



SMEC INTERNAL REF. 3002844

Runway 12/30 threshold displacement Study

Safety Case Report – Final 1.1

Project Reference No. 3002844
Prepared for: Canberra Airport
27 June 2022

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Contents

| | | |
|------------|---|-----------|
| 1. | Introduction | 4 |
| 2. | Existing Runway 12/30 Dimensions | 4 |
| 3. | Existing Runway 12/30 Operations | 5 |
| 3.1 | Historical Use..... | 5 |
| 3.1.1 | Overall activity | 5 |
| 3.1.2 | Royal Australian Air Force VIP transport squadron | 8 |
| 3.1.3 | Air Ambulance..... | 8 |
| 3.2 | Future Use..... | 8 |
| 4. | Analysis of displaced Runway 12 end | 8 |
| 5. | Aircraft performance | 9 |
| 5.1.1 | Take-offs | 9 |
| 5.1.2 | Landings..... | 10 |
| 6. | Impact on Runway 12/30 operations | 10 |
| 6.1 | Runway 12 landings | 10 |
| 7. | Required infrastructure and visual aids changes | 11 |
| 8. | OLS implications on existing CA airport operations and obstacles/terrain | 11 |
| 9. | Safety Case | 11 |
| 9.1 | Risk Assessment Categories | 11 |
| 9.2 | Risk Analysis | 12 |
| 10. | Conclusion and Safety Assessment Outcome | 12 |
| 11. | Acronyms | 12 |

Appendices

| | |
|----------|----------------------|
| 1 | OLS Obstacles |
| 2 | Risk Matrix |

Figures

| | |
|-------------------------------------|---|
| Figure 2–1: Taxiway locations | 5 |
| Figure 4–1: Runway distances..... | 9 |

Tables

| | |
|--|---|
| Table 2–1: Runway distances (m) | 4 |
| Table 2–2: Taxiway distances (m) from existing runway ends | 5 |
| Table 3–1: Aircraft types using Runway 12/30 | 6 |
| Table 3–2: Aircraft movements from the 12-runway end | 7 |

Table 4–1: Proposed Runway Distances.....8

Table 4–2: Revised distance from the taxiway intersections9

Table 5–1: Revised landing distances from the proposed threshold relocation10

Table 9–1: Levels of Risk.....11

Table 11–1: Acronyms12

Table 9–2: Relocation Risk Assessment.....13

1. Introduction

Canberra Airport (CA) has two runways; the primary Runway 17/35 is 3,283 metres (m) long and is aligned in the north-south direction and an intersecting Runway 12/30 which is aligned in the east-west direction.

In accordance with its Master Plan CA is considering displacing the Runway 12 approach threshold Runway 12/30 by 360 m.

“Aircraft using Runway 12 arrival and Runway 30 departure are limited to light aircraft, less than 5.7 tonne (MTOW), a result of the constraints of the nearby Canberra Noise Abatement Area. In the medium term 5-10 years, the use of Runway 12/30 may be restricted to Runway 30 arrival and Runway 12 departure on a shortened runway length.”

“In the short term, 1-3 years, and subject to further studies, the landing point for Runway 12 arrival will be moved by displacing the threshold up to 450m east of the existing threshold. This will mean aircraft on arrival to the displaced threshold will be higher over the new Majura Parkway and the now duplicated Majura Road. The current lower height street lighting under the Runway 12 arrival over the Majura Parkway compared to the balance of street lighting on the Parkway points to a need for a short-term safety improvement supplied by a displaced threshold.”

(extract from CA’s 2020 Master Plan (7.5, last para p107 and first para p108):

CA has engaged SMEC to identify operational impacts and infrastructure changes required to facilitate and mitigate operational risks associated with this change.

2. Existing Runway 12/30 Dimensions

Runway 12/30 is classified as a Code 2C runway. It is 1,679 m long and 30 m wide, is located within a 90 m strip, and has 60 m clearways at both ends. Runway 30 has an RNP non precision approach and so Runway 12/30 is classified as an instrument non precision runway.

The 30 m width makes it suitable for use by aircraft with an OMWGS of up to but not including 9 m. The runway elevation is 1,849 feet (ft) at the 12 end and 1,886 ft at the 30 end. The overall Runway 12/30 grade is 0.7%.

There are medium intensity runway edge lights (operating at stages 1 to 3) at 90 m separation and the Runway 30 approach has a PAPI.

Its pavement has a PCN of 12, making it suitable for unlimited use by aircraft up to the Dash 8-300 (ACN 12) and restricted use by aircraft such as the Dash 8-400 (18), CL604 (14) and ATR 72 (14).

The existing Runway 12 distances are shown in Table 2-1.

Table 2-1: Runway distances (m)

| Runway | TORA | TODA | ASDA | LDA | STODA |
|--------|-------|-------|-------|-------|--------------|
| 12 | 1,679 | 1,739 | 1,679 | 1,679 | 1,702 (5.0%) |

Source: Airservices Australia Runway distance supplement 02 December 2021

For Runway 12 there are two obstacles which are not considered when calculating the TODA gradient and STODA

- a fence 10.5 ft above and 19 m south-east of the runway strip end
- transient 16.2 ft and 10 m south-east of the runway strip

Runway 12/30 is intersected by seven taxiways and Runway 17/35 (Figure 1). Table 2-2 shows the distance from the taxiway intersections to the existing runway ends.



Figure 2-1: Taxiway locations

Table 2-2: Taxiway distances (m) from existing runway ends

| Taxiway | Distance to Rwy 12 end |
|--------------|------------------------|
| C1 | 0 |
| K | 555 |
| H | 555 |
| J | 555 |
| B | 839 |
| G | 1,098 |
| Runway 17/35 | 1,098 |
| C5 | 1,679 |

3. Existing Runway 12/30 Operations

3.1 Historical Use

3.1.1 Overall activity

Runway 12/30 has been used by a range of propeller and turbo prop aircraft. The following aircraft types are derived from data and flight paths Airservices Australia (AsA) provided for the CA 2019 ANEF as shown in Tables 3-1 and 3-2.

Aircraft operations associated with the runways include both take offs and landings. The overall data breakdown shown in section 3 has been determined by CA. The records show no jet aircraft operated on runway 12.

Table 3–1: Aircraft types using Runway 12/30

| Runway 12 | | Runway 30 | | |
|--|---|--|-----------------------------|---------------------------------|
| Propeller | Turbo prop | Propeller | Turbo prop | Jet |
| Aerostar AEST | Beechcraft Models 200, 350, 90 King Air | Aerostar AEST | Beechcraft Models 200, 350, | Beech 400 |
| Aquila A210 | Cessna Models 208, 44 | Beechcraft Models 23, 33, 35, 36, 55, 58, 76, 95 | Cessna Models 208, 441 | Boeing 737 -800 |
| Beechcraft Models 23, 33, 35, 36, 55, 58, 76 | Jet stream 32 | Cessna Models 24R, 72R, 77R, 82R, 82S, 150, 152, 170, 172, 180, 182, 185, 206, 207, 210, 303, 305, 310, 337, 340, 402, 404, 414, 421 | C27 Spartan | Bombardier Global express |
| Brumby BR60 | Piper M600/SLS | Champion Sky-Trac CH7B | De Havilland Dash 8-300 C | Canadian Regional Jet CL60 |
| Bristell NG5 | Socata TBM 700 | CT4 Airtourer | Embraer 120 | Cessna Models 500, 501, 510 525 |
| Cessna Models 82, 150, 152, 172, 180, 182, 185, 206, 207, 210, 24R, 310, 337, 340, 404, 414, 72R | | Diamond Models 20, 40, 42 | Jet stream 32 | Lear jet 45 |
| Champion Sky-Trac CH7B | | Gippsland GA8 Airvan | Pilatus Models PC9, 12 | |
| CT4 Airtourer | | Grumman American AA5 | Socata TBM 700B | |
| Diamond models 40, 42 | | Mooney 20 | Swearingen Merlin 3 | |
| Gippsland GA8 Airvan | | Piper Models 27, 28, 28A, 28R, 28T, 30, 31, 32, 32R, 32T, 34, 38, 44 | | |
| Grumman American AA5 | | Sirrus 20, 22 | | |
| Mooney 20 | | Jabiru | | |
| Partenavia P.68 | | Socata TB20 | | |
| Piper Models 28A, 28R, 28T, 32R, 32T, 27, 28, 30, 31, 32, 34, 38, 44 | | Van RV4, RV5, RV7, RV10, RV14 | | |
| Sirrus 20, 22 | | | | |
| Robin R200 | | | | |
| Jabiru | | | | |
| Socata TB20 | | | | |
| Van RV7, RV10 | | | | |

In 2018 the Runway 12/30 width was reduced from 45 m to 30 m making it unsuitable for operations by larger aircraft such as the B737. Currently the DH8-400 is not using Runway 12/30 since it was reclassified as a Code 2C.

Table 3-2 shows the number of aircraft movements by operation and type for 12 runway end operations obtained from AsA noise reports for the period January 2016 to March 2021. ¹ While there is a discrepancy in the total between the aircraft operations and types, the data indicates that changes to the Runway 12 end will impact relatively few, mainly propeller, aircraft. The data shows that while the runway width was reduced from 45m to 30m in 2018 the overall low runway use has been consistent since 2016.

Table 3-2: Aircraft movements from the 12-runway end

| Period | Operation | | Aircraft Type | | |
|------------------------|----------------|------------------|---------------|-------------|--------------|
| | Arrival Rwy 12 | Departure Rwy 30 | Propeller | Turboprop | Unknown |
| Jan – Mar 2016 | 133 | 146 | 229 | 21 | 29 |
| Apr- June 2016 | 34 | 185 | 179 | 0 | 36 |
| July- Sept 2016 | 28 | 162 | 158 | 0 | 48 |
| Oct – Dec 2016 | 49 | 245 | 215 | 0 | 70 |
| Jan – Mar 2017 | 99 | 147 | 192 | 13 | 39 |
| Apr- June 2017 | 121 | 172 | 213 | 11 | 67 |
| July- Sept 2017 | 24 | 208 | 177 | 0 | 45 |
| Oct – Dec 2017 | 104 | 146 | 202 | 11 | 27 |
| Jan – Mar 2018 | 106 | 212 | 276 | 0 | 46 |
| Apr- June 2018 | 92 | 178 | 223 | 0 | 36 |
| July- Sept 2018 | 36 | 211 | 217 | 0 | 24 |
| Oct – Dec 2018 | 70 | 163 | 199 | 0 | 29 |
| Jan – Mar 2019 | 128 | 186 | 231 | 0 | 78 |
| Apr- June 2019 | 92 | 229 | 247 | 0 | 70 |
| July- Sept 2019 | 48 | 222 | 203 | 0 | 65 |
| Oct – Dec 2019 | 48 | 355 | 246 | 16 | 141 |
| Jan – Mar 2020 | 136 | 211 | 197 | 47 | 102 |
| Apr- June 2020 | 57 | 172 | 169 | 10 | 49 |
| July- Sept 2020 | 42 | 211 | 209 | 5 | 38 |
| Oct – Dec 2020 | 82 | 213 | 208 | 4 | 83 |
| Jan – Mar 2021 | 112 | 203 | 253 | 4 | 57 |
| Total | 1,641 | 4,177 | 4,443 | 138 | 1,179 |
| Monthly Average | 26.05 | 66.30 | 70.52 | 2.19 | 18.71 |
| 2016 Total | 244 | 738 | 781 | 21 | 183 |
| 2017 Total | 348 | 673 | 784 | 35 | 178 |
| 2018 Total | 304 | 764 | 915 | 0 | 135 |
| 2019 Total | 316 | 992 | 927 | 16 | 354 |
| 2020 Total | 317 | 807 | 783 | 66 | 272 |

¹ <http://aircraftnoiseinfo.emsbk.com/canberra/home/>

3.1.2 Royal Australian Air Force VIP transport squadron

CA is the base for RAAF (VIP) Squadron is 34. It operates Boeing 737 Business Jets and Dassault Falcon 7Xs. CA provides permanent dispensation for the Falcon to operate on Runway 12/30.

3.1.3 Air Ambulance

Runway 12/30 is used on a 24-hour basis as needed by the RFDS. The RFDS operates the King Air BEC350C and BEC200C in NSW.

3.2 Future Use

CA forecasts that the future use of Runway 12/30 will follow the historic pattern i.e., primarily by propeller and turbo prop aircraft. The RAAF VIP Squadron and the air ambulance will also continue to use the runways required. It is anticipated that the following aircraft will continue to use Runway 12/30 in the foreseeable future. Additionally, the aircraft listed below will not be impacted by the relocated threshold, as these aircraft do not use Runway 12 for landings.

- Link Airways: Saab 340B plus
- Rex Airways: Saab 340B plus
- Qantas Link: Dash 8 200/300 variants
- Fly Pelican: Jetstream 32
- Royal Flying Doctor Service: King Air B350 C and B200 C variants
- 34 SQN Falcon 7X.

4. Analysis of displaced Runway 12 end

Displacing the Runway 12 approach threshold by 360 m will change the available Runway 12 landing distance as shown in Table 4-1 and Figure 4-1. There will be no impact on Runway 12 take-off distances or Runway 30 distances.

Table 4-1: Proposed Runway Distances

| Runway | TORA | TODA | ASDA | LDA |
|--------|-------|-------|-------|-------|
| 12 | 1,679 | 1,739 | 1,679 | 1,319 |
| 30 | 1,679 | 1,739 | 1,679 | 1,614 |

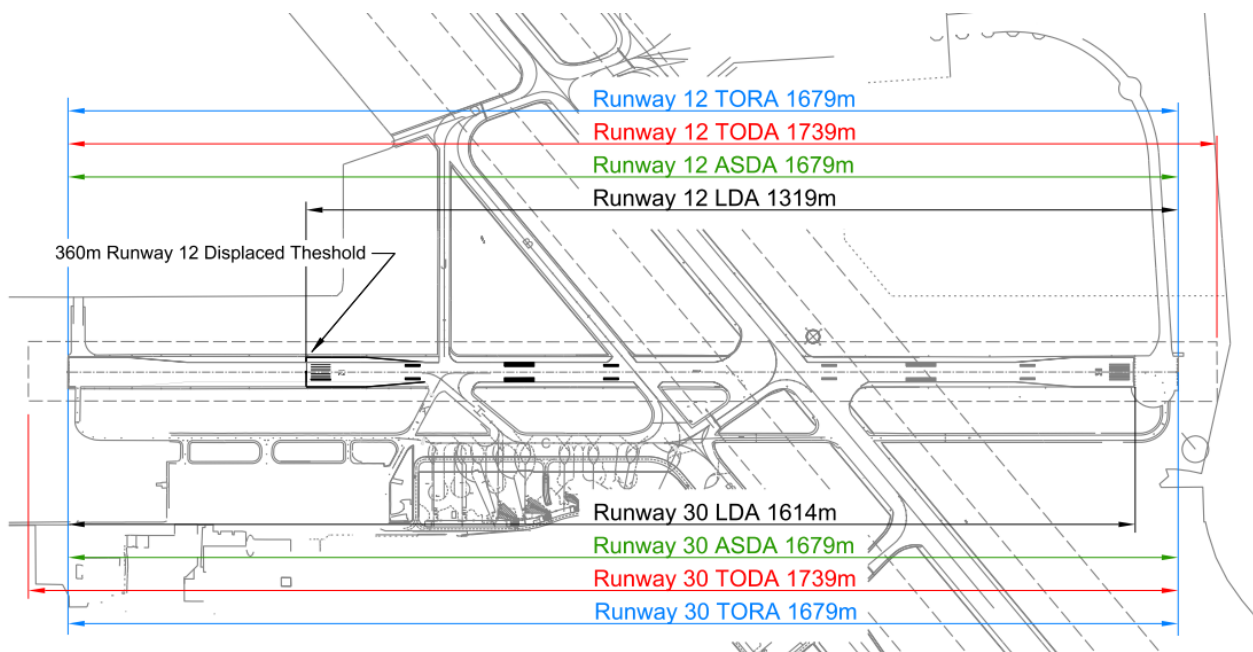


Figure 4-1: Runway distances

Table 4-2 shows the distance from the taxiway intersections to the relocated Runway 12 end.

Table 4-2: Revised distance from the taxiway intersections

| Taxiway | Distance to new Runway 12 end (m) |
|--------------|-----------------------------------|
| C1 | NA |
| K | 195 |
| H | 195 |
| J | 195 |
| B | 479 |
| G | 738 |
| Runway 17/35 | 738 |
| C5 | 1319 |

5. Aircraft performance

AsA records show that the largest aircraft operating on Runway 12/30 included the Boeing 737 -800, Bombardier Global Express, Canadian Regional jet CL60 and Dash 8-300. All these aircraft only landed on Runway 30 when it was 45 m wide and did their take-offs on Runway 17/35. Since the runway width was reduced to 30 m the larger aircraft no longer use Runway 12/30. Qantas has advised that similarly the Dash 8-Series 400 will no longer use Runway 12/30.

The aircraft listed in section 3.2 will not be impacted by the relocated threshold, as these will not use the shortened Runway 12 for landings.

The Master Plan ANEF endorsed by AsA has identified all landings and take offs on Runway 12 will be by light propeller and turbo prop (BEC200, Cessna 441) aircraft.

5.1.1 Take-offs

As the Runway 12 take-off distance will not be impacted by the relocated threshold there will be no impact on future Runway 12 take offs by the light aircraft types nominated in the Master Plan.

5.1.2 Landings

Only landings on Runway 12 will be impacted by the relocated threshold. As future Runway 12 landings will be only by light propeller and turbo prop aircraft the reduced landing distance of 1,319 m will be suitable to accommodate future landings by these aircraft. Table 5-1 includes the estimated required landing distance for a range of aircraft considered likely to land on Runway 12.

Table 5-1: Revised landing distances from the proposed threshold relocation

| Engine | Aircraft | Estimated Landing distance (m) |
|--------|----------|--------------------------------|
| Single | BEC 33 | 300 |
| | BEC36 | 450 |
| | CNA150 | 200 |
| | CNA172 | 160 |
| | CNA182 | 411 |
| | CNA206 | 450 |
| | CNA210 | 450 |
| | M20T | 350 |
| | PA28A | 300 |
| | PA32R | 350 |
| | PA38 | 200 |
| Twin | AC50 | 400 |
| | BEC200 | 540 |
| | BEC350 | 820 |
| | BEC58 | 600 |
| | CNA404 | 600 |
| | CNA414 | 720 |
| | CNA441 | 350 |
| | PA32 | 575 |

Source: <https://contentzone.eurocontrol.int/aircraftperformance/default.aspx/GroupFilter=11>

6. Impact on Runway 12/30 operations

6.1 Runway 12 landings

Relocating the Runway 12 approach threshold will reduce the amount of landing runway available and will also reduce the distance from the threshold to the intersecting taxiways.

The analysis of past activity (section 3) shows that the reduced landing length will have little impact on this runway's usability, as ASA records show that on average over the last four years there has been less than one landing per day on Runway 12.

The taxiway locations relative to the new threshold may impact some aircraft ground movements. Currently the closest taxiways, Kilo, Hotel and Juliet are 555 m from the Runway 12 end. With a 360 m relocated threshold the distance to taxiways Kilo, Hotel and Juliet is reduced 195 m, Bravo to 479 m, and Golf 738 m. The relocation of the threshold will make a direct runway exit via taxiways Kilo, Hotel and Juliet unlikely and will require most aircraft to back track along the runway or exit using taxiways Bravo and Golf.

As these aircraft will primarily park at the GA apron most will need to either back track along Runway 12/30 to reach Kilo or Hotel or exit onto other taxiways. Exiting on taxiway Bravo will require aircraft either to traverse the RPT apron area or travel a circuitous route to the GA parking area via Juliet.

Considering the historically low use of Runway 12 for arrival movements, which at an average of less than 1 movement per day (as shown in table 3-2), it is envisaged no congestion will occur when aircraft either backtrack onto Runway 12/30 or exit via taxiway Bravo onto taxiway Charlie through to the GA apron.

7. Required infrastructure and visual aids changes

To comply with the requirements of MOS Part 139 the following infrastructure changes are required:

- Runway lights (reflecting the proposed threshold location)
- Line marking

8. OLS implications on existing CA airport operations and obstacles/terrain.

The current Runway 12/30 is based on a MOS part 139 coding of 2C. This has been determined based on a 30m wide runway with a 90m wide flight strip.

An Instrument Survey of the Approach, Take Off, Transitional, Visual Segment and Obstacle Assessment Surfaces at CA was carried out on the 18 February 2021. The results of this survey are included in Appendix 1. No obstacles were identified in the Runway 12 approach or transitional surfaces, or the Runway 30 take-off surface.

Additionally, a subsequent survey was conducted based on the Runway 12 threshold displacement of 360m. In relation to the OLS permutations, this survey determines that any relocation of the threshold at 90m increments from the existing runway end, out to 360m, will remain obstacle free.

In relation to changes associated with the current part 139 MOS, the new standard requires an overall flight strip width of 140m. Under the current strip dimensions no obstacles exist within the associated OLS, in relation to the Runway 12 approach, transitional and take-off protection surfaces. Currently the OLS is based on a 90m wide strip, with critical consideration to the vertical stabilisers of the Code E aircraft. All are currently below the transitional surface and based on this, there are no plans to increase the Runway 12/30 strip width and introduce obstacles where none currently exist.

9. Safety Case

9.1 Risk Assessment Categories

The safety risks associated with this concept can be categorised using the project risk matrix located in Appendix 2. Three categories of risk were identified: **Acceptable, Tolerable, and Intolerable**. The criteria for the outcomes of the levels are listed in Table 9-1.

Table 9-1: Levels of Risk

| Risk Category | Criteria |
|---------------|--|
| Intolerable | The consequence is unacceptable under the existing circumstances. The work or activity shall not proceed at all. |
| Tolerable | After reasonable mitigating measures, have been taken to reduce the probability or the severity of the consequence, the work or activity may proceed upon endorsement from management. |
| Acceptable | The consequence is extremely improbable or not severe enough to be of a concern. |

9.2 Risk Analysis

The following risk assessments (Table 9-2) consider how to mitigate risks associated by hazards introduced by the relocation of the Runway 12 threshold.

10. Conclusion and Safety Assessment Outcome

The risk assessment found that applying the current requirements of MOS part 139 would mitigate any risk associated with the relocation of the threshold. The application of these standards, in relation to new threshold markings, relocated runway/threshold end lights, including an update of the AsA AIP DAPs publications and Enroute and CA operational documents provides a safe and compliant outcome.

The assessment found that any impact on operations by displacing the Runway 12 approach threshold are acceptable.

11. Acronyms

Table 11-1: Acronyms

| Acronym | Meaning |
|---------|---|
| AsA | Airservices Australia |
| ASDA | Accelerate Stop Distance Available |
| CA | Canberra Airport |
| LDA | Landing distance available |
| MLW | Maximum landing weight |
| MOS | CASA Manual of Standards |
| MTOW | Maximum Take-off weight |
| OLS | Obstacle Limitation surfaces |
| TODA | Take off distance available |
| TORA | Take off runway available |
| STODA | Supplementary Take off distance available |

Table 9–2: Relocation Risk Assessment

| Hazard | Cause | Likelihood | Consequence | Risk | Mitigation | Residual Likelihood | Residual Consequence | Residual Risk | Responsibility | Comment |
|--|--|----------------------|--------------|------------|--------------------|---------------------|----------------------|---------------|--------------------------|--|
| Pilot missing approach threshold | Not being aware of new threshold | Remote | Negligible | Acceptable | No action required | | | | Ops Manager to implement | Markings and light in accordance with CASA standards New threshold included in AIS publications Issue NOTAM |
| Obstacles in infringing OLS | New OLS creates new obstacles | Extremely improbable | Catastrophic | Tolerable | No action required | | | | Ops Manager to implement | Carry out regular survey to identify obstacles Carry out risk and analysis and obtain CASA sign-off including lighting and making obstacles as required |
| Pilots not exiting runway as instructed by ATC | Not being aware of new distances to taxiways | Remote | Major | Acceptable | No action required | | | | Ops Manager to implement | Record new threshold in AIS publications Issue NOTAM |

1 OLS Obstacles

CANBERRA **POINT CO-ORDINATES** **AIRPORT SURVEYS**
AIRPORT

Surveyor : Paul Fitzgerald
 Date of Survey : 18/02/2021

HORIZONTAL DATUM: MGAM Zone 55
 VERTICAL DATUM: AUSTRALIAN HEIGHT DATUM

| 12 Take-Off Splay Origin Coordinates: | | E 699902.17 | N 6990277.87 | 575.24 AHD | | | |
|---------------------------------------|--------------------|----------------|----------------------------|---------------------|------------|----------|-----------|
| TAKE-OFF RUNWAY No. | Surveyed Point No. | DESCRIPTION | DIST. FROM END OF CLEARWAY | OFFSET FROM RWY O/L | OBST. R.L. | E | N |
| 12 | 1 | HAZARD LIGHT | 1638.3 | 255.8 L | 659.29 | 701394.2 | 6990382.8 |
| 12 | 2 | EUC. TREE | 1646.4 | 267.7 L | 659.23 | 701403.7 | 6990460.3 |
| 12 | 3 | EUC. TREE | 1937.8 | 179.7 R | 648.93 | 701333.4 | 6989867.7 |
| 12 | 4 | WATTLE | 126.1 | 76.0 L | 581.53 | 700137.1 | 6990252.3 |
| 12 | 5 | SIGN | 17.1 | 22.9 R | 577.70 | 699990.0 | 6990249.4 |
| 12 | 6 | EUC. TREE | 1260.5 | 4.2 L | 630.64 | 701042.2 | 6990386.3 |
| 12 | 7 | SIGN | 39.0 | 34.8 L | 578.65 | 700044.4 | 6990378.4 |
| 12 | 8 | EUC. TREE | 1623.4 | 198.9 L | 653.18 | 701345.7 | 6990359.7 |
| 12 | 9 | EUC. TREE | 1609.5 | 200.7 L | 654.23 | 701336.4 | 6990370.3 |
| 12 | 10 | FENCE | 19.0 | 41.8 L | 578.38 | 700034.0 | 6990396.9 |
| 12 | 11 | FENCE | 18.6 | 53.2 L | 578.45 | 700041.2 | 6990385.7 |
| 12 | 12 | ROAD 4.3m High | 22.9 | 58.3 L | 580.31 | 700047.8 | 6990386.7 |
| 12 | 13 | ROAD 4.3m High | 7.6 | 58.0 R | 579.35 | 699991.1 | 6990230.7 |
| 12 | 14 | ROAD 4.3m High | 20.7 | 42.0 L | 580.18 | 700035.4 | 6990295.9 |
| 12 | 15 | ROAD 4.3m High | 9.6 | 40.9 R | 579.47 | 699972.5 | 6990240.8 |

| 30 Take-Off Splay Origin Coordinates: | | E 699637.63 | N 6991461.04 | 583.26 AHD | | | |
|---------------------------------------|--------------------|-------------|----------------------------|---------------------|------------|-----------|-----------|
| TAKE-OFF RUNWAY No. | Surveyed Point No. | DESCRIPTION | DIST. FROM END OF CLEARWAY | OFFSET FROM RWY O/L | OBST. R.L. | E | N |
| 30 | 1 | EUC. TREE | 2319.4 | 271.9 L | 634.64 | 699711.9 | 6992782.1 |
| 30 | 2 | PLANE TREE | 326.3 | 50.2 L | 574.49 | 6990358.9 | 6991637.8 |

| 17 Take-Off Splay Origin Coordinates: | | E 699444.45 | N 6993448.34 | 589.37 AHD | | | |
|---------------------------------------|--------------------|------------------|----------------------------|---------------------|------------|----------|-----------|
| TAKE-OFF RUNWAY No. | Surveyed Point No. | DESCRIPTION | DIST. FROM END OF CLEARWAY | OFFSET FROM RWY O/L | OBST. R.L. | E | N |
| 17 | 1 | EUC. TREE | 10776.1 | 827.6 L | 601.82 | 700103.7 | 6979853.8 |
| 17 | 2 | DECIDUOUS TREE | 633.0 | 127.4 L | 583.36 | 699597.8 | 6988810.6 |
| 17 | 3 | EUC. TREE | 1500.4 | 234.7 L | 595.18 | 699685.9 | 6987941.0 |
| 17 | 4 | DECIDUOUS TREE | 622.6 | 58.7 L | 580.93 | 699527.4 | 6988822.5 |
| 17 | 5 | PINE TREE | 1520.9 | 82.4 L | 594.29 | 699533.2 | 6987923.9 |
| 17 | 6 | LIGHT POLE | 275.0 | 112.8 L | 574.09 | 699591.1 | 6989188.8 |
| 17 | 7 | LIGHT POLE | 266.3 | 214.3 L | 580.84 | 699692.8 | 6989175.3 |
| 17 | 8 | TERRAIN | 10786.2 | 1429.2 R | 623.03 | 697817.0 | 6978694.3 |
| 17 | 9 | POPLAR TREE | 331.0 | 258.5 R | 590.93 | 699218.7 | 6989121.0 |
| 17 | 10 | PINE TREE | 342.0 | 278.4 L | 594.03 | 699755.2 | 6989098.2 |
| 17 | 11 | DECIDUOUS TREE | 832.0 | 136.8 R | 583.99 | 699335.3 | 6988617.3 |
| 17 | 12 | TREE | 558.1 | 187.9 R | 581.58 | 699284.3 | 6988862.4 |
| 17 | 13 | DECIDUOUS TREE | 937.8 | 273.1 R | 593.25 | 699190.7 | 6988514.7 |
| 17 | 16 | ROAD - 4.5m HIGH | 277.3 | 124.8 L | 574.81 | 699632.9 | 6989166.3 |
| 17 | 17 | ROAD - 4.5m HIGH | 269.1 | 180.3 L | 575.88 | 699688.8 | 6989173.0 |

| 35 Take-Off Splay Origin Coordinates: | | E 699553.68 | N 6992578.11 | 571.27 AHD | | | |
|---------------------------------------|--------------------|----------------|----------------------------|---------------------|------------|----------|-----------|
| TAKE-OFF RUNWAY No. | Surveyed Point No. | DESCRIPTION | DIST. FROM END OF CLEARWAY | OFFSET FROM RWY O/L | OBST. R.L. | E | N |
| 35 | 1 | EUC. TREE | 2914.2 | 821.6 L | 638.98 | 699863.0 | 6990509.0 |
| 35 | 2 | POWER POLE | 4524.4 | 608.2 R | 709.68 | 700259.7 | 6997088.0 |
| 35 | 3 | FENCE CORNER | 77.9 | 180.2 L | 573.74 | 699095.2 | 6992659.5 |
| 35 | 4 | AERIAL ON BLDG | 311.1 | 81.5 R | 577.55 | 699642.0 | 6992687.4 |
| 35 | 5 | EUC. TREE | 5819.6 | 1015.7 L | 682.20 | 699696.8 | 6998418.7 |
| 35 | 6 | EUC. TREE | 8279.5 | 1117.3 R | 825.31 | 700853.7 | 6100830.9 |
| 35 | 7 | FLAG POLE | 437.3 | 216.4 R | 584.85 | 699779.7 | 6993010.5 |
| 35 | 8 | EUC. TREE | 4448.2 | 870.2 R | 712.92 | 700522.0 | 6997087.0 |
| 35 | 9 | WIND INDICATOR | 115.7 | 175.8 R | 582.32 | 699732.0 | 6992689.9 |

2 Risk Matrix

The following is the applicable quantitative and consequential breakdown for hazards associated with the relocation of the Runway 12 landing threshold.

Probability of Occurrence

| Quantitative Definition | Meaning |
|-------------------------|---|
| Frequent | Likely to occur many times (has occurred frequently in the industry) |
| Occasional | Likely to occur sometimes (has occurred infrequently in the industry) |
| Remote | Unlikely, but possible to occur (has occurred rarely in the industry) |
| Improbable | Very unlikely to occur (not known to have occurred in the industry) |
| Extremely Improbable | Information not available |

Severity of Occurrence (Consequence)

| Aviation Definition | Meaning |
|---------------------|---|
| Catastrophic | Death, fatal disease or multiple major injuries Aircraft /Equipment destroyed |
| Major | Serious injury or life-threatening occupational medical conditions Significant aircraft equipment damage Large reduction in safety margins |
| Hazardous | Injury to persons that require medical treatment or ill-health leading to disability Serious incidents/minor damage to aircraft Significant reduction in safety margins |
| Minor | Injury or ill-health requiring first-aid only |
| Negligible | Not likely to cause damages, injury ill-health |

| Risk Probability | Risk Severity | | | | |
|---------------------------|---------------|-------|-----------|-------|------------|
| | Catastrophic | Major | Hazardous | Minor | Negligible |
| | A | B | C | D | E |
| Frequent 5 | I | I | I | T | T |
| Occasional 4 | I | I | T | T | T |
| Remote 3 | I | T | T | A | A |
| Improbable 2 | T | T | T | A | A |
| Extremely Improbable 1 | T | A | A | A | A |



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