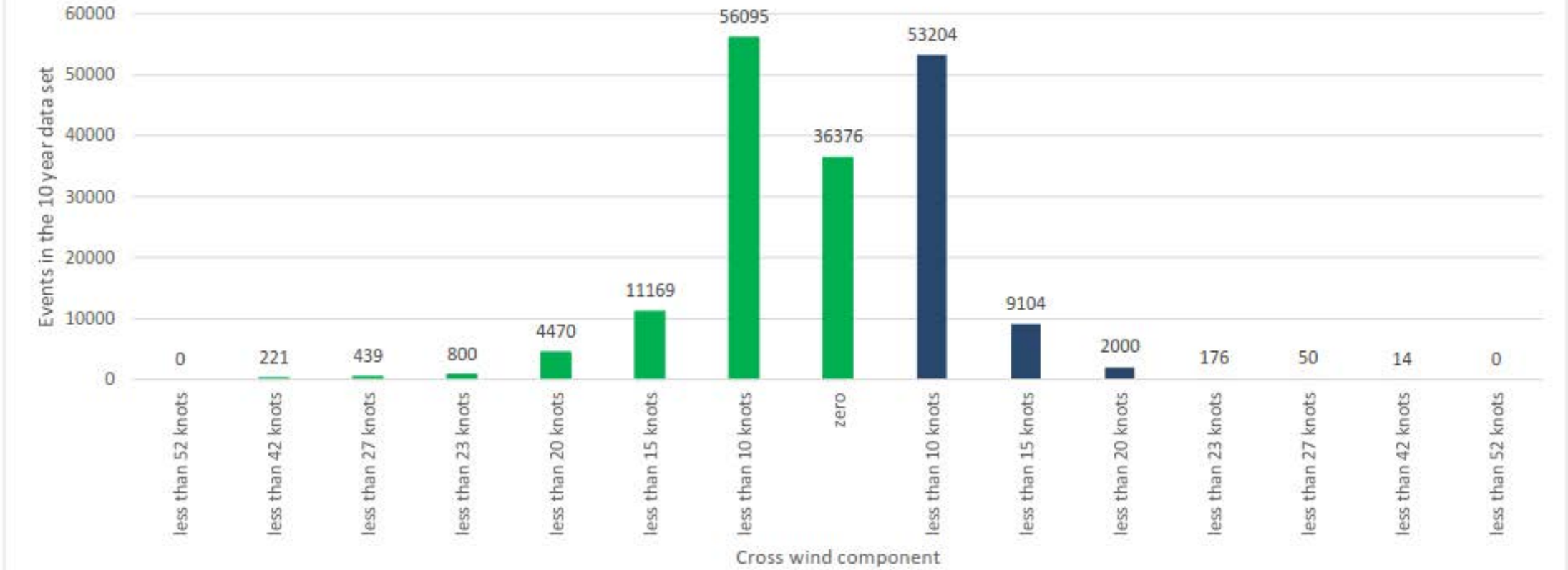

Figure 2 - Distribution of wind gusts components in the crosswind direction, recorded by BoM over the 10 year data set. The peak gust during the last 10 minutes within each half hour was recorded. Events on the left hand side (shaded green) correspond to the winds which do not place the runway centrelines downwind of the PolAir building.

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SYNERGETICS

9 October 2017

Lee de Winton
Chief Executive Officer
Bankstown Airport Limited
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Bankstown Airport
NSW

RE: PolAir building wind shear and turbulence impact assessment – Response to follow up questions from CASA

Introduction

This letter provides responses to the following requests raised by CASA (CASA, 28 September 2017) in relation to our report *PolAir building wind shear and turbulence impact assessment F01* (Synergetics, 12 May 2017):

1. *"Provide the actual wind directions modelled."*
2. *"The test results should include testing to the 60 m altitude band across points commencing 900 m before the threshold and up to 500 m along the runway from the threshold ... you should explain why full testing across this altitude band is not required."*

These are addressed in attachments A and B respectively.

Please phone me on (03) 93284800 or email me at jamesb@synergetics.com.au if you would like to discuss this matter further.

Yours sincerely,

James Brett

James Brett
BE(Hons) BSc MEngSc PhD
Lead Modelling Engineer

References

CASA. (28 September 2017). *Bankstown Airport - Preliminary Draft Major Development Plan, NSW Police Air Wing Development - Wind Shear and Turbulence Assessment.* Canberra: CASA.

Synergetics. (12 May 2017). *PolAir building wind shear and turbulence impact assessment F01.* Melbourne: Synergetics.

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Attachment A - Response to request 1

The three modelled wind directions are summarised in Table 1 and are marked on Figure 1.

Table 1 - Summary of modelled wind directions.

Name	Description	Direction (degrees from true North)
WD1	Normal to the proposed building, approximately northerly	014
WD2	Normal to the runways, approximately north northeasterly	034
WD3	At a 45° angle to the proposed building, approximately northeasterly	059

Figure 1 - Schematic showing modelled wind directions relative to the proposed building and runways

Attachment B - Response to request 2

Wind shear and turbulence were assessed on a series of 60 m high vertical measurement planes in accordance with the quality assurance materials that are referenced by the draft NASF Guideline B. The measurement planes were located to capture the full building wake width, with the horizontal extent of the measurement plane varying with wind direction, as shown in *Figure 2*. Wind shear and turbulence were not assessed below the obstacle limitation surface (OLS) as aircraft are not expected to operate below the OLS.

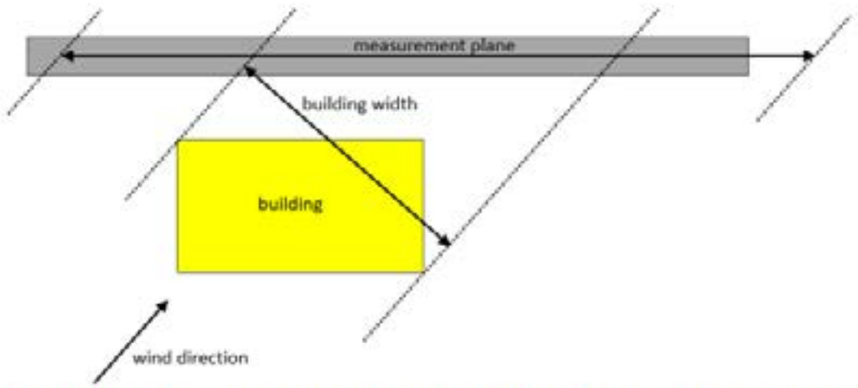

Figure 2 - Plan view schematic showing the location and length of measurement planes used in our assessment. The length of the measurement plane is three times the building width (with a minimum length of 500 m)

CASA have requested that wind shear and turbulence be assessed on a 60 m high vertical plane from *"900 m before the threshold and up to 500 m along the runway from the threshold."* This measurement plane covers a longer horizontal distance than the measurement planes used in our assessment. This request is consistent with requirements stipulated in the most recent draft NASF Guideline B[1]. The most recent draft NASF Guideline B also states that *"it should be noted that the modelling envelope is applied flexibly. If a proponent demonstrates that wind effects are attenuated beyond a certain point, there is no requirement for additional modelling beyond that point."*

The measurement planes used in our assessment cover the entire building wake width for each of the assessed wind directions. This is shown for WD2 for wind speed deficit and turbulence in *Figure 3* and *Figure 4* respectively. For both wind speed deficit and turbulence, the impacts induced by the PolAir building occur directly downwind from the building at the middle of the measurement planes and the building wake width is narrower than the measurement plane. This is also the case for WD1 and WD3, as outlined in our report. Outside of the building wake, wind shear and turbulence induced by the PolAir building are negligible. As such, the measurement planes used in our assessment capture the wind shear and turbulence induced by the PolAir building and it is not necessary to extend the length of the measurement planes to *"900 m before the threshold and up to 500 m along the runway from the threshold."*

In summary, the measurement planes used in our assessment capture the wind shear and turbulence induced by the PolAir building for all of the modelled wind directions. Therefore, the method employed in our assessment is appropriate for assessing against the PolAir building

[1] Our assessment predates the most recent draft version of NASF Guideline B. There was no requirement to assess wind shear and turbulence "from 900 m before the threshold and up to 500 m along the runway from the threshold" at the time that we conducted our assessment.

against the NASF Guideline B wind shear and turbulence criteria and it is not necessary to extend the measurement planes *"900 m before the threshold and up to 500 m along the runway from the threshold."*

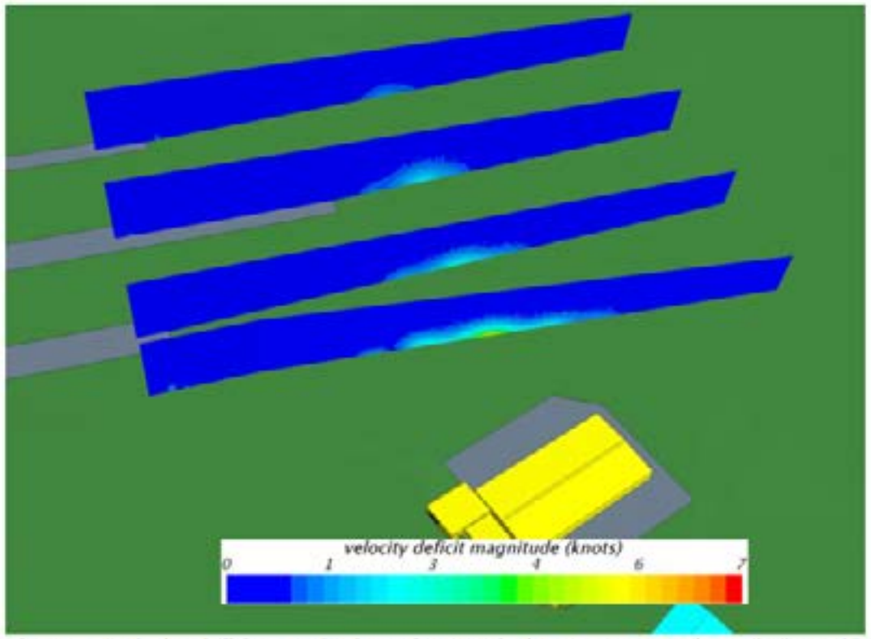

Figure 3 - Velocity deficit magnitude on four vertical measurement planes (coloured in blue) for winds blowing from wind direction 2 with a 20 knot crosswind component.

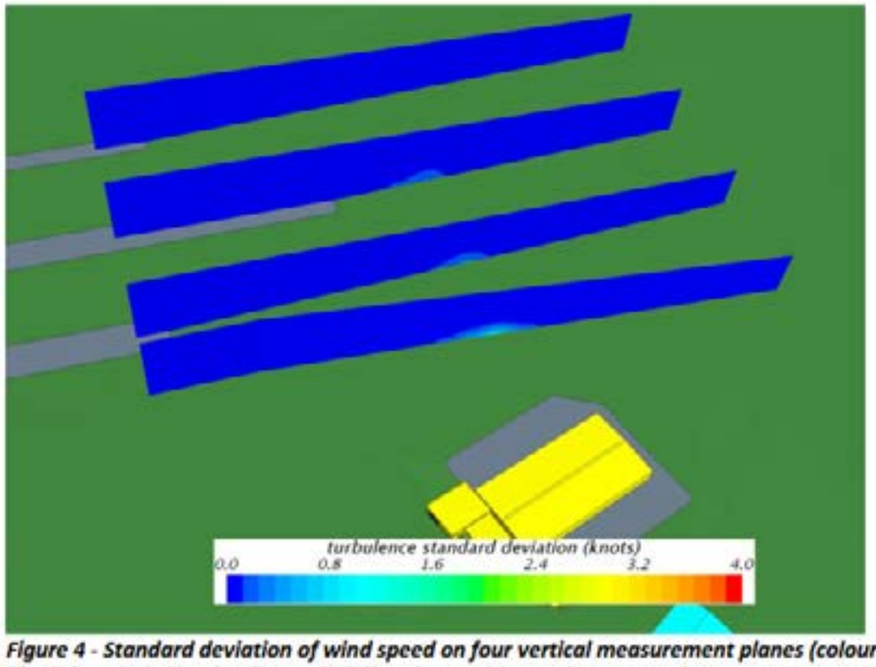

Figure 4 - Standard deviation of wind speed on four vertical measurement planes (coloured in blue) for winds blowing from wind direction 2 with a 20 knot crosswind component.

SYNERGETICS

23 October 2017

Lee de Winton
Chief Executive Officer
Bankstown Airport Limited
3 Avro Street
Bankstown Airport
NSW

Dear Lee,

RE: Further comments on PolAir building induced windshear and turbulence assessment

Further to our report *PolAir building wind shear and turbulence impact assessment F01* (Synergetics, 12 May 2017), we can also confirm that:

- The results presented in Table 3, Table 6 and Table 8 of our report are the minimum wind speeds required to exceed the NASF Guideline B (2012 and 2016) assessment criteria at any point on the assessed measurement planes, i.e.: the results presented for each measurement plane are worst-case.
- We will provide the results of the windshear and turbulence assessment for runway 11L/29R[1] in the format shown on Paragraph 45 of Attachment A to NASF Guideline B (2017). This will be provided in letter format by the 6th of November.

Please phone me on (03) 9328 4800 or email me at jamesb@synergetics.com.au if you would like to discuss this matter further.

Yours sincerely,

James Brett
BE(Hons) BSc MEngSc PhD
Lead Modelling Engineer

References

Synergetics. (12 May 2017). *PolAir building wind shear and turbulence impact assessment F01.* Melbourne: Synergetics.

[1] Runway 11L/29R is the nearest runway to the proposed PolAir building. Our assessment (Synergetics, 12 May 2017) showed that building induced windshear and turbulence impacts are lower at runways 11C/29C and 11R/29L as these runways are further from the proposed PolAir building.

Melbourne: Positive Energy Places, 490 Spencer Street Melbourne VIC 3003 Australia Tel: +61 3 9328 4800 Fax: +61 3 9328 4822
www.synergetics.net.au and www.positiveenergyplaces.com.au

Hibbertia fumana Management Plan

Appendix F

BANKSTOWN AIRPORT

Hibbertia fumana Management plan

For:

Bankstown Airport Limited

March 2018

Final

cumberland ecology

PO Box 2474
Carlingford Court 2118

Document No. **SMA-EN-BAL-PLN-000705**

The preparation of this management plan has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or recommendations contained within the management plan are based only on the aforementioned circumstances. The management plan has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

Version	Date Issued	Amended by	Details
A	22/12/2017	VO / TM	Draft
B	22/01/2017	VO	Revised Draft
1	23/01/2018	FWVO	Final
2	27/02/2018	VO	Revised Final
3	02/03/2018	FWVO	Final

Approved by:	David Robertson
Position:	Director
Signed:	David Robertson
Date:	2 March, 2018

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Glossary of Terms

BAL	Bankstown Airport Limited
BC Act	*Biodiversity Conservation Act 2016*
CEMP	Construction Environmental Management Plan
DoEE	Department of Environment and Energy
DIRDC	Department of Infrastructure, Regional Development and Cities
EMS	Environmental Management System
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
LGA	Local Government Area
MDP	Major Development Plan
OEH	NSW Office of Environment and Heritage
SMA	Sydney Metro Airports
SoS	Saving Our Species program
TSC Act	NSW *Threatened Species Conservation Act 1995* - Repealed

cumberland ecology

Executive Summary

S1 Introduction

Cumberland Ecology has been commissioned by Altis Property Partners on behalf of Bankstown Airport Limited (BAL) to prepare a detailed threatened species management plan (this Plan) for the management of the newly discovered population of *Hibbertia fumana* that is known to occur in close proximity to the proposed PolAir development site (the Project), on the Bankstown Airport.

Hibbertia *fumana* is a small shrublet endemic to NSW, and was thought to be extinct when originally described in 2012, from several collections made prior to 1824. In 2016 the species was rediscovered in Moorebank, and a final determination as Critically Endangered under the BC Act was made on the 16th of December 2017 (NSW Scientific Committee 2017).

It is noted that this Plan forms part of BAL's Environmental Management System (EMS), specifically regarding the management of flora and fauna aspects on the airport. The purpose of this Plan is to provide a framework for the management of the newly identified *H. fumana* population to minimise impacts during the construction of the Project and the general day to day operations of the Airport post completion of the Project.

S2 Existing Population

The existing population of *H. fumana* has been surveyed by RPS (November, 2017) and Cumberland Ecology (December, 2017). Specimens were collected by Mark Aitkens of RPS, which were positively identified as *H. fumana* by Andrew Orme of the National Herbarium of NSW (2017). The survey methods included random meander searches and grid based searches within identified patches of habitat for the species.

From these surveys, a total of approximately 1550 *Hibbertia fumana* individuals were recorded, spread over 3 main patches, located in areas of low grass density and large areas of bare ground. The sub-populations were of multi-generational age, with a large number of established mature plants recorded. The condition was moderate, with few individuals appearing to have lost or damaged leaves.

At the time of the survey, a total of 0.24 ha of habitat with a high density of *H. fumana*, and 0.02 ha of habitat with a moderate density of *H. fumana* was recorded on the Project site. Overall there was ten low density patches or individual records of *H. fumana* in the study area, which have not been calculated based on area.

S3 Risk Assessment

The overarching management objective of this Plan is to conserve the *insitu* population of *Hibbertia fumana* at Bankstown Airport.

The impact on the population of *Hibbertia fumana* is considered to be minor, and will include the removal of approximately three (3) individuals, out of the population of 1550 (based on field survey work), for the construction of a new Code-C Taxiway. The three (3) individuals are already isolated from the main population group and avoidance of these three (3) individual plants is not possible due to aviation requirements associated with the design and operation of the taxiway.

The following potential risks to *H. fumana* have been identified during the construction of the Project and general operation of the area post construction:

- Removal of additional individuals (more than the (3) three within the footprint of the new taxiway);
- Increased dust, which could smother the plants and limit their ability to photosynthesise and reproduce;
- Increased run-off from the development, increasing overland-flow resulting in inundation of the habitat for the plants;
- Increased nutrient levels and/or pollutants resulting from increased overland flow;
- Increased erosion and sedimentation resulting from uncontrolled run-off from development areas, or machinery operating in close proximity to the population of the species, creating increased dust, and removing top soil, to a minor extent;
- Decreased air quality as a result of diesel plant and equipment operating in close proximity to the population of the species, resulting in residue settling on plant leaves are reducing the ability to photosynthesise, to a minor extent;
- Soil compaction and plant damage from machinery;
- Mowing frequency and height that could potentially be detrimental for the population to persist or maintain growth; and
- Use of herbicide in adjoining areas entering the habitat areas and resulting in death.

However, it should be noted that the Project site and surrounds are currently, and will continue to be, utilised as an operational airport, and must be managed in accordance with the aviation safety requirements managed by Bankstown Airport Limited and regulated by the Civil Aviation Safety Authority (CASA).

S3.1 Risk Mitigation

A suite of mitigation measures have been prescribed, and relate to the ongoing minimisation of potential risks during the construction of the Project and during the general operation of the Airport post completion of the Project. The newly identified population of *Hibbertia fumana* occurs within an active part of the airport, close to the existing North Western Helipad and Code-C Taxiway. Daily helicopter activity adjacent to the Project site includes training flights from adjoining businesses, and aircraft flying very low during their taxi to nearby hangars. This generates wind and dust in the habitat areas of the *H. fumana* habitat area as identified in **Figure 4.1**. Mowing of the grasslands of the airport is ongoing, and the frequency depends on the grass height and rate of growth, but is generally maintained twice a month between 10-15cm in height.

S4 Ongoing Management

A management strategy has been developed with the purpose of maintaining the population of *H. fumana* within the area, and improving the robustness and increasing the area of occupancy of the population.

The strategy outlines measures to protect the species and minimise impacts during and post construction of the Project. The management measures include:

- Creating management zones for the population of *H. fumana*;
- Installing temporary fencing to restrict access to the management zones during the construction of the Project;
- Installing physical markers to mark the extent of the management zone boundaries to alert personnel to the presence of *H. fumana*;
- Implementation of a mowing program inside management zones; and
- The propagation of *H. fumana* by the Royal Botanic Gardens, Mt Annan.

S5 Monitoring

Site assessments will be conducted to monitor the health and condition of the *H. fumana* population during and post construction of the Project. Monitoring efforts will focus on the health of the population and the area of occupancy. Monitoring will be conducted every three months in the first year and every six months in the second year. Monitoring to occur from the third year onwards will be determined by a review of the NSW Office of Environment and Heritage (OEH) Biodiversity Licence monitoring conditions. The NSW OEH Biodiversity Licence will be varied accordingly to capture the ongoing monitoring requirements.

The monitoring strategy includes identifying the area of occupancy, assessing the general condition of *H. fumana* clumps, recording images of clumps, assessing the condition of boundary markers.

S6 Reporting and Review

Reporting to the NSW OEH will occur after monitoring events and after a significant environmental incident or after non-compliance with management and monitoring measures.

This Plan will be reviewed annually by Bankstown Airport and updated as required and provided to NSW OEH. The review will take into account the monitoring records, new information, corrective actions and the results of audits.

Chapter **1**

Introduction

1.1 Background

Cumberland Ecology has been commissioned by Altis Property Partners on behalf of Bankstown Airport Limited (BAL) to prepare a detailed threatened species management plan (this Plan) for the management of *Hibbertia fumana* that is known to occur within close proximity to the proposed PolAir development site (the Project).

The NSW Police Force have been operating its Aviation Support Branch (PolAir) from Bankstown Airport since the late 1980's. The proposed development consists of the construction of a new "PolAir" facility, the consolidation of all existing operations of PolAir, will include a two-storey office building, helicopter hangars, aprons, parking areas and modifications to taxi ways.

The Project will be constructed in close proximity to a recently discovered population of *Hibbertia fumana*, a species listed as Critically Endangered under the *NSW Biodiversity Conservation Act 2016* (BC Act). The species was first detected on the Project Site by RPS in November 2017.

Hibbertia fumana is a small shrublet endemic to NSW, and was thought to be extinct when originally described in 2012, from several collections made prior to 1824. In 2016 the species was rediscovered in Moorebank, and has since been provisionally listed, on an emergency basis, as Critically Endangered under the BC Act (and the former NSW *Threatened Species Conservation Act 1995* – repealed). A final determination as Critically Endangered under the BC Act was made on the 16th of December 2017 (NSW Scientific Commitee 2017).

Hibbertia puberula subsp. *glabrescens* is a listed species that has been identified within Bankstown Airport land, known as Area 5, however it is not found within the Project site. The species is listed as Critically Endangered under the EPBC Act, and as Endangered under the BC Act. A Hibbertia glabrescens Management Plan (SMA-EN-BAL-PLN-000704) for the species has been prepared for Bankstown Airport, and has been reviewed in the preparation of this Management Plan. However it is noted that the Hibbertia glabrescens Management Plan (SMA-EN-BAL-PLN-000704) is draft and requires finalising once key stakeholders have provided comment.

1.2 Site Description

1.2.1 Location

The Project site is located at Bankstown Airport, a 313 ha property, located roughly 20 km from the Sydney CBD, within the Canterbury-Bankstown Local Government Area (LGA), and is zoned as infrastructure (SP2). Surrounding land uses include warehouses and industrial uses, commercial operations and low density residential dwellings. The NSW Police Force have been operating PolAir from Bankstown Airport since the late 1980's.

The Project will be located at the end of Drover Road, south of the Red Barron facility located partially on the following lots:

- Lot 307/DP1077440;
- Lot 308/DP1077440;
- Lot 408/DP1152148;
- Lot 102/DP852861; and
- Lot 671/DP1014122.

1.2.2 Proposed Development

The Project involves consolidating the existing operations of PolAir into a single facility. The Project will occur on the north-western portion of Bankstown Airport and will consist of the construction of:

- Two storey office building;
- Two hangars and maintenance facilities;
- Concrete aprons to either side of the apron;
- Parking areas;
- Modifications to the existing taxiways;
- Road upgrades; and
- Ancillary facilities (amenities, pump room, trailer storage, stormwater detention, landscaping and sprinkler tanks).

The Project construction phase is expected to take 14 months. The development layout is shown in Appendix B of the MDP (Drawing A002 Issue S (Crawford Architects, 14 February 2018)).

1.2.3 Existing Vegetation

The existing vegetation at Bankstown Airport is limited to open grasslands and isolated pockets of shrubs and tree plantings. These plantings consist primarily of exotics and planted natives near buildings and along roads. The majority of the grassland is dominated by exotic grass and forb species. There is also a native stand of Cooks River/ Castlereagh Ironbark Forest, listed as Critically Endangered under the EPBC Act at the eastern end of the airport.

The Project is proposed to be constructed within grassland areas, and existing operational area of the airport. The Project infrastructure will be located in close proximity to a newly discovered population of *H. fumana*. The population present in this location is well established, with multi-generational individuals within each sub-population, including numerous large (although prostrate) mature plants. The existing conditions experienced by this population include regular mowing, erosion, dust, flooding and windshear from landing helicopters. The local occurrences are concentrated on open areas, with low grass density and on exposed eroded soil.

For the purposes of this Plan, the area of potential habitat for *H. fumana* has been identified as the 'Study Area', and represents the area surveyed by Cumberland Ecology, as shown in **Figure 4.1**.

1.3 Legislative Framework

Bankstown Airport is a federally leased airport, and as such is exempt from approval under the EPBC Act if a Major Development Plan (MDP) has been approved for the Project. A draft MDP has been prepared for the Project, and was submitted to the Department of Infrastructure, Regional Development and Cities (DIRDC) in October 2017. Since the submission of the draft MDP, *Hibbertia fumana* was discovered in close proximity to the Project site in field surveys conducted on 17 November 2017 by RPS, and positively identified by Andrew Orme of the National Herbarium of NSW (2017). DIRDC were notified of this finding, who passed down their comments on the draft MDP. The italicised wording below is copied verbatim from the letter received from DIRDC (dated 29 November 2017) and is of relevance to this Plan:

> *Hibbertia fumana is listed by NSW Office of Environment and Heritage as a critically endangered species, facing an extremely high risk of extinction in Australia in the immediate future. This plant has only been found in one other location, at the site of the Moorebank Intermodal Terminal. The population discovered on Bankstown Airport is highlighted in the dMDP as the location of a taxiway reconfiguration and a hardstand expansion area for the proposed development.*
>
> *The Department of the Environment and Energy (DoEE) advised the Department that, following this find, the PolAir development will now require a conservation plan for the Hibbertia fumana population, as well as detailed information outlining changes to the dMDP.*

Accordingly, it would assist the Minister to decide whether to approve the dMDP, for BAL to provide to the Department evidence of DoEE's satisfaction with the required conservation plan. BAL should also provide the Department with a submission detailing any changes to the dMDP made in respect to the conservation plan and providing evidence of consultation with affected parties, including the NSW Office of Environment and Heritage and local environmental groups.

Hibbertia fumana is listed as Critically Endangered under the BC Act, and is not listed under the Commonwealth EPBC Act. However, the development of Commonwealth leased land does not require approval under the BC Act or EPBC Act (where a MDP is accepted).

The NSW OEH administers the BC Act, which provides for the protection of threatened species, populations and ecological communities and their habitat within NSW. As part of the continual operation of the airport, a Threatened species licence, a class of biodiversity conservation licence under Part 2 of the BC Act, will be required for any action that is likely to result in:

- harm to an animal that is a threatened species or part of an ecological community; or
- picking a plant that is a threatened species or part of an ecological community; or
- damage to a habitat of a threatened species or ecological community; or
- damage to a declared area of outstanding biodiversity conservation value.

1.4 Purpose

The purpose of this Plan is to provide details on the management of the population of *H. fumana* at Bankstown Airport. This Plan aims to ensure that the existing population is protected and managed to reduce impacts to the population.

The objectives of this Plan are as follows:

- Summarise existing information on the history of *H. fumana*, and its occurrence on the airport as detailed in **Figure 4.1**.
- Describe the methods and results of surveys conducted to date to determine the current extent and condition of *H. fumana* on the airport, as detailed in **Figure 4.1**.
- Establish guidelines to manage the existing population of *H. fumana* on the airport as detailed in **Figure 4.1**; and
- Establish maintenance, monitoring and reporting measures to provide ongoing information on the condition of the *H. fumana* population on the airport as detailed in **Figure 4.1 and 6.1**.

1.5 Roles and Responsibilities

The relevant parties involved with ensuring the management actions in this Plan are carried out are summarised in **Table 1.1** and include both construction phase and post-construction phase activities.

Table 1.1 Roles and responsibilities

Phase	Action	Responsible Personnel
Construction Phase	Ensure that all parties comply with the management measures outlined in this Plan.	BAL CEO
	Maintain an active monitoring role to ensure that the requirements of the Plan are implemented.	BAL Airport Environment and Heritage Manager
	Ensure that the Project approvals are met.	Principle Contractor
	Supervise the works and ensure all personnel adhere to the management measures outlined in training and induction measures.	Principle Contractor
	Ensure that the Site Supervisors and personnel on the Project adheres to the management measures outlined in this Plan.	Principle Contractor
	Ensure that the management measures in this Plan are incorporated in its Construction Environmental Management Plan (CEMP).	Principle Contractor
	Maintain regulatory oversight of the works, and maintain an active monitoring role to ensure that the requirements of the Plan are implemented.	DoEE, OEH
Post Construction Phase	Ensure that all parties comply with the management measures outlined in this Plan.	BAL CEO
	Maintain an active monitoring role to ensure that the requirements of the Plan are implemented.	BAL Airport Environment and Heritage Manager
	Supervise all site works and maintenance and ensure all personnel adhere to the management measures outlined in training and induction measures.	Aviation Facilities Manager BAL Airport Environment and Heritage Manager
	Undertake monitoring in accordance with this Plan.	BAL Airport Environment and Heritage Manager Consultant Ecologist
	Undertake maintenance works (e.g. weeding, marker painting etc.), as required, in accordance with this Plan.	BAL Airport Environment and Heritage Manager Environmental Contractor Aviation Facilities Manager

Chapter 2

Conditions of Approval

2.1 Commonwealth Conditions of Approval

As discussed above, Bankstown Airport is a federally leased airport and the Project has a Major Development Plan (draft) to be approved by the Department of Infrastructure and Regional Development (Bankstown Airport Limited, 2014). DIRDC

Under Section 160 of the EPBC Act, the Minister for Infrastructure must consider advice from the Environment Minister before authorising the implementation of an MDP if the action will have a significant impact on the environment. The Environment Minister can recommend conditions to be attached to the authorisation to protect the environment. As *H. fumana* is not listed under the EPBC Act, a Part 13 Permit is not required.

2.2 State Conditions of Approval

Hibbertia fumana is listed under the BC Act as Critically Endangered. The assessment and approval process for the Project is administered by DIRDCC under the Airports Act, and therefore no State approval is required.

As part of the ongoing management of the site, including undertaking actions such as mowing, a Threatened species licence, a class of biodiversity conservation licence under Part 2 of the BC Act, will be required.

Chapter 3

Species Profile

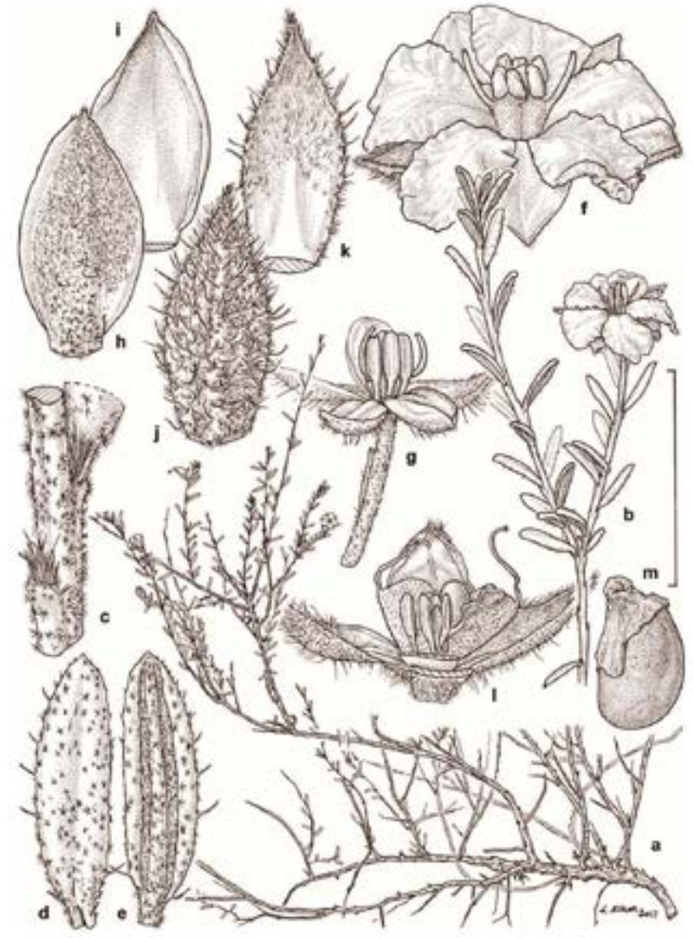
3.1 Physical description

Hibbertia fumana is a decumbent shrublet of the family Dilleniaceae that grows to 20 cm high and has characteristic yellow flowers (**Photograph 2.1**) (Botanic Gardens Trust 2017). The branches are wiry and shortly fascicled pubescent, with many branches originating at the base (**Figure 3.2a**) (Botanic Gardens Trust 2017).

A number of characters can separate *H. fumana* from similar co-occurring *Hibbertia* species when not in flower. For instance, *H. fumana* has a tuft of hair in the leaf axil to 0.7 mm long (**Figure 3.2 c**), stellate (star-shaped) hairs on the leaf surface (**Figure 3.2 d**) with the abaxial surface being visible and not entirely revolute (**Figure 3.2 e**) (Botanic Gardens Trust 2017).

The flowers are pedunculate, with single flowers terminal on the stems, the peduncle elongating in fruit (**Figure 3.2 g**). *Hibbertia fumana* has usually 5 or 6 stamens clustered to one side of the ovaries (**Figure 3.2 i**). The leaves are usually narrow-oblong, 2.1–6.5 mm long, 0.5–1.2 mm wide, with a petiole 0.2–0.45 mm long and an obtuse recurved apex of the central vein (Botanic Gardens Trust 2017).

Photograph 3.1 *Hibbertia fumana* (source: Royal Botanic Gardens, 2017)



Key: a, habit; b, branch; c, branch detail showing tufts of hairs in leaf axil; d, leaf, adaxial surface; e, leaf, abaxial surface; f, flower; g, flower, petals removed; h, inner sepal, abaxial surface; i, inner sepal, adaxial surface; j, outer sepal, abaxial surface; k, outer sepal, adaxial surface; l, flower with fruit; m, seed. Scale bar: a = 80 mm; b = 15 mm; c = 2.5 mm; d & e = 4 mm; f = 6 mm; g & l = 8 mm; h–k = 5 mm; m = 3 mm. Drawn from (Duretto, Orme et al. 2017) Royal Botanic Gardens Trust, 2017)

Figure 3.2 Diagram of *Hibbertia fumana* characteristics

3.2 Regional Distribution

The species was considered extinct when described by Toelken and Miller (2012) as the species was only known from three herbarium collections compiled in the early 19th century. Until its discovery at the Project site, there was only one known population of *H. fumana*, within the Moorebank Intermodal Terminal Precinct, with the Area of Occupancy estimated to be 4km^2. The species was found at Bankstown Airport on 17 November 2017 in flora surveys conducted for the Project.

Little is known of its historical distribution, however the population of *H. fumana* at Moorebank Intermodal Terminal Precent was located in the transition zone between Castlereagh Ironbark Forest and Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion (Threatened Species Scientific Committee 2016).

3.3 Threats

As the species has been only recently rediscovered, little is known about the threats to the species. The NSW Threatened Species Scientific Committee (2016) and the NSW Office of Environment and Heritage (2017) identified some threats to *H. fumana* based on the only other known population occurring at Moorebank Intermodal Terminal Precinct. Threats include:

- Alteration to fire regime, fires occurring too frequently or too rarely;
- Loss of existing habitats, and habitat degradation;
- Invasions from weed species, particularly, low shrubs, dense shrubs and smothering grasses; and
- Fragmentation and isolation of the population.

3.4 Biology and Ecology

Very little is known about the biology and life cycle of this species. However, the species is known to sucker, which suggests that it may be able to re-sprout from rootstock following fire events (NSW Threatened Species Scientific Committee 2016).

Chapter **4**

Assessment of Existing Population

4.1 Methods

4.1.1 Literature Review

In preparation for this Plan, relevant literature from past studies of the Project site, and from studies of the *H. fumana* population at Moorebank Intermodal Terminal Precinct were reviewed. This includes a Hibbertia glabrescens Management Plan (SMA-EM-BAL-PLN-000704) outlining the management of the closely related species, *Hibbertia puberula* subsp *glabrescens*, at the Bankstown Airport. However, as previously noted, the Hibbertia glabrescens Management Plan (SMA-EN-BAL-PLN-000704) is draft and requires finalising once key stakeholders have provided comment.

Additionally, the Bankstown Airport Master Plan (Bankstown Airport Limited 2014) has been used to assist with preparing the Plan.

4.1.2 Site Inspections

Previous flora surveys were conducted by Mark Aitkens of RPS, who recorded the location of *H. fumana* on the Project site. Specimens were collected by Aitkens which were positively identified as *H. fumana* by Andrew Orme of the National Herbarium of NSW (2017). The survey methods included random meander searches and grid based searches within identified patches of habitat for the species. Co-ordinates were recorded from each plant identified, or a close group of individuals.

Targeted *H. fumana* surveys for the Project site were undertaken by Cumberland Ecology on 7 December 2017 to verify the extent of the population and identify management areas. For the purposes of this Plan, the area of potential habitat for *H. fumana* has been identified as the 'Study Area', and represents the area surveyed by Cumberland Ecology, as shown in **Figure 4.1**.

Random meander technique to identify the location of the habitat patches. At the outer edges of the habitat patches recorded by RPS (2017), detailed traverses were used, with two ecologist walking in 2m wide transects to identify any new areas of habitat and extend the known patch areas. Random meanders were continued throughout the Study Area, to identify any new areas of habitat.

The locations of all individuals were recorded using a hand-held GPS, with an accuracy of 5-10m. A leaf and bud was collected from an individual, and was pressed.

4.2 Survey Results

4.2.1 Previous surveys – RPS, November 2017

Surveys conducted in November 2017 by Mark Atkens of RPS observed and recorded the location of *Hibbertia* specimens on the Project site and collected samples to be identified. After collection, Andrew Orme of the National Herbarium of NSW (2017) positively identified the specimens to be *H. fumana*. From this survey a total of 1361 observations of *H. fumana* were made in the study area. The location of the observations is mapped in **Figure 4.1**, along with the location of the species as recorded by Cumberland Ecology.

4.2.2 Targeted surveys for H. fumana – CE, December 2017

Cumberland Ecology conducted targeted *H. fumana* site inspections in December 2017. The occurrences of *H. fumana* on the Project site were concentrated on open areas, with low grass density and on exposed soil (**Photograph 4.1**). Additional records of *H. fumana* made by Cumberland Ecology, totalled approximately 189, which results in a total population of approximately 1550 individuals.

The sub-populations were of multi-generational age, with a large number of established mature plants recorded (**Photograph 4.2**). The condition was moderate, with few individuals appearing to have lost or damaged leaves, although no dead stalks were evident at the time of survey. No individuals were flowering, although several had buds and one dried flower was found beneath an individual. The dissection of this flower positively identified it as *H. fumana*, having six stamens.

The species was found in vegetation dominated by exotic grass species including; *Cenchrus clandestinus* (Kikuyu grass), *Cynodon dactylon* (Couch grass), *Lolium rigidum* (Annual Ryegrass) and *Stenotaphrum secundatum* (Buffalo grass), and some native shrub species, including; *Kunzea ambigua* (Tick bush), *Leucopogon* sp. and Melaleuca decora that has been routinely mown. (Photograph **4.1**).

As noted above, at the time of the site inspection, the individuals recorded were located in areas of low grass density, with groundcover of approximately 5-25%. However, outside of the habitat areas, groundcover was approximately 50-75%. Species diversity appeared to be higher in this area than surrounding parts of the site, where a higher cover of exotic grasses was observed.

Photograph 4.1 Grassland and existing structures occurring on the Project Site

Photograph 4.2 Patch of *H. fumana* in the Project Site

A combination of recorded observation from RPS and Cumberland Ecology surveys was used to designate patches/areas as either high density patches, moderate density patches or low density patches/individual records (**Figure 4.1**). The total area of occupancy, which is the smallest area occupied within the extent that the species occurs, was 0.61 ha.

At the time of the survey, a total of 0.24 ha of habitat with a high density of *H. fumana*, and 0.02 ha of habitat with a moderate density of *H. fumana* was recorded on the Project site. Overall there was ten low density patches or individual records of *H. fumana* in the study area, which have not been calculated based on area (**Figure 4.1**). The estimated number of individuals in each habitat type (based on analysis of data from RPS, 2017 and Cumberland Ecology, 2017) are represented in **Table 4.1**, and includes an indicative number of plants present in each habitat type.

Table 4.1 ***Hibbertia fumana* habitat area and number of individuals recorded on the Project Site**

Habitat Area	Total Area of Habitat (Ha)	Approximate Number of Individuals
High Density	0.24	1508
Moderate Density	0.02	34
Low Density/Individual Records	0	8
Total		**1550**

Figure 4.1. Areas of Hibbertia fumana Habitat

Chapter 5

Risk Assessment

5.1 Management Objectives

The overarching management objective of this Plan is to conserve the *insitu* population of the species on Bankstown Airport.

Risks to achieving this management objective, including site specific risks to the population of *H. fumana*, are outlined in the sections below. However, it should be noted that the population occurs within an area that is currently, and will continue to be, utilised as an operational airport, and must be managed in accordance with the safety requirements stipulated by BAL.

5.2 Existing Risks

The population of *Hibbertia fumana* occurs within an active part of the airport, in close proximity to the existing helipad and Code-C Taxiway. Daily helicopter activity around the Project Site includes training flights from adjoining businesses, rotary wing aircraft flying very low during their hover taxi to nearby hangars and fixed wing aircraft movements on nearby taxiways. This creates wind and dust in the habitat areas of the *H. fumana*.

Mowing of the grasslands of the airport is ongoing, and the frequency depends on the grass height and rate of growth, but is generally maintained twice a month at between 10-15 15cm in height. The habitat for *H. fumana* is predominantly within more bare areas, where competition from grasses is reduced, and hence this area is likely to have been mowed less frequently than adjoining areas. Nonetheless, the population appears to be well established and has tolerated frequent and low mowing over an extended period of time.

Weed species are present in the *H. fumana* habitat areas, as listed in **Section 4.2.2**, and include the grass species; *Stenotaphrum secundatum* (Buffalo grass) and *Kunzea ambigua* (Tick bush). The growth of these species is currently suppressed by the slashing regime and localised erosion. However, there is a risk of either species, particularly *K. ambigua*, to outcompete or shade the *H. fumana* individuals present if management measures are altered, or environmental conditions change, that are favourable for the exotic and native grass species.

5.3 Project Risks

5.3.1 Construction Risks

The impact on *Hibbertia fumana* is considered to be minor, and will include the removal of approximately three (3) individuals, out of the population of 1550 (based on field surveys), for the construction of a new Code-C Taxiway, as shown in **Figure 5.1**. The individuals are not from within the high density or medium density patches, and would not have been included in the Hibbertia Habitat Management Areas (Section 6.1). Avoidance of these three (3) individual plants is not possible due to aviation requirements associated with the design of taxiways.

The following potential risks to *H. fumana* have been identified during the construction phase:

- Removal of additional individuals (more than the 3 identified within the new Code-C Taxiway alignment);
- Increased dust, which could smother the plants and limit their ability to photosynthesise and reproduce;
- Increased run-off from the development, increasing overland flow at resulting in inundation of the habitat for the plants;
- Increased nutrient levels and/or pollutants resulting from increased overland flow;
- Spread of exotic species on machinery wheels between areas outside of the construction area, or airport land;
- Increased erosion and sedimentation resulting from uncontrolled run-off from development areas, or machinery operating in close proximity to the population of the species, creating increased dust, and removing top soil, to a minor extent;
- Decreased air quality as a result of diesel plant and equipment operating in close proximity to the population of the species, resulting in residue settling on plant leaves are reducing the ability to photosynthesise, to a minor extent;
- Escape of pollution, such as petrochemical substances or water containing suspended solids, from the construction site; and
- Compaction and damage from machinery.

5.3.2 Operational Risks

The following risks to *H. fumana* have been identified during the operational phase:

- Mowing frequency and height inappropriate for the population to persist or maintain growth;

- Soil compaction and plant damage from vehicles and machinery;
- Use of herbicide in adjoining areas entering the habitat areas for the population and resulting in death;
- Weed invasion due to changes in management regime or environmental conditions that favour exotic and native grass species, which could outcompete *H. fumana*; and
- Shadowing from new buildings resulting in unsuitable habitat for *H. fumana*

These management objectives and risks to achieving them are summarised in **Table 5.1**. Management actions, triggers for detection of risks, and feasible corrective actions are also summarised in **Table 5.1**. The risk matrix is based on the table provided in **Appendix A**.

Figure 5.1. Project Impacts

Table 5.1 Risk assessment								
Management objective/ desired outcome	Event or Circumstance	Risk mitigation addressed in the Plan	Residual Risk			Trigger detection and monitoring activities	Feasible/effective corrective actions	Timeframe
			L*	C*	RL*			
To ensure that *H. fumana* is protected during the construction phase of the project.	Removal of additional *H. fumana* individuals (more than the three identified)	6.3.1 and 6.3.3	Possible	Moderate	Medium	Daily construction monitoring Flora surveys (Section 8.1)	Stop construction work on the Project site and review construction management measures.	Immediate stop. Resume once measures reviewed and signed off by DIRDC and BAL Environment and Heritage Manager
	Increased dust, which could smother the plants and limit their ability to photosynthesise and reproduce	6.3.1	Possible	Moderate	Medium	Daily construction monitoring Flora surveys (Section 8.1)	Stop construction work on the Project site and review construction management measures.	Immediate stop. Resume once measures reviewed and signed off by BAL Environment and Heritage Manager
	Increased run-off from the development, increasing overland-flow at resulting in inundation of the habitat for the plants	6.3.1	Possible	Moderate	Medium	Daily construction monitoring Flora surveys (Section 8.1)	Stop construction work on the Project Site and review construction management measures.	Immediate stop. Resume once measures reviewed and signed off by BAL Environment and Heritage Manager

Table 5.1 Risk assessment								
Management objective/ desired outcome	Event or Circumstance	Risk mitigation addressed in the Plan	Residual Risk			Trigger detection and monitoring activities	Feasible/effective corrective actions	Timeframe
			L*	C*	RL*			
	Increased erosion and sedimentation resulting from uncontrolled run-off, top soil removal or increased wind from machinery	6.3.1	Possible	Moderate	Medium	Daily construction monitoring Flora surveys (Section 8.1)	Stop construction work on the Project Site and review construction management measures.	Immediate stop. Resume once measures reviewed and signed off by BAL Environment and Heritage Manager
	Increased nutrient levels and/or pollutants resulting from increased overland flow	6.3.1	Possible	Moderate	Medium	Daily construction monitoring Flora surveys (Section 8.1)	Stop construction work on the Project Site and review construction management measures.	Immediate stop. Resume once measures reviewed and signed off by BAL Environment and Heritage Manager
	Escape of pollution, such as petrochemical substances or water containing suspended solids, from the construction site	6.3.1	Possible	High	Low	Daily construction monitoring Incident records / reporting	Stop construction work on the Project Site and review construction management measures.	Immediate stop. Resume once measures reviewed and signed off by BAL Environment and Heritage Manager

Table 5.1 Risk assessment

Management objective/ desired outcome	Event or Circumstance	Risk mitigation addressed in the Plan	Residual Risk			Trigger detection and monitoring activities	Feasible/effective corrective actions	Timeframe
			L*	C*	RL*			
To ensure that the *H. fumana* is protected during operational activities	Compaction and damage from machinery	6.3.3	Rare	High	Low	Flora surveys (Section 8.1) and daily exclusion fence monitoring (Section 6.3.3)	Stop construction work on the Project Site and review construction management measures.	Immediate stop. Resume once measures reviewed and signed off by DIRDC and BAL Environment and Heritage Manager
	Mowing frequency and height is detrimental for the population to persist or maintain growth	6.4.3ii	Possible	High	Medium	Flora surveys (Section 8.1)	Stop mowing works and review mowing regime immediately.	Immediate stop. Resume once revised regime is signed off with OEH, as per Threatened Species Licence and Plan is approved by DIRDC
	Compaction and damage from vehicles and machinery	6.4.1 and 6.4.5	Rare	High	Low	Flora surveys (Section 8.1)	Restrict access to the Project Site and review management of boundary markers and access management.	Immediately review inductions and access protocols are followed. Reinstatement of markers within 1 week, if removed or

Table 5.1 Risk assessment

Management objective/ desired outcome	Event or Circumstance	Risk mitigation addressed in the Plan	Residual Risk			Trigger detection and monitoring activities	Feasible/effective corrective actions	Timeframe
			L*	C*	RL*			
								unclear.
	Use of herbicide in adjoining areas entering the habitat areas for the population and resulting in death	6.4.4	Unlikely	High	Medium	Flora surveys (Section 8.1)	Stop herbicide treatments and review the use of herbicide in adjoining areas, as per the PolAir Operational Environment Plan Bankstown EMS	Immediate stop within airport. Review of protocols signed off by BAL CEO prior to resuming weed control
	Weed invasion, leading to *H. fumana* being smothered or shaded, risking the population.	6.4.4.	Possible	High	Medium	Flora surveys (Section 8.1)	Review weed management measures and initiate a more intensive weed control program, as part of a review of this Plan.	Review plan within 1 month of monitoring results for approval by DIRDC. Implement actions as per revised Plan.

*L = Likelihood of risk occurring (highly likely, likely, possible, unlikely, rare), C = Consequence if risk occurs (minor, moderate, high, major, critical), RL = Risk rating (Severe, high, medium, low). The risk framework and details on the likelihood and consequence measures used are provided in Appendix A.

Chapter 6

Management Details

6.1 Environmental Management Outcomes

The priority for the management of the *H. fumana* population at Bankstown Airport is to maintain the population within the area of habitat, to improve robustness and increase the area of occupancy of the population.

Specific environmental outcomes for the management of *H. fumana* include:

- Ensuring the species is protected from impacts resulting from construction works;
- Ensuring there is no net loss to the population, and the area of occupancy is maintained;
- Ensuring the long-term maintenance of the species at the airport; and
- Facilitating off-site management through propagation.

The management strategies to be implemented to deliver these environmental management outcomes are outlined in detail below, and include the following:

- Develop management zones to identify the population zones of *H. fumana* on the Project site;
- Construct a temporary exclusion fence during the construction phase of the Project to limit access and mitigate against potential damage to the species;
- Establish a Hibbertia Management Area to identify boundaries to facilitate mowing activities;
- Develop a mowing regime for the maintenance of *H. fumana* inside the management zones; and
- Propagate individuals for cultivation by the Australian Botanic Gardens, Mount Annan.

6.2 *Hibbertia fumana* Management Zones

In order to manage the population of *H. fumana* at Bankstown Airport, three distinct management zones will be established during construction of the Project (**Figure 6.1**). The management zones encompass the three main groups of *H. fumana* occurring at the airport, and will allow for targeted monitoring of the populations.

Due to the distribution of *H. fumana* in relation to the Project site, and the close proximity of some individual plants to the existing infrastructure, it is necessary that three isolated individual clumps are not included in these management zones (**Figure 6.1**). These individuals occur too close to existing infrastructure, and are too isolated from the management zones for it to be practical for them to be fenced.

However, if suitable plant material is present at the time of collection, these individuals will be used for the collection of cuttings and seeds for the propagation and seed conservation of the species by the Mt Annan Royal Botanic Gardens (see **Section 6.5**).

6.3 Construction Management Measures

6.3.1 General Construction Management Measures

Potential impacts to flora and fauna occurring in the construction phase that can be managed include: run-off, sedimentation, erosion and pollution. To reduce sedimentation on the construction site, erosion control measures should be implemented. This includes minimising the amount of exposed soils on the Project site at any given time. All soil stockpiles should be adequately covered when not in use to prevent erosion during heavy rainfall.

Sediment fences should be established around the perimeter of the development area to minimise the impacts of sedimentation on the adjoining vegetation. During development, precautions should be taken to ensure that no pollution, such as petrochemical substances or water containing suspended solids, escapes the construction site. Pollution traps and removal of pollution to an off-site location would help to minimise pollution impacts.

All general construction management measures will be fully detailed in the Construction Environmental Management Plan (CEMP), to be prepared by the Principle Contractor.

6.3.2 Inductions

All construction personnel will be required to attend an induction briefing prior to commencing work on site. The induction will be presented by the BAL Environment and Heritage Environment Manager, or a nominated supervisor for the Principle Contractor, who has been authorised by the BAL CEO or delegate.

The induction will include an overview of the environment of the airport, location of sensitive species within a no-go-area (the *Hibbertia fumana* habitat area) and details of the CEMP applicable to mitigating risk to the population present in close proximity to the Project site.

6.3.3 *Temporary Exclusion Fencing*

The three management zones (**Figure 6.1**) of *H. fumana* will be fenced during the construction phase of the project to ensure no damage is done to the species as a result of construction works. Contractors and sub-contractors will be made aware that these fenced zones are not to be accessed during site inductions.

The temporary fences need to be constructed and kept in the following condition:

- Located on the outside of the pre-placed markers (as described in **Section 6.4.1**), that will be placed in the locations shown in **Figure 6.1**. The temporary fencing will be installed at a distance of approximately 5m from the markers;
- Metal star pickets with caps (fixed on) need to be installed along the prescribed boundary (**Figure 6.1**) a maximum of 2 m apart;
- Paraweb fencing needs to be fixed onto the star pickets;
- The fence need to be upright and stand approximately 1 – 1.5 m off the ground;
- The fence should be checked at the start and end of each shift to ensure its integrity is maintained; and
- The fence will be sign-posted to make it clear that the area fenced off is an environmental exclusion zone with restricted access.

The construction of the Project is due to take 14 months to complete. However, works adjacent to the management zones, consists largely of the decommissioning of the pre-existing taxiway, and may only take a relatively short period of time. The management zones should be fenced whilst this construction work occurs in the adjacent areas. After this construction is completed, the management zones will be physically marked to allow for the operational mowing requirements to continue.

6.4 Operational Management Measures

6.4.1 *Marking the Extent of the Population*

After the disassembly of the temporary construction fencing, the three management zones of *H. fumana* will be physically marked-out to ensure that field workers and airport personnel are aware of the presence of the species. The extent of the boundaries is detailed in **Figure 6.1**.

Mowing operations will continue (See **Section 6.4.3**i), which makes fencing the zones impractical. Boundary markers in the form of cinder blocks or other suitable material, painted blue (as per the *Hibbertia bankstown* population, located within the airport) are considered effective measures to mark the boundary of the *H. fumana* management zones. The markers are to be placed at 20m intervals on the boundary of each Hibbertia fumana habitat area, and established under the supervision of a qualified Ecologist.

The marking of boundaries of the management zones allows field workers easily observe the extent of the zones and apply the appropriate mowing regime to the area (as discussed in **Section 6.4.2**). The approximate set-backs of works from the high and medium density patches of the population are at least 15m, as shown in **Figure 5.1**.

6.4.2 *Inductions*

From the adoption of this Plan, all site personnel requiring access to the *Hibbertia fumana* Management Area will be required to undertake an induction with the BAL Environment and Heritage Manager, or a suitably trained person, nominated by the BAL CEO or delegate. The contents of the induction will be as per the construction phase (**Section 6.1.2**), with the addition of specific precautions for works within the habitat of the populations, including:

- Access is limited to scheduled maintenance (mowing) and monitoring activities;
- Parking within the *Hibbertia fumana* Management Area is not permitted, and driving of machinery should be limited to a ride-on mower, or light weight small tractor and slasher;
- No herbicide is to be used within the *Hibbertia fumana* Management Areas, or within a 20m radius of each patch. If weeding is required (see **Section 6.4.4**), then hand-weeding must be undertaken by a qualified bush regenerator.

As all site work (mowing) will be conducted by BAL grounds maintenance staff, the risk of breaches to this protocol is limited, as there is will be consistency of access by trained staff.

General site inductions for all BAL staff and contractors are mandatory, using the BAL on-line site-induction program. This program will be updated to include identification of the Hibbertia fumana Management Area locations i.e. 'No Go Zones', and a direction to avoid entering without prior approval. Additionally, the PolAir Operational Environment Plan will provide details around no-go zones and training for their employees.

6.4.3 *Maintenance Mowing Regime*

i. Current Mowing Regime

Mowing currently occurs on the Project site as part of Bankstown Airports' general grounds keeping regime, to discourage small mammals and birds, which may pose a risk to aircraft operators.

Mowing currently occurs approximately twice a month during warmer periods and once every two months during cooler periods. Grass is mown to a height of 10-15 cm above ground with either a tractor and mower unit, with rear rotating blades, or a ride on mower, with front rotating blades.

The persistence of *H. fumana* at Bankstown Airport may have been benefitted by this mowing regime, as mowing may control the exotic grasses that may otherwise out-compete *H. fumana*.

ii. Proposed Mowing Regime

Mowing will continue as part of the management of *H. fumana* inside the prescribed boundaries under the following requirements:

- Ensure that all mowing staff members are inducted to the correct mowing procedures outlined below and can identify *H. fumana* correctly;
- The frequency of mowing events will be determined by grass height. A grass height of 20 cm or above will trigger a mowing event;
- Within the marked boundaries a minimum blade height of 15 cm above ground should be maintained; and
- As mowing may cause disturbance to the soil, a tractor with broad, low pressure tyres must be used to minimise damage to plants and disturbance of soils.

6.4.4 Weed Management

At the time of preparation of this Plan, the *Hibbertia fumana* Habitat Areas were not identified as contains significant densities of weed species, or other ground cover species that would threaten the survival of individuals of the populations. It was noted however, that adjoining areas contained higher densities of some of the grass and herb species that may outcompete or smother individuals of the population.

As the population of *H. fumana* is well established, it is not proposed that regular weeding is scheduled. However, this will be reviewed as part of the regular monitoring. An increased abundance of exotic grasses and herbs of above 50% within the *H. fumana* Management Areas will trigger the requirement to conduct hand-weeding, to be undertaken by a qualified bush-regeneration contractor.

Weeding methods will be consistent with those undertaken for the *Hibbertia bankstown* population on the airport. Methods used are as follows:

- Undertake hand-weeding manually using the hand-pulling techniques to remove the existing exotic grass cover and non-natives from roots within the extent of *Hibbertia fumana* Management Areas;
- Undertake hand-weeding using crowning technique to remove the existing exotic grass cover and non-natives outside the *Hibbertia fumana* Management Areas, out to a distance of at least three metres from the edges of the individual sub-populations;
- Remove the resulting green waste from the management site by proper bagging and disposal in the Bankstown Airport bins; and
- Provide a concise report outlining the work undertaken, methods used, and results obtained (including amount of weeds cleared in terms of the area (ha) or percentage of the area) along with recommendations to control / eliminate the

weeds in the future. This is to include weed density mapping before and after weed control activities.

In adjoining areas of Polair Facility, herbicide use will continue to be applied, as per the BAL EMS. If spray drift occurs, and plants within the Hibbertia Management Area are incidentally sprayed, then a review of the protocols will be undertaken.

6.4.5 Traffic and Pedestrian Management

Currently, the *H. fumana* area is not a high traffic area, and will not be considered a high traffic area post development. The entirety of the *H. fumana* area is on the restricted airside of the airport. During construction phase, access to the management zones will be restricted via the use of exclusion fencing. During the operational phase of the Project, boundaries will mark the extent of the management zones, and users of the surrounding areas will be informed to stay on asphalted areas to minimise impacts to *H. fumana*.

6.5 Propagation of *Hibbertia fumana*

Peter Cuneo of the Royal Botanic Gardens, will oversee the propagation of *H. fumana* at the seedbank at Mt Annan Botanic Gardens. Mr Cuneo is currently working on the propagation and translocation plan being developed for the closely related species *Hibbertia puberula* subsp. *glabrescens* at Bankstown Airport. Preliminary consultation has been initiated with Mr. Cuneo (phone correspondence 21/12/2017), and an adaptive plan discussed, depending on when flowering events occur in the population, and how well the material collected survives and is propagated. Samples were taken by Mr Cuneo, for DNA analysis, in February 2018, although no seed was able to be collected, or viable specimens for cuttings to be used in propagation. This was due to the extreme drought conditions being experienced, resulting in very little living material being observed above-ground. Due to the heat wave conditions experienced in the preceding month, it is likely that some plants were burnt.

Prior to the commencement of construction works, cuttings and seeds will be collected by Mr Cuneo from a viable specimens within the population, as determined through further consultation with the Royal Botanic Gardens, Mount Annan and OEH). The individuals to be impacted by the Project will all be sampled, if suitable material is present.

Cuttings of *H. fumana* plants will be taken in autumn by Mr Cuneo. The collection of seeds will occur if and when the plant has set seed, however, little is known about the life-history of the species and its flowering and seeding times. Mr Cuneo will monitor the plants to determine when the species sets seed and collect seeds at the appropriate time, most likely during late Autumn, if condition become less dry and the summer period, as closely related *Hibbertia* species set seed in summer, between November-December.

Cuttings will be propagated to grow tube-stock and seeds will also be collected to be included in the seed bank conservation collection at Mt Annan Botanic Gardens. Leaf material gained from cuttings can also be used to develop a genotype profile of the species.

if required. The tube-stock plants may be used for future translocation projects developed by the Botanic Gardens in conjunction with the OEH.

Figure 6.1. Hibbertia fumana Management Areas

Chapter 7

Contingency Planning

7.1 Contingency Response and Corrective Actions

As part of the risk assessment process, a number of Project and site risks have been identified in **Section 5.1,** and appropriate responsive actions have been developed. Responsive actions for each risk include stopping works, removing the hazard, and reviewing the *Hibbertia fumana* Management Plan, in consultation with DoEE and OEH, as detailed in Table 5.1.

In the case that the key management objective of this Plan, to conserve the insitu population of the species on Bankstown Airport is not met, a contingency plan is required. The key performance measure is that there is no reduction in the area of occupancy of the population. If this target is not met, a review of the Plan will be initiated. The contingency plan is this case is to re-establish or increase the area of occupancy of the population in this location, or a more suitable one, from the reference collection propagated at the herbarium.

The CEMP will include details of the contingency plan for environmental breaches, such as those reportable to the NSW Environment Protection Agency (EPA). Corrective actions will be dependent on the nature of the non-compliance, and will involve consultation with all relevant stakeholders, including DoEE and OEH. This Plan will be reviewed after events of non-compliance.

7.2 Managing Uncertainty and Adaptive Implementation

It is unknown if the area of habitat for this species will decrease, increase or remain stable. Environmental conditions, such as extreme weather events, such as extended heavy rainfall and localised flooding, wildfire, and incidents such as spills or misuse of herbicide or trampling by vehicles, have the potential to threaten the population of *H. fumana*. Adaptive management will be required to adjust to any such events, as appropriate, although ultimately, the population is 'wild' and within an active airport.

As a safeguard for the population of *Hibbertia fumana*, a herbarium collection in addition to seed storage and propagation by the Mt Annan Botanic Gardens, will be established, which will ensure that the genetic profile of the local population is maintained.

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Chapter 8

Monitoring and Compliance Details

8.1 *Hibbertia fumana* population surveys

Site assessments will be conducted to monitor the health and condition of the *H. fumana* population. Monitoring will focus on the area of occupancy of *H. fumana* and record changes to the size or condition of plants/clumps. Each Habitat Management Area will be marked at furthest boundary, and this will mark the extent of the area of occupancy for monitoring period one, until review of the plan.

The three management zones will be surveyed by a qualified ecologist, using a modified version of the Biodiversity Assessment Method (BAM) (OEH 2017b) guidelines for flora surveys. Three monitoring plots will be surveyed using fixed monitoring transects, with the management zones being represented in each plot. Management zones will be focused on, as they represent the known areas of the species distribution, and the focus of this report is on changes to the species distribution over time.

This includes collection of the following data:

- Recording the name and count of species recorded within a 20 m x 20 m plot, centred on the 50m transect;
- Assessment of function attributes at intervals along a 50 m transect, including:
  - Count of number of *H. fumana* within five 1 m x 1 m plots evenly spread either side of the transect line;
  - Estimate of cover for litter, bare ground, rock, moss and vegetation within each 1 m x 1 m plot;
  - Map the boundary of each *H. fumana* habitat patch using a GPS visually checking this in reference to the pegged extent of the patch.

Area of occupancy is a measure of geographical range that describes the smallest area occupied within the extent that the species occurs. The area of occupancy will be gained from the mapped boundaries of habitat for H. *fumana* on the Project site, and will be used to assess any changes in the area of the species occupancy between monitoring events. Population density estimates will be monitored using the counts of individuals within the 1 m x 1 m plots, which can be extrapolated to a density per hectare, and compared to previous results.

Monitoring of the *H. fumana* population will occur during and post construction of the Project. The monitoring regime includes the construction period of 14 months and will be carried out over the following intervals:

- **Year 1**: every 3 months (or throughout the duration of the construction phase, whichever is longer);
- **Year 2**: every 6 months; and
- **Subsequent years:** licence monitoring conditions would be reviewed to determine ongoing monitoring requirements.

Chapter **9**

Reporting

9.1 Reporting

Performance reports will be developed to outline the condition of the *H. fumana* population and determine the effectiveness of the management measures. Performance reports will outline the results of monitoring sessions and any changes to the condition or the area of occupancy of *H. fumana*.

Reporting will occur to the NSW Office of Environment and Heritage after the following triggers:

- After each monitoring session, as outlined in **Section 8.1**;
- After a significant environment incident; and
- When non-compliance with the management and monitoring measures outlined in this plan is reported.

9.2 Plan review

This Plan will be reviewed annually by the Bankstown Airport Environment and Heritage Manager in conjunction with OEH licensing requirements and updated as necessary. The review will take into account environmental monitoring records, corrective actions and the results of any audits.

A review will also be undertaken:

- Following significant environmental incidents;
- If performance reports a decrease in population area of occupancy greater than the trigger value of 5%, or a decrease in estimated population numbers (based on density estimates from plots) of greater than 10% of the preconstruction estimate;
- When there is a need to improve performance in an area when new information comes to light in the form of new research on the species or updated species listing or policy statements; and
- At the end of the second year of monitoring, the licence monitoring conditions will be reviewed to determine ongoing monitoring requirements.

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Appendix A

Risk Matrix

Table 9.1 Risk Framework

		Consequence				
Likelihood		Minor	Moderate	High	Major	Critical
	Highly Likely	Medium	High	High	Severe	Severe
	Likely	Low	Medium	High	High	Severe
	Possible	Low	Medium	Medium	High	Severe
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

Table 9.2 Likelihood and consequence

Qualitative measure of likelihood (how likely is it that this event/ circumstances will occur after management actions have been put in place/ are being implemented)	
Highly likely	Is expected to occur in most circumstances
Likely	Will probably occur during the life of the project
Possible	Might occur during the life of the project
Unlikely	Could occur but considered unlikely or doubtful

Rare	May occur in exceptional circumstances
Qualitative measure of consequences (what will be the consequence/ result if the issue does occur)	
Minor	Minor risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing low cost, well characterised corrective actions.
Moderate	Moderate risk of failure to achieve the plan's objectives. Results in short term delays to achieving plan objectives, implementing well characterised, high cost/effort corrective actions.
High	High risk of failure to achieve the plan's objectives. Results in medium-long term delays to achieving plan objectives, implementing uncertain, high cost/effort corrective actions.
Major	The plan's objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies.
Critical	The plan's objectives are unable to be achieved, with no evidenced mitigation strategies.

Approval Letter

Appendix G

The Hon Michael McCormack MP

Deputy Prime Minister
Minister for Infrastructure and Transport
Leader of The Nationals
Federal Member for Riverina

Ref: MS17-002441

18 MAY 2018

Ms Lee de Winton
Chief Executive Officer
Bankstown Airport Limited
3 Avro Street
BANKSTOWN AIRPORT NSW 2200

Dear Ms de Winton

Thank you for your letter dated 6 November 2017 seeking consideration of the draft Major Development Plan (draft MDP) for a new NSW Police Force Aviation Support Branch (PolAir) facility within the Bankstown Airport estate. I am satisfied the draft MDP complies with the requirements of the *Airports Act 1996* (the Act) and am pleased to advise I have approved the MDP.

In considering the draft MDP, I note the development will consolidate PolAir's functions into a single building, making their vital aviation operations more efficient. This is the first MDP approved at Bankstown Airport since privatisation, and I believe this is an important milestone for the Airport which demonstrates your commitment to support general aviation in Australia.

In making my decision I have given regard to the views of the Civil Aviation Safety Authority (CASA) and Airservices Australia (Airservices). It is my expectation Bankstown Airport Limited will continue to work closely with Airservices, CASA and the Department of Infrastructure, Regional Development and Cities to ensure appropriate permits are obtained during the construction and commissioning of the facility including for the use of plant equipment and cranes.

I have also considered the additional information requested regarding the conservation of the recently discovered *Hibbertia fumana* population on the development site. As noted by the Department of the Environment and Energy, your plans to monitor, maintain, conserve and propagate this population is an appropriate response.

Bankstown Airport Limited also outlined commitments to the Department of the Environment and Energy regarding management of any per- and poly-fluoroalkyl substances found on the development site.

Parliament House Canberra | (02) 6277 7520 | minister.mccormack@infrastructure.gov.au
Suite 2, 11-15 Fitzmaurice Street, Wagga Wagga NSW 2650 | michael.mccormack.mp@aph.gov.au

Publication of the final MDP is required within 50 business days of the date of my approval in accordance with section 96 of the Act. As additional information was required for consideration as part of this approval, I request this information be incorporated in the final MDP. A version of the MDP containing the information requested on 29 November 2017 should be provided to my Department prior to publication to confirm these matters have been appropriately addressed.

In accordance with section 242 of the Act, and subject to the *Administrative Appeals Tribunal Act 1975*, an application may be made to the Administrative Appeals Tribunal for a review of my decision.

I wish you and your team at Bankstown Airport all the best for the construction of this significant project.

Yours sincerely

Michael McCormack