

Technical Aerodrome Safeguarding Assessment

Oval Real Estate

Albert Bridge House

April 2025

PLANNING SOLUTIONS FOR:

- Solar
- Defence
- Airports
- Telecoms
- Buildings
- Radar
- Railways
- Wind
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ADMINISTRATION PAGE

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1	October 2022	Initial issue
2	December 2022	Comments on updated site plans
3	April 2025	Re-assessment Considering Updated Design

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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been retained to assess the potential impacts of the proposed Albert Bridge House development upon aviation activity and infrastructure associated with Manchester Airport. Building developments have the potential to affect aviation operations in numerous ways. The most common impacts relate to building developments as physical obstructions both to aircraft and wireless signals used for radar systems.

The proposed development is located on St Mary's Parsonage in central Manchester and will consist of three buildings with a maximum height of 189.14 metres above mean sea level (AMSL). The closest building is located approximately 13.39km north of the runway 23R threshold.

Assessment Results - Manchester Airport SSR

The proposed development is located approximately 16km from the Secondary Surveillance Radar (SSR) at Manchester Airport, and two of three towers are predicted to be visible to the radar. Whilst the impact is predicted to be small, due to the advanced built-in capabilities for increasing its reliability and performance, the potential for some adverse effects on the radar cannot be conclusively ruled out.

It is recommended that consultation with NATS is undertaken so that evaluation in the context of the consented and built environment can be undertaken to ascertain whether it will be visible to the radar in practice.

Assessment Results - Manchester Airport's OLS

The proposed development lies laterally under the Outer Horizontal Surface (OHS). The proposed development is clear of the Obstacle Limitation Surfaces (OLS) at Manchester Airport, with a minimum vertical clearance margin of 17.64m. No infringements of Manchester Airport OLS are predicted.

Assessment Results - High-Level IFP

A high-level review of the Instrument Flight Procedures (IFPs) relative to the proposed development indicates sufficient clearances between the proposed development and aircraft flying procedures. There are also taller existing buildings in the surrounding area that already co-exist with the current IFPs. Therefore, no impact upon the IFPs is predicted. It is possible, however, that a detailed IFP assessment may be requested by Manchester Airports Group (MAG). If a detailed IFP assessment is required, details of any proposed crane locations, heights, and jib radius will need to be provided.

Assessment Results - High-Level Aviation Lighting and Crane Usage

The proposed development will need to be lit as a mandatory requirement for structures over 150m agl. Cranes are expected to be higher than this during construction and will therefore also be required to be lit. A lighting scheme will need to be agreed with the Civil Aviation Authority

(CAA) and MAG. It is likely that the lighting scheme will comprise steady red medium intensity lights marking the height and shape of the proposed development, along with intermediate lights.

The Civil Aviation Authority (CAA) should also be notified of the proposed development and any proposed cranes. All crane and obstacle notifications to the CAA should be made to the Airspace Coordination and Obstacle Management Service (ACOMS). The registration process is via the CAA customer portal to access the ACOMS service to submit a notification.

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 61 countries within Europe, Africa, America, Asia, and Oceania.

The company comprises a team of experts to provide technical expertise and guidance on a range of planning issues for large and small developments.

Pager Power was established in 1997. Initially, the company focus was on modelling the impact of wind turbines on radar systems. Over the years, the company has expanded into numerous fields, including:

- Renewable energy projects;
- Building developments;
- Aviation and telecommunication systems.

Pager Power prides itself on providing comprehensive, understandable and accurate assessments of complex issues in line with national and international standards. This is underpinned by its custom software, longstanding relationships with stakeholders and active role in conferences and research efforts around the world.

Pager Power's assessments withstand legal scrutiny, and the company can provide support for a project at any stage.

1 INTRODUCTION

1.1 Overview

Pager Power has been retained to assess the potential impacts of the proposed Albert Bridge House development upon aviation activity and infrastructure associated with Manchester Airport. Building developments have the potential to affect aviation operations in numerous ways. The most common impacts relate to building developments as physical obstructions both to aircraft and wireless signals used for radar systems.

The proposed development is located on St Mary's Parsonage in central Manchester and will consist of three buildings with a maximum height of 189.14 metres above mean sea level (AMSL). The closest building is located approximately 13.39km north of the runway 23R threshold.

The report includes:

- Proposed development details;
- Identification of relevant aviation infrastructure, including:
 - Manchester Airport;
 - Manchester Airport Radar.
- Radar line of sight analysis;
- Obstacle limitation surfaces (OLS) assessment for Manchester Airport;
- High-level Instrument Flight Procedures (IFPs) assessment;
- High-level comments regarding aviation lighting;
- Overall risk and key issues.

2 PROPOSED DEVELOPMENT LOCATION AND DETAILS

2.1 Proposed Development Layout

The proposed layout¹ for buildings A, B and C is presented in Figure 1 below.



Figure 1 Site layout

The location of the proposed development relative to Manchester Airport is presented in Figure 2 on the following page.

¹ Source: 0476-SEW-ZZ-ZZ-DR-L-PL0100. PDF (cropped).



Figure 2 Location of proposed development relative to Manchester Airport

The red line boundary for the proposed development overlaid on aerial imagery is shown in Figure 3 below. The building footprints (blue lines) are also shown.

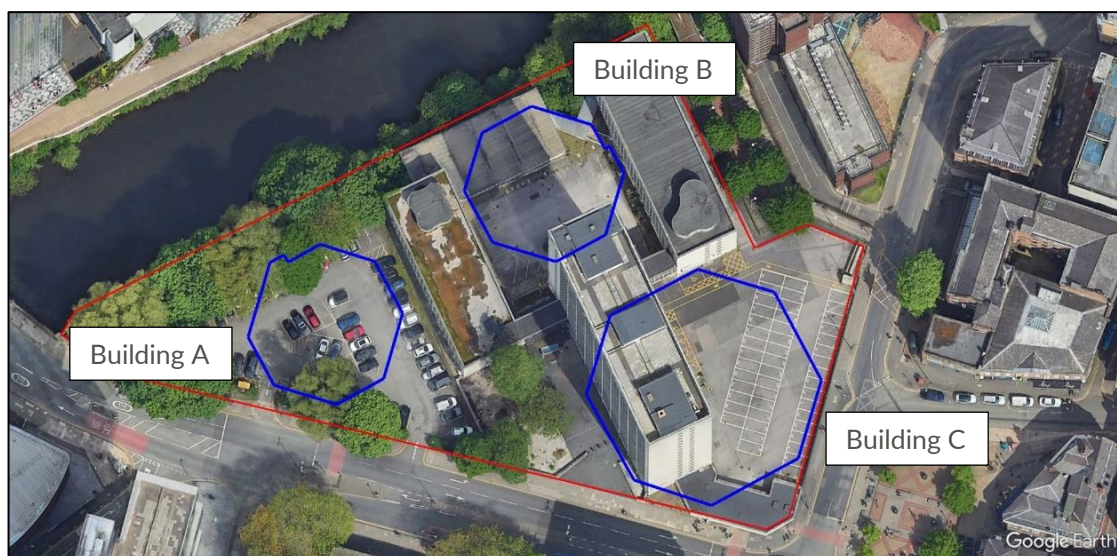


Figure 3 Proposed development red line boundary overlaid on aerial imagery

The elevations for Buildings A, B and C are shown in Figures 4², 5³ and 6⁴ below and on the following pages.

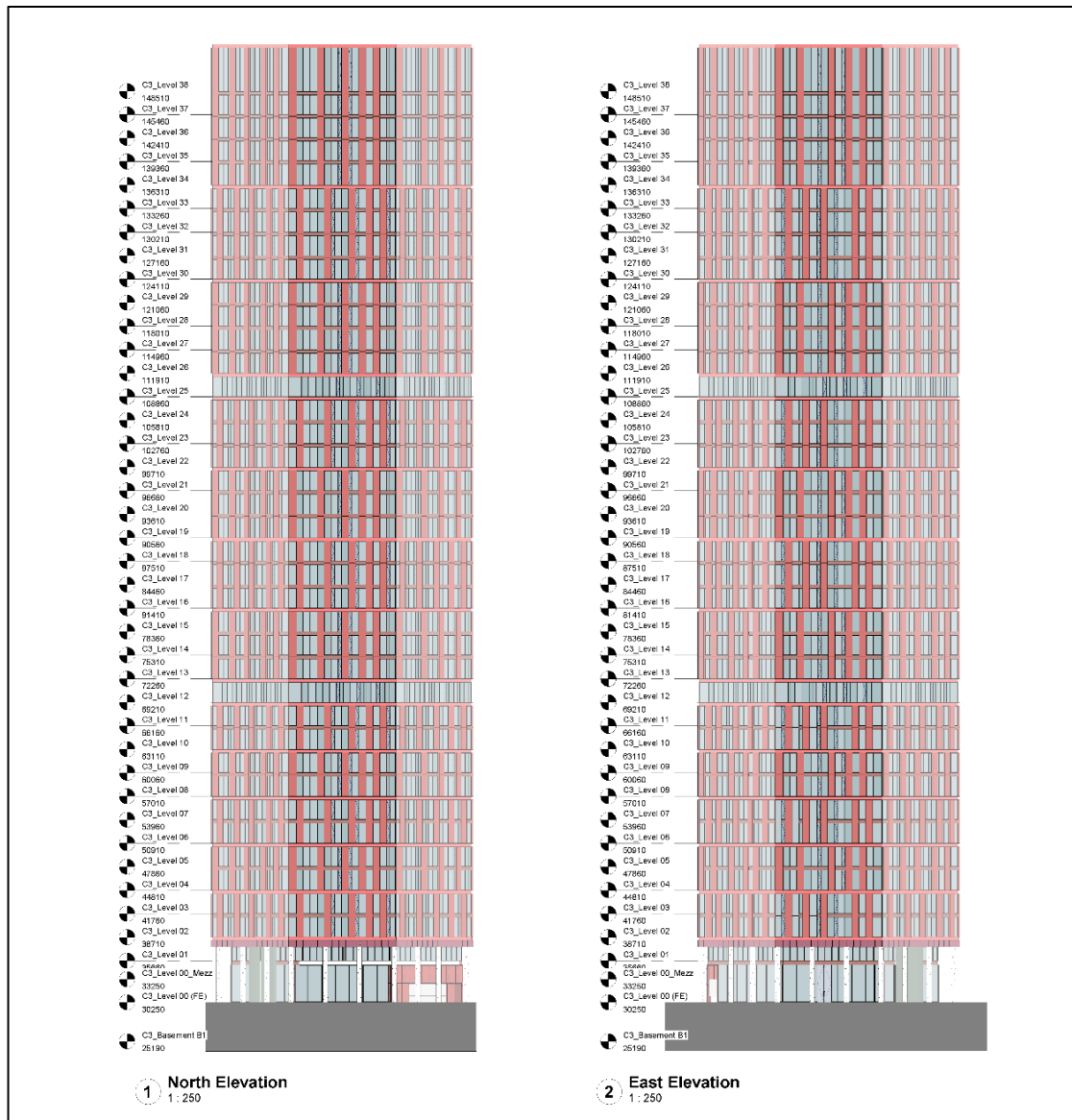


Figure 4 Proposed development elevation – Building A

² Source: 0476-SEW-AA-ZZ-DR-A-001302 (cropped).

³ Source: 0476-SEW-BB-ZZ-DR-A-001321(cropped).

⁴ Source: 0476-SEW-CC-ZZ-DR-A-001351 (cropped).

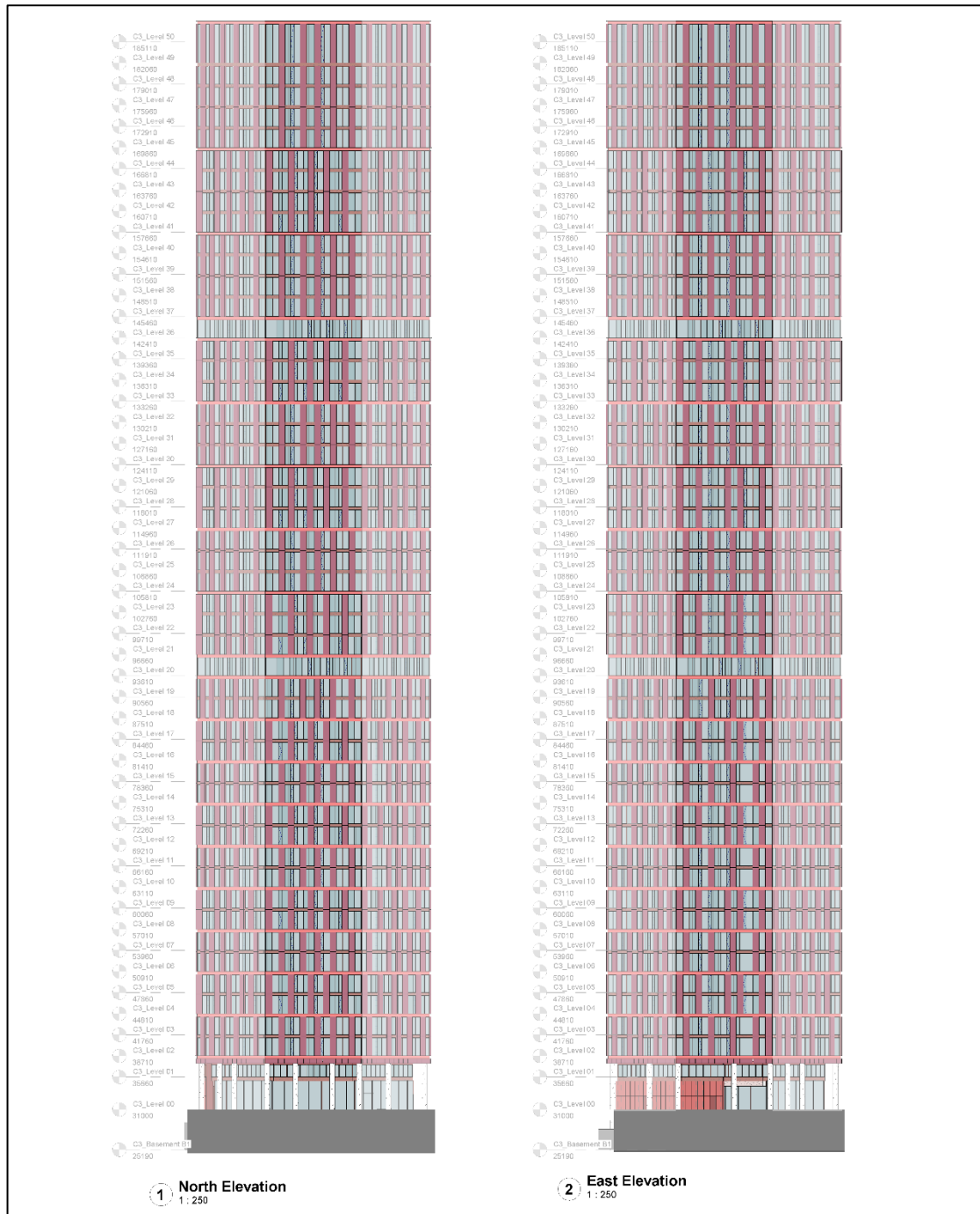


Figure 5 Proposed development elevation – Building B

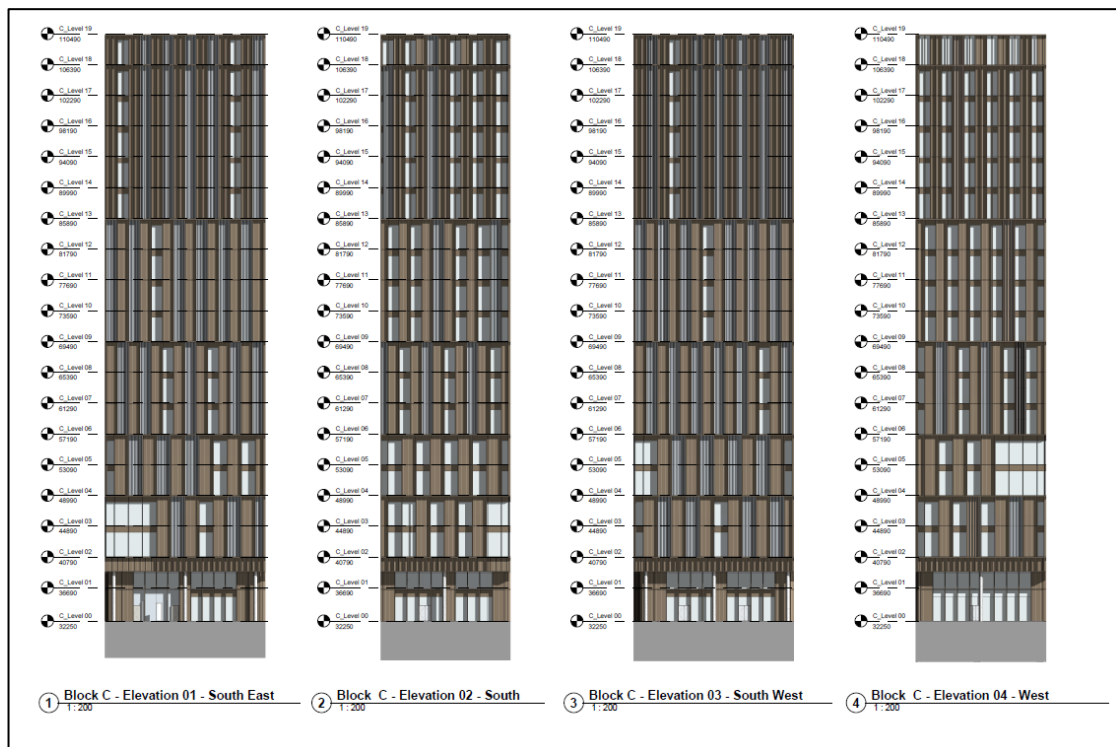


Figure 6 Proposed development elevation – Building C

The proposed development comprises three buildings with a maximum altitude of 189.14m above mean sea level (AMSL). Figure 7 below shows the 3D representation of buildings A, B and C.

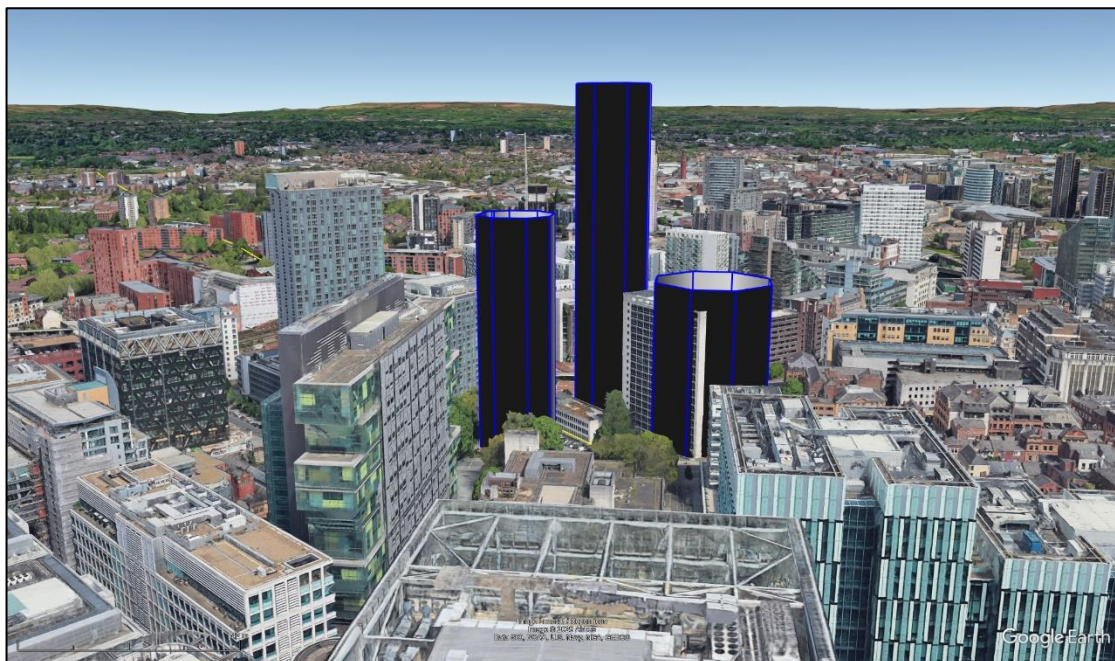


Figure 7 Proposed development 3D representation

3 MANCHESTER AIRPORT DETAILS AND ASSESSMENT

3.1 Airport Details

Manchester Airport is a CAA licenced airport with an Air Traffic Control (ATC) Tower and two runways. The runway details⁵ are presented below:

- 05L/23R measuring 3,048m by 45m (concrete and asphalt);
- 05R/23L measuring 3,050m by 45m (concrete and asphalt).

The aerodrome chart for Manchester Airport is shown in Figure 8 on the following page.

⁵ NATS AIP.

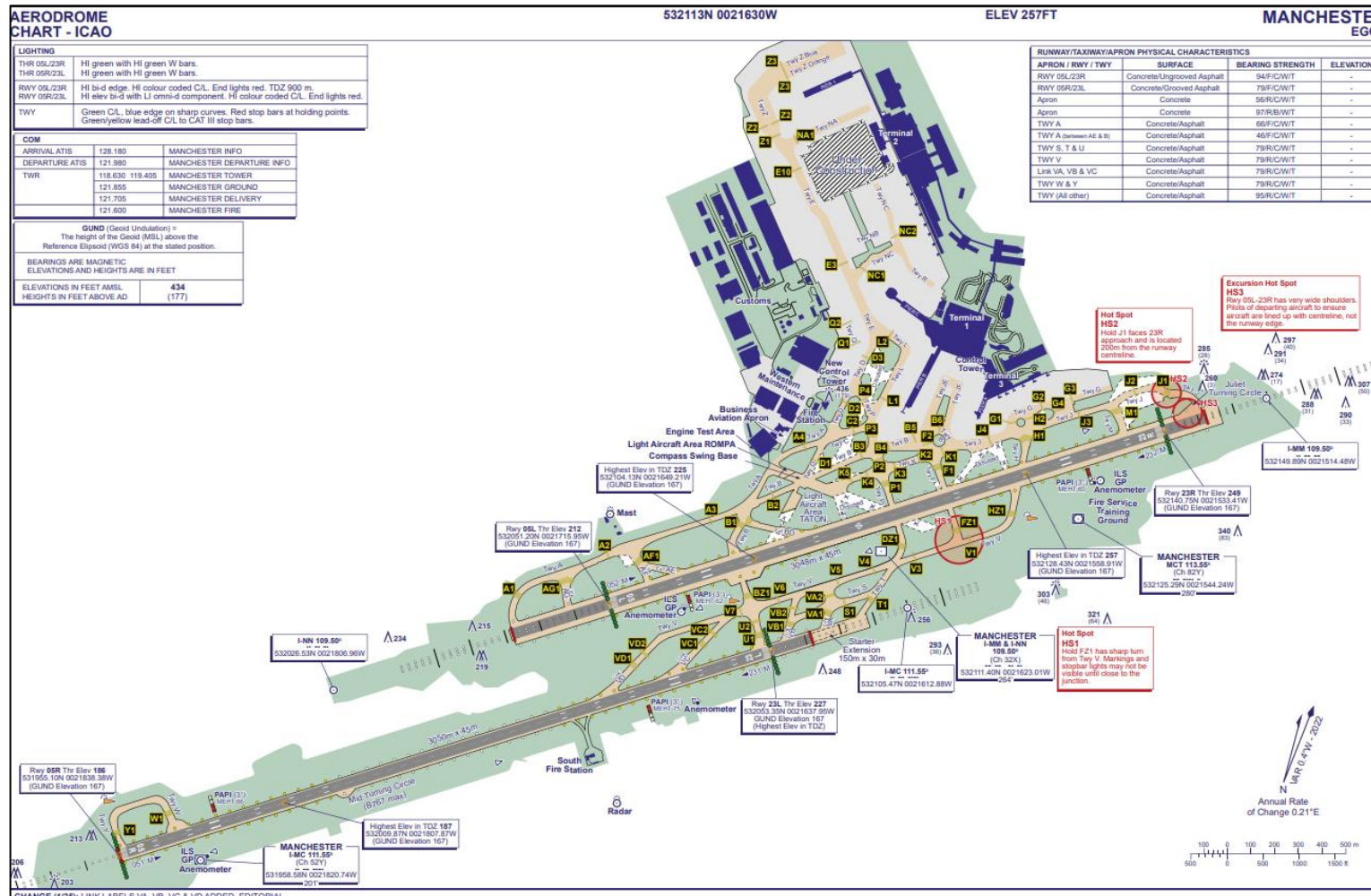


Figure 8 Aerodrome chart for Manchester Airport

3.2 Radar Overview

3.2.1 Radar Types and Usage

There are two types of radars situated at Manchester Airport, including:

- Primary Surveillance Radar (PSR);
- Secondary Surveillance Radar (SSR).

There are two radars situated upon the metal lattice tower. The lower radar is a non-cooperative PSR; the taller is the cooperative SSR, which has been assessed within this report. PSR are used for non-cooperative surveillance of both approaching and departing aircraft, and for the en-route phase of flight. PSR are generally not significantly affected by static objects, such as building developments and therefore has not been considered further.

The radar of significance with respect to the proposed development is the SSR. SSR broadcasts interrogating radio signals that are detected by aircraft with onboard transponders. The transponder responds by broadcasting a radio reply, which normally contains identification and altitude information. Unlike PSR, SSR relies on aircraft transponders that respond to interrogating signals by transmitting identification and altitude data. The SSR determines the aircraft's horizontal position from the direction the antenna is orientated and the time taken to receive a response from the interrogation. SSR will be used by air traffic controllers to provide approach services to aircraft landing at and departing Manchester Airport. The radar may also be used by air traffic controllers at national air traffic control centres to provide services to en-route aircraft.

Ensuring that SSR remains fully functional is critical for maintaining safe and efficient air traffic operations at Manchester Airport. Any potential obstructions or interference must be addressed to prevent disruptions.

3.3 Secondary Surveillance Radar Interference Overview

3.3.1 Overview

An overview of the various possible interference mechanisms is presented in the following subsections.

Buildings, structures, and terrain can interfere with SSR. The level of interference normally depends on the size of the interfering structure and its distance from the radar. A larger structure closer to the radar is more likely to interfere than a smaller structure which is further away. The two predominant forms of interference are considered.

3.3.2 Reflections

Reflections from a structure can potentially result in genuine aircraft returns being plotted in the wrong place as a result of the structure reflecting signals in a specular (mirror-like) way. This means that an air traffic controller could mismanage aircraft, leading to safety implications. Both in-bound and out-bound signals are weakened due to reflections because they are reflected by a structure in both directions.

3.3.3 Shadowing

Radar signals are weakened by physical obstacles. The most significant signal blocking is often caused by terrain. Large obstructions within a radar's area of coverage can have a 'shadowing' effect, reducing the signal strength immediately behind them.

This effect is most pronounced immediately behind the structure and becomes less pronounced with distance. This is important because it means a structure's 'shadow' does not block radar coverage indefinitely, and the areas with the highest losses should be considered in an operational context.

Both in-bound and out-bound signals are weakened by shadowing because signals are attenuated by a structure in both directions.

3.4 SSR Capabilities

The radar is a Secondary Surveillance Radar (SSR) fitted with a Large Vertical Aperture (LVA) antenna. The radar is located to the south of Manchester Airport. It is a Mode S monopulse SSR supplied by Raytheon Systems Limited as part of a nationwide contract to upgrade NATS' national network of twenty sites.

The radar is understood to be a Condor 300 dual channel system with Mode S capabilities. This radar has a range of advanced built-in capabilities for increasing its reliability and performance. Specific features that reduce the radar's susceptibility to interference from buildings are listed in Table 1 below and on the following pages.

Feature	Form of interference	How feature reduces interference	Additional Information
Integral Tracking Function	Reflections	More likely to determine return is genuine if it moves as an aircraft return is expected to.	Ensures good false target suppression.
Refined Algorithms	Reflections and Shadowing	Experience on many sites used to enhance performance.	Ensures good performance in complex environments.
Identification and rejection of false replies	Reflections	False returns are rejected	If two or more replies are identified from the same source all but the first is rejected.

Feature	Form of interference	How feature reduces interference	Additional Information
Side Lobe Suppression	Reflections	False returns arising from antenna sidelobes are rejected	P1 and P2 pulses are used. This is an encoding system which enables sidelobe signals to be detected by comparing pulse sizes.
Sensitivity Time Control (STC)	Reflections	Removes reflections	Removes relatively low amplitude replies
Minimum Detection Signal Level (MDS)	Shadowing	Maximises radar coverage whilst minimising noise detections	-
Dynamic Threshold	Shadowing	Weak signals stronger than any interference signals are detected.	-
Reply to Reply Correlation	Reflections	Multiple replies required for target processing	Single reply reports are rejected.
FRUIT ⁶ Rejection	Reflections	Track initiation only allowed if report contains two or more correlating replies in the same SSR mode	e.g. two or more Mode A replies
Track Processing	Reflections and Shadowing	Improvements are made in target location using history of target position.	Improvements made when confidence in location information is low

⁶ FRUIT – False Replies Unsynchronized in Time

Feature	Form of interference	How feature reduces interference	Additional Information
False Target Processing	Reflections	Advanced processing that applies a series of tests to identify and reject false returns	Techniques include: 1: Check whether Mode A code is unique 2: Check “known” reflection zones 3: Use geometric analysis for checking reflection zones 4: Self adaptive processing

Table 1 Radar features for reducing interference

3.5 Radar Line of Sight Analysis

3.5.1 Overview

A radar line of sight assessment was completed for the proposed development, considering the building outline and the maximum development elevation presented in Section 2.

3.5.2 Methodology

The approach taken within this report is presented below:

- Radar line of sight assessment based on the tower coordinates assessed at their relative height above ground level;
- Screening assessment to determine whether existing buildings and/or landscape features would hide/shield the proposed development from the SSR;
- Consideration of the distance from the SSR;
- Assessment of the predicted impact in the context of the existing environment has been undertaken.

The assessment has included earth curvature and radar refraction. The resulting visibility margin could, in practice, vary by a few metres relative to the results calculated here due to data accuracy. This is not considered a significant limitation when the results are considered holistically.

3.5.3 Line of Sight Chart

Figure 9 on the following page shows the line-of-sight chart for the proposed development (the most visible point to the SSR). The box labelled ‘certainty’ in the figure advises how much of the building vertically is within line of sight to the assessed radar (rounded to one decimal place). A certainty of 155.7 metres means that the top 155.7 metres of the proposed development is predicted to be illuminated by the radar beam, accounting for earth curvature and radar refraction. In this case, the proposed development would be mostly visible to radars, considering

bare earth terrain. Further information regarding the methodology or the additional line-of-sight charts can be provided upon request.

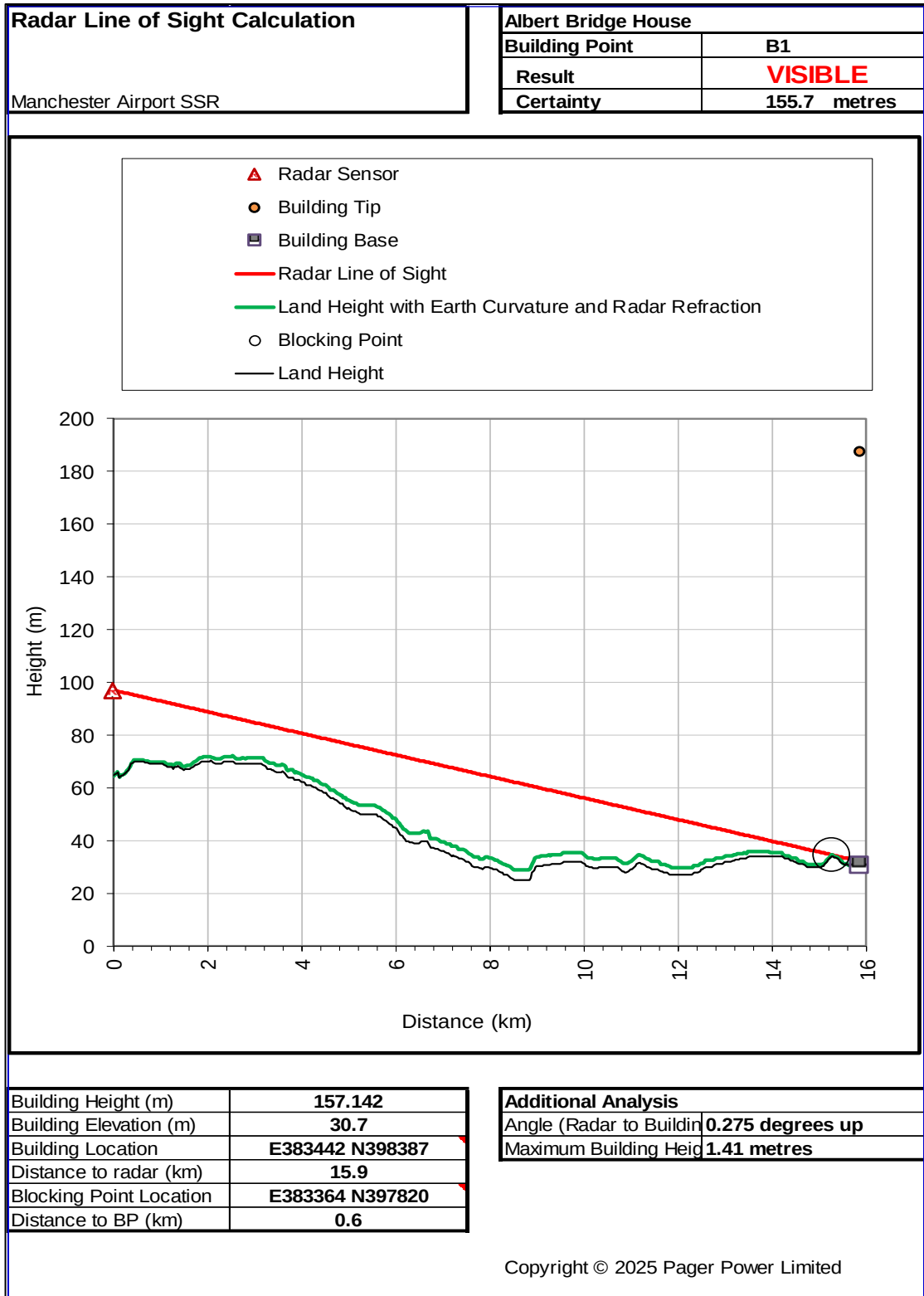


Figure 9 Radar line of sight chart

3.5.4 Line of Sight Results – Bare Earth Terrain

The line-of-sight results for all assessed building boundary points are presented in Table 2 below.

Reference Point	Visible building height in metres
A1	122.3
B1	155.7
C1	96.3

Table 2 Line of sight results for all assessed building boundary points – bare earth terrain

3.6 Additional Screening Analysis

The modelling described in the sections above accounts for the intervening terrain. It does not account for additional obstructions on the ground along the radar line of sight e.g. buildings or vegetation. A review of additional screening has therefore been undertaken.

Figure 10 on the following page shows the current line of sight towards the proposed development from the SSR.

The radar line-of-sight towards Building A is entirely obstructed by an existing building (The Residences, Deansgate Square).

No existing obstructions for the radar line of sight towards Buildings B and C have been identified; however, several buildings in and around Deansgate have been consented or are under construction which may obstruct line-of-sight to these buildings. If the consented and under construction buildings completely obstruct line-of-sight from the radar then no impacts are possible.

Overall, it is expected that the proposed development could have a technical impact if visible to the radar.



Figure 10 Point-of-view from the SSR at Manchester Airport

3.7 Radar Line of Sight Conclusions

The results show that the proposed development would be significantly visible to the SSR at Manchester Airport, based on bare-earth terrain. Several buildings in and around Deansgate have been consented or are under construction which may obstruct line-of-sight to these buildings. If the consented and under construction buildings completely obstruct line-of-sight from the radar then no impacts are possible. Consultation with NATS is recommended to confirm whether the buildings within their system would provide sufficient evidence to confirm line-of-sight would be obstructed,

If the buildings are visible to the radar, the technical impact mechanisms are discussed in the following sub-section.

3.8 Interference Assessment

SSR radar broadcast interrogating radio signals that are detected by aircraft with on-board transponders. The transponder responds by broadcasting a radio reply which normally contains identification and altitude information. The SSR determines the aircraft's horizontal position from the orientation of the antenna and the time taken to receive a response from the interrogation.

Buildings, structures, and terrain can interfere with SSR. The level of interference normally depends on the size of the interfering structure and its distance from the radar. A larger structure closer to the radar is more likely to interfere than a smaller structure which is further away. Two forms of interference have been considered. These are:

1. Reflections – Either in-bound or out-bound signals are reflected off a structure;
2. Shadowing – Either in-bound or out-bound signals are weakened because they are attenuated by a structure.

The proposed development's location, height and orientation has been reviewed and the reflection and shadow zones considered at a high level.

3.8.1 Reflection Effects

The proposed development can be considered a flat façade acting as a uniform reflector. Reflection effects caused by static structures have the potential to create false targets, azimuth errors and target fading issues. These could occur when an obstruction reflects the outgoing and/or incoming radar signals between the SSR and an aircraft. To be received by the radar, the signals also have to be strong enough to be detected. A radar return that is reflected via a building will be significantly weaker than a return received directly from an aircraft. Furthermore, a radar antenna is also designed to have reduced gain at very low angles to reduce ground clutter returns. Overall, radar returns that are reflected via buildings are significantly weaker than those that are received directly from aircraft.

The façades of the proposed development will be exposed to the radar, where reflections would be geometrically possible, and therefore concerns due to reflections are possible.

In practice, the effects from the proposed development are likely to be small. The radar is understood to be a Condor 300 dual-channel system with Mode S capabilities. This radar has a range of specific features that reduce the radar's susceptibility to interference from buildings.

Whilst the impact is predicted to be small, the potential for some adverse effects on the radar cannot be conclusively ruled out. It is therefore possible that NATS would object to the development in the absence of mitigation.

The most common mitigation solution for building developments in this range from modern SSR is a software-based solution, whereby the building information, specifically coordinates and altitudes of each building corner, is programmed into the radar system such that reflection effects can be ameliorated.

This agreement would be funded by the developer and commercially agreed with NATS via a contract ahead of starting development. Deployment of the solution is typically within six months of the final agreement between the developer and NATS, therefore, it is recommended that engagement regarding the mitigation process is progressed with this timescale in mind.

It is possible that NATS would seek to limit any construction at the site to five metres above ground prior to installation of the mitigation solution (i.e. within six months of signing the mitigation agreement).

3.8.2 Shadowing Effects

Shadowing effects will be extremely limited. This is because the development is already within a built-up area of Manchester city centre, including the Residences, Deansgate Square, which consists of three towers. These towers have a similar bearing as the proposed development relative to the SSR.

3.9 Assessment Conclusions

The modelling has revealed that two of the three towers of the proposed development will be significantly visible to the SSR at Manchester Airport.

Whilst the impact is predicted to be small, due to the advanced built-in capabilities for increasing its reliability and performance, the potential for some adverse effects on the radar cannot be conclusively ruled out.

It is recommended that consultation with NATS is undertaken so that evaluation in the context of the consented and built environment can be undertaken to ascertain whether it will be visible to the radar in practice.

4 OBSTACLE LIMITATION SURFACES ASSESSMENT

4.1 Overview

The Obstacle Limitation Surfaces (OLS) for Manchester Airport have been modelled with respect to Buildings A, B and C. The aim is to identify whether the proposed development would infringe the OLS at Manchester Airport.

OLS are imaginary planes defined in three dimensions for physical safeguarding purposes (i.e., ensuring that physical structures do not present a safety hazard at an airfield) and are defined around licensed airfields. The dimensions and geometry of the surfaces are constructed based on detailed rules defined in the UK Civil Aviation Authority's Civil Aviation Publication 168. The size of the surfaces is dependent on the number of runways, their dimensions and the procedures carried out at the airfield.

4.2 Obstacle Limitation Surfaces

The OLS for Manchester Airport are presented in Figure 11 below. The proposed development building plot coordinates are shown by the red crosses on the left of the chart; due to the scale, they appear as a single icon.

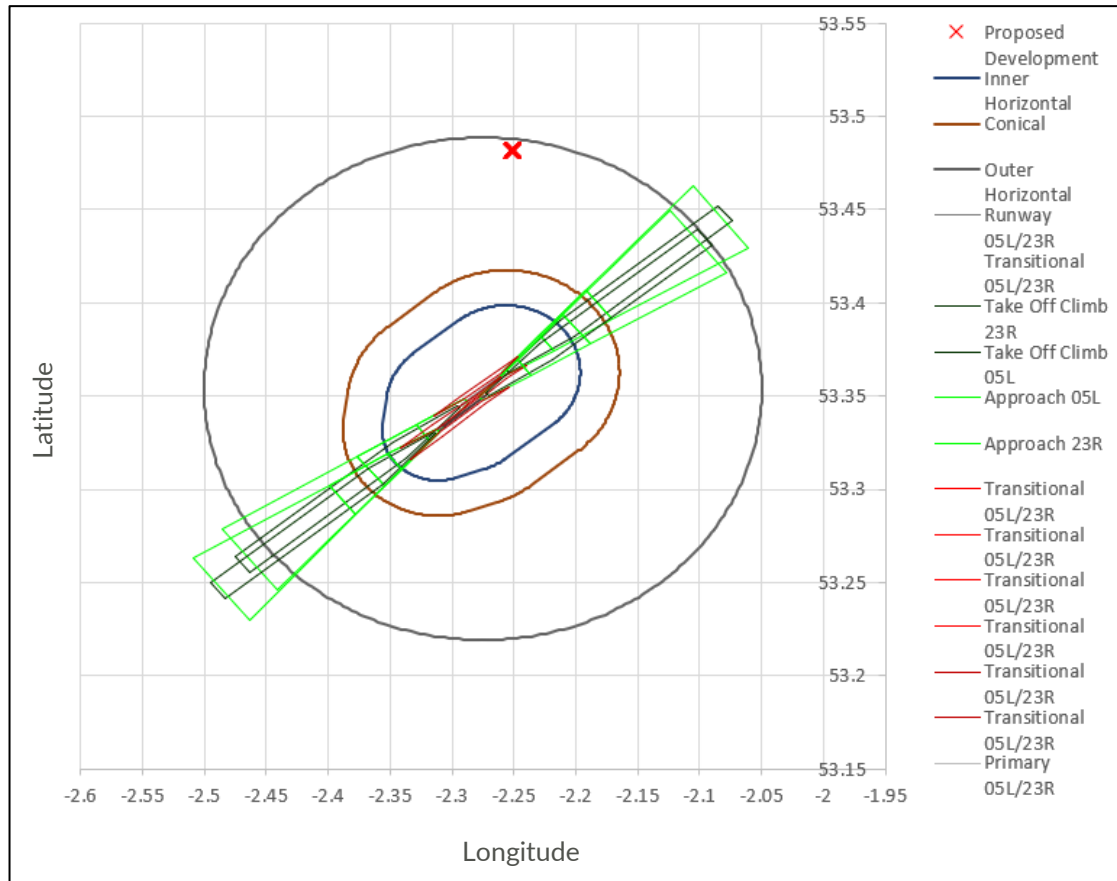


Figure 11 Manchester Airport OLS chart

Table 3 below presents a summary of the Obstacle Limitation Surfaces assessment results. The analysis has shown that the proposed development is clear of the conical surface. The smallest margin of clearance⁷ is 17.64m.

ID	Assessed Height (m AGL)	Relevant Surface	Vertical Clearance ⁸ (m)
A1	124.37	Outer Horizontal Surface	52.41
B1	157.14	Outer Horizontal Surface	18.64
C1	97.8	Outer Horizontal Surface	76.98

Table 3 *Manchester Airport Obstacle Limitation Surfaces detailed results*

The proposed development lies laterally under the OHS. The proposed development is clear of the OLS at Manchester Airport, with a minimum vertical clearance margin of 17.64m.

No infringements of Manchester Airport OLS are predicted.

⁷ Vertical clearance between the top of the building and the Outer Horizontal Surface, given to two decimal places.

⁸ Given to two decimal places.

5 INSTRUMENT FLIGHT RULES ANALYSIS

5.1 Overview

Instrument Flight Procedures (IFPs) are published documents that consist of defined three-dimensional routes for aircraft arriving and departing airports.

In practice, aircraft do not necessarily fly these routes exactly due to limitations on the performance of aeronautical instruments, pilots and variations in wind and pressure conditions.

This means that an area around and beneath these three-dimensional routes must be kept clear of obstacles to ensure that there is no significant collision risk to aircraft flying these procedures, as shown in Figure 12 on the following page.

As a general rule, IFPs are designed so that there are vertical and horizontal safety margins between the specified trajectory and surrounding terrain and obstacles. These margins vary depending on the phase of flight and whether UK, European, or International rules are being considered. Nevertheless, the vertical margins are typically 300m (984 feet)⁹ except in particularly mountainous regions, which Manchester is not. This means that if the vertical clearance between an IFP route and the top of the proposed development exceeds 300m (984 feet) then it will not have a significant safety impact on aircraft flying the route.

The maximum altitude of the proposed development is 620.5 feet AMSL. This means that aircraft subject to any IFP route or limit which is more than 1,605 feet will not be affected. Key IFPs are discussed in the following subsection.

Aircraft flying Instrument Flight Rules (IFR) have been assessed at a high-level by considering:

- Impact on Manchester Airport Surveillance Minimum Altitude Chart (SMAC);
- Impact on current Manchester Airport Standard Instrument Departures;
- Impact on current Manchester Airport Standard Arrival Charts;
- Impact on current Manchester Airport Instrument Approach Charts.

This has been undertaken to determine whether an impact upon Instrument Flight Procedures (IFP) is likely or whether further, more detailed analysis is required.

⁹ 300m (984ft). Procedures for Air Navigation Services, Aircraft Operations (PANS OPS) guidance states 1,000ft. It is open to interpretation whether to apply 984ft or 1000ft. In this report the former has been applied. Procedures for Air Navigation Services, Aircraft Operations, Volume II Construction of Visual and Instrument Flight Procedures. Fifth edition (2006). International Civil Aviation Organization (ICAO). Section 1-1-1-5. Part I – Section I, Chapter I. 'Minimum sector altitude (MSA). The lowest altitude which may be used which will provide a minimum clearance of 300 m (1 000 ft) above all objects located in an area contained within a sector of a circle of 46 km (25 NM) radius centred on a radio aid to navigation.'

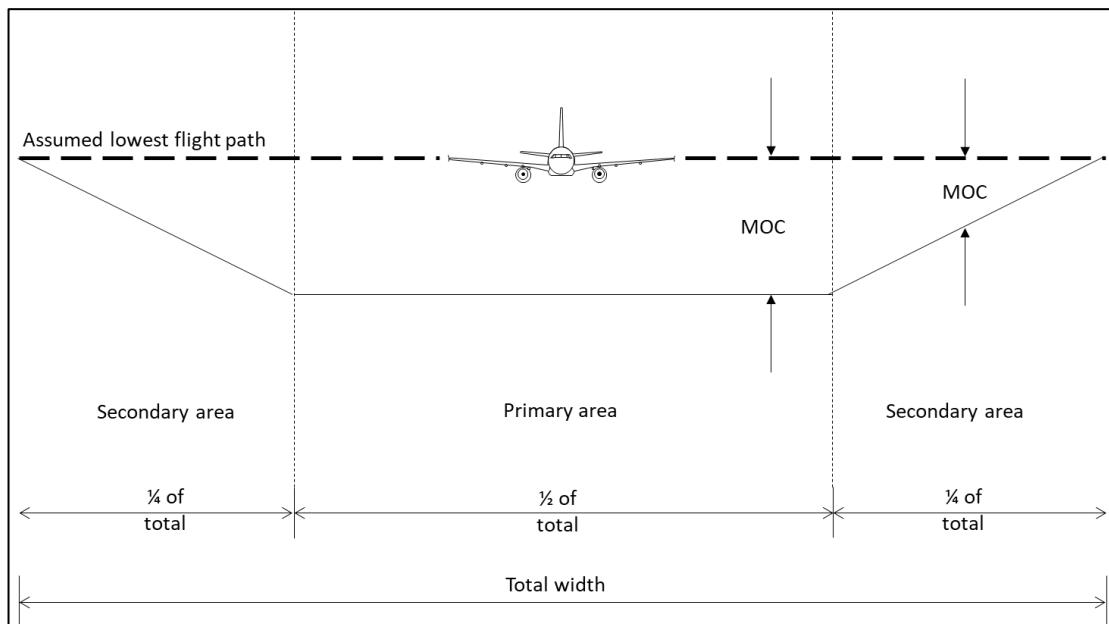


Figure 12 IFP – Minimum Obstacle Clearances

5.2 Minimum Obstacle Clearance

The Minimum Obstacle Clearance provides the minimum obstacle clearance above all obstacles (terrain and structures) in a particular quadrangle of an aeronautical chart. The Area Minimum Altitude shown for the quadrangle in which the development is located is 3,500 feet AMSL. The proposed development has a maximum altitude of 620.5 feet AMSL, which is 2,879.5 feet below the Area Minimum Altitude. The proposed development will therefore not affect the current Area Minimum Altitude.

5.3 Maximum Elevation Figure (MEF)

The MEF shows the maximum altitude of the highest terrain or structure in a particular quadrangle of a standard aeronautical chart. The proposed development has a maximum altitude of 620.5 feet AMSL.

The MEF¹⁰ for the quadrant in which the proposed development is located is 2,000 feet. The proposed development is 1,380 feet below the MEF, and therefore MEF will be unaffected by the proposed development.

5.4 Surveillance Minimum Altitude Charts

SMAC¹¹ are published to show the lowest altitude a pilot will be instructed to fly whilst receiving an air traffic control service. The Manchester Airport SMAC shows that the minimum altitude for the Surveillance Minimum Altitude Area (SMAA) is 2,400 feet AMSL and within 5NM of the proposed development. The proposed development has a maximum altitude of 620.5 feet. The

¹⁰MEF is altitude which indicates the height of the highest feature within a quadrant. Any aircraft following Visual flight rules (VFR) would be expected to fly above this height to evade elevated obstacles.

¹¹ NATS AIP, AD 2.EGCC-5-1 (cropped)

vertical clearance between aircraft subject to a radar control service and the top of the buildings will be at least 1,779.5 feet. This is 804 feet greater than the specified clearance of 984 feet stated in the CAA publication (CAP 777) for designing SMACs. This means that aircraft flying IFR and receiving a radar control service will have an acceptably low collision risk.

Figure 13 below shows the ATC Surveillance Minimum Altitude Chart for Manchester Airport. It presents the approximate location of the proposed development (yellow triangle) as well as the area of tall buildings present in the surrounding city centre (restricted airspace R319, which is restricted from surface to 1,700ft – therefore, aircraft should not be flying in this area). The approximate location of the proposed development is denoted by the yellow triangle.

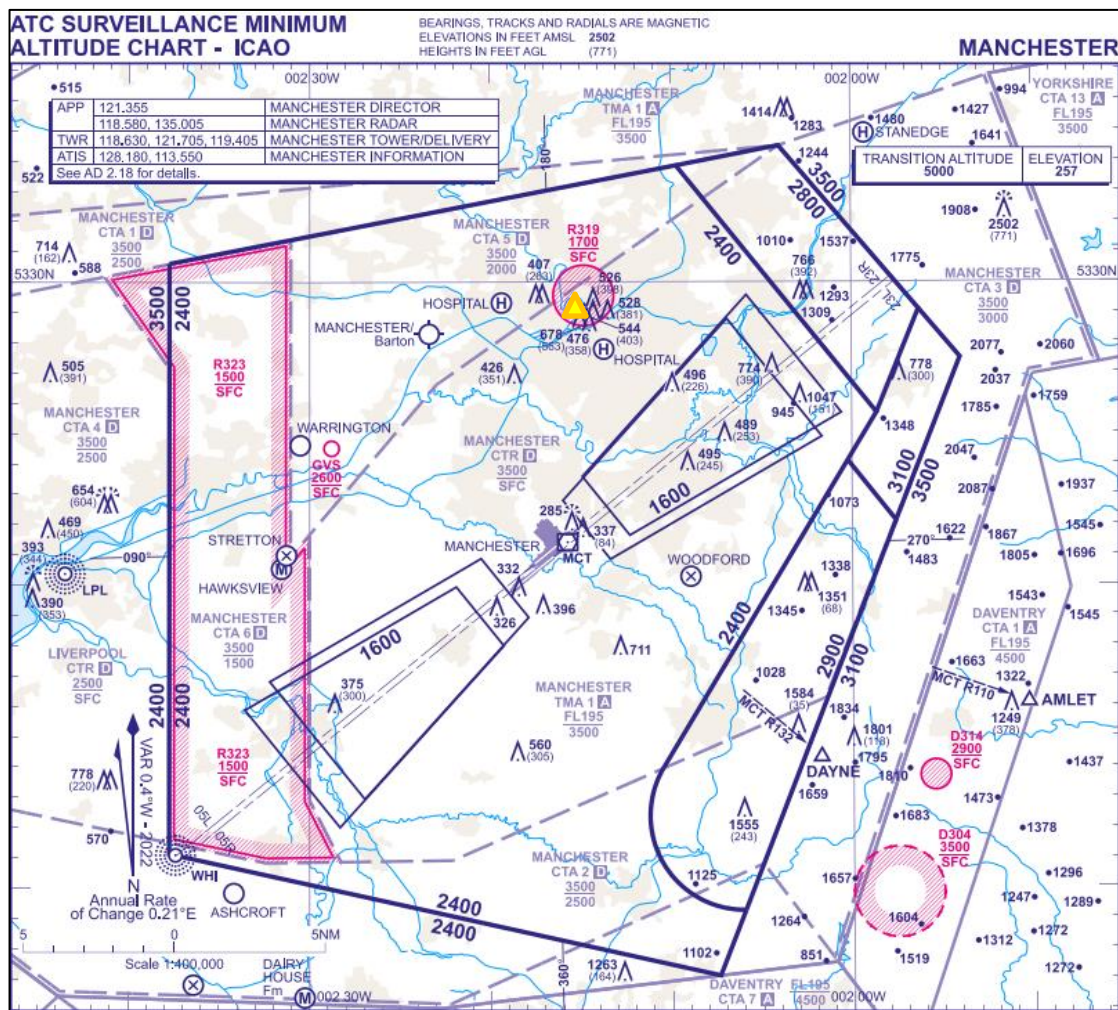


Figure 13 ATC Surveillance Minimum Altitude Chart – ICAO (AD 2.EGCC-5-1)

5.5 Minimum Sector Altitudes (MSAs)

The procedures also show MSAs for aircraft flying within 25 nautical miles of an airport.

The MSA¹² for the sector in which the proposed development is located is 3,500ft, therefore, the proposed development is over 3,070 feet vertically clear and will not impact the MSA.

5.6 Standard Instrument Departures (SIDs)

Manchester Airport has seven published SIDs. Each of these has been assessed with respect to the proposed development. Results of the assessment are shown in Table 4 below and on the following page.

SID Name	Observations	Assessed Impact	Recommendation
MONTY 1R 1S 1Y 1Z	SID is laterally 3.2NM south-west of the proposed development At this point of the procedure, aircraft will be at a minimum altitude of 2,500ft	Aircraft will be 1,879 ft vertically clear of the proposed development	No further action
ASMIM 1S 1Z/KUXEM 1R 1Y/EKLAD 1R 1Y	SID is laterally 3.2NM south-west of the proposed development At this point of the procedure, aircraft will be at a minimum altitude of 2,500ft	Aircraft will be 1,879 ft vertically clear of the proposed development	No further action
LISTO 2S 2Z	SID is laterally 6.4NM south of the proposed development	No impact. The development is significantly horizontally clear of this SID	No further action
LISTO 2R 2Y	Runway threshold is 8.2NM to the south-west. SID tracks south-west	No impact. The development is significantly horizontally clear of this SID	No further action
POL 5R 4S 1Y 1Z	SID is laterally 5.4NM east of the proposed development	No impact. The development is significantly horizontally clear of this SID	No further action

¹² MSA 25NM NDB(L) BHX and MSA 25NM ARP.

SID Name	Observations	Assessed Impact	Recommendation
SONEX 1R 1Y/DESIG 1S 1Z	SID is laterally 0.4NM north of the proposed development, At this point of the procedure, aircraft will be at a minimum altitude of 5,000ft	Aircraft will be 4,379 ft vertically clear of the proposed development	No further action
SANBA 1R 1Y	Runway threshold is 8.3NM to the south-west. SID tracks south-west	No impact. The development is significantly horizontally clear of this SID	No further action

Table 4 *Standard Instrument Departure assessment results*

The building is likely to present an acceptably low collision risk to aircraft flying all Standard Instrument Departure routes.

5.7 Standard Arrival Charts (STARs)

Manchester Airport has four published STAR charts. Each of these has been assessed with respect to the proposed development. Results of the assessment are shown in Table 5 below and on the following page.

STAR Name	Observations	Assessed Impact	Recommendation
via ROSUN (north) (LAKEY 1M SETEL 1M TILNI 1M)	Minimum Altitude FL70	Aircraft will be 6,379 ft vertically clear of the proposed development	No further action
via ROSUN (east) (LIBSO 1M OTBED 1M)	Minimum Altitude FL90	Aircraft will be 8,380 ft vertically clear of the proposed development	No further action
via MIRSI (AXCIS 1M PENIL 1M)	Minimum Altitude 6,000 feet	Aircraft will be 5,380 ft vertically clear of the proposed development	No further action
via DAYNE (ELVOS 1M LESTA 1M)	Minimum Altitude FL70	Aircraft will be 6,379 ft vertically clear of the proposed development	No further action

Table 5 *Standard Arrival Chart Assessment Results*

Aircraft flying Manchester Airport's Standard Arrival Routes will be at least 5,379 feet vertically clear of the building. This means that such aircraft will have an acceptably low collision risk.

5.8 Instrument Approach Charts

Manchester Airport has 15 published Instrument Approach Charts. Each of these has been assessed with respect to the proposed development. For each, the following have been considered:

- The final approach phase;
- Earlier approach phases are
 - shown on the chart;
- Missed approach procedure;
- Decision heights and circling minima;
- Minimum Safe Altitude (MSA) within 25 nautical miles.

Results of the assessment are shown in Table 6 on the following pages.

V = vertically and H = horizontally.

The proposed development is not predicted to impact the Instrument Approach Charts. No further action is recommended.

Name	Final Approach	Earlier Approach	Missed Approach	Decision and Circling	MSA	Assessed Impact	Recommended Action
ILS/DME (I-MC) RWY 05R	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
ILS/DME (MCT) RWY 05R	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
LOC/DME (I-MC) RWY 05R	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
VOR/DME RWY 05R	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
ILS/DME (I-MM) RWY 05L	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
ILS/DME (MCT) RWY 05L	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
LOC/DME RWY 05L	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
VOR/DME RWY 05L	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
ILS/DME (I-NN) RWY 23R	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None

Name	Final Approach	Earlier Approach	Missed Approach	Decision and Circling	MSA	Assessed Impact	Recommended Action
ILS/DME (MCT) RWY 23R	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
LOC/DME RWY 23R	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
VOR/DME RWY 23R	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
VOR/DME RWY 23L	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None
RNP RWY 23L	Clear V,H	Clear V,H	Clear V,H	Clear V,H	Clear V	None	None

Table 6 Instrument Approach Charts assessment results

5.9 IFPs Conclusions

As a general rule, IFP are designed so that there are vertical and horizontal safety margins between the specified trajectory and surrounding terrain and obstacles. It is likely that if an obstacle does not infringe the OLS it will not adversely affect the IFP. The OLS will not be affected by the proposed development.

A high-level review of the IFPs relative to the proposed development indicates sufficient clearances. The proposed development with a maximum height of 620.5 feet is not predicted to impact aircraft flying under Instrument Flight Rules at Manchester Airport. The development is clear of published IFPs and their minimum obstacle clearances. There are also taller existing buildings in the surrounding area that already co-exist with the current IFPs. Therefore, no impact upon the IFPs is predicted, and a detailed IFP assessment is not recommended. It is possible however, that this could still be requested by Manchester Airport.

6 AVIATION LIGHTING AND CRANE USAGE

6.1 Aviation Lighting

Aviation lighting is required where an object becomes a collision risk. This is most likely where there is an infringement of the OLS. It also becomes mandatory to have lighting where an object extends to 150m above ground level or more¹³. The following section explores the requirement for aviation lighting at a high level.

The proposed development (Building B) extends to 157.1m agl. On this basis, aviation lighting is mandatory for the proposed development (Building B), as per the associated CAA guidance and will be requested by Manchester Airport.

The following lighting arrangements are therefore recommended:

- The proposed development is to be lit with medium intensity lights at the top of the building to ensure its visibility.
- Intermediate lights on proposed development to be included, as appropriate.
- The top of any associated crane that breaches the OHS or is 150m agl or taller will be lit with medium intensity lights.

The specific aviation lighting scheme for each tower is to be decided and will need to be agreed with the CAA and MAG.

6.2 Crane Operation Scheme

During the construction phase, cranes will be present at the site that will reach elevations greater than the final building height. In principle, safeguarding concerns for cranes are the same as for building developments.

The ideal scenario would be to keep cranes below the OLS. This may not be feasible, particularly due to the small identified clearance of the OLS calculated in section 4.

A temporary infringement of an OLS by a crane can sometimes be accommodated, subject to close coordination with the airport. In this case, the site's location on the outer horizontal surface could place relatively significant restrictions on the times at which the cranes can be fully extended. The level of constraint should be established at the earliest opportunity.

Manchester Airport is likely to require any crane operation to be in accordance with an agreed scheme. Such a scheme would likely set out:

- Where the cranes are to be located and operated;
- What times the cranes will be operational;
- What the process is for the airport to contact the crane operator if needed.

¹³ Air Navigation Order, 2016. There is a requirement unless the CAA allow otherwise.

The CAA should be notified of the proposed development and any proposed cranes. All cranes and obstacle notifications to the CAA should be made to the Airspace Coordination and Obstacle Management Service (ACOMS). Registration and ACOMS can be accessed via the CAA customer portal^{14,15}.

The analysis within the section does not account for crane usage which should be considered within the design of the proposed development and its construction. It is possible that Building B will be constructed with a crane that infringes the OHS.

Consultation with Manchester Airport should be conducted regarding crane usage and any temporary infringement of the OLS. Aviation lighting will be required on the crane as it is expected they will extend to 150m or more above ground level.

A Crane Operations Scheme will likely be requested regardless of any infringement of the OLS.

¹⁴ <https://www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/crane-notification/>

¹⁵ <https://www.caa.co.uk/commercial-industry/airspace/event-and-obstacle-notification/obstacle-notification/>

7 OVERALL CONCLUSIONS

7.1 Assessment Results - Manchester Airport SSR

The proposed development is located approximately 16km from the Secondary Surveillance Radar (SSR) at Manchester Airport, and two of three towers are predicted to be visible to the radar. Whilst the impact is predicted to be small, due to the advanced built-in capabilities for increasing its reliability and performance, the potential for some adverse effects on the radar cannot be conclusively ruled out.

It is recommended that consultation with NATS is undertaken so that evaluation in the context of the consented and built environment can be undertaken to ascertain whether it will be visible to the radar in practice.

7.2 Assessment Results - Manchester Airport's OLS

The proposed development lies laterally under the Outer Horizontal Surface (OHS). The proposed development is clear of the Obstacle Limitation Surfaces (OLS) at Manchester Airport, with a minimum vertical clearance margin of 17.64m. No infringements of Manchester Airport OLS are predicted.

7.3 Assessment Results - High-Level IFP

A high-level review of the Instrument Flight Procedures (IFPs) relative to the proposed development indicates sufficient clearances between the proposed development and aircraft flying procedures. There are also taller existing buildings in the surrounding area that already co-exist with the current IFPs. Therefore, no impact upon the IFPs is predicted. It is possible, however, that a detailed IFP assessment may be requested by Manchester Airports Group (MAG). If a detailed IFP assessment is required, details of any proposed crane locations, heights, and jib radius will need to be provided.

7.4 Assessment Results - High-Level Aviation Lighting and Crane Usage

The proposed development will need to be lit as a mandatory requirement for structures over 150m agl. Cranes are expected to be higher than this during construction and will therefore also be required to be lit. A lighting scheme will need to be agreed with the Civil Aviation Authority (CAA) and MAG. It is likely that the lighting scheme will comprise steady red medium intensity lights marking the height and shape of the proposed development, along with intermediate lights.

The Civil Aviation Authority (CAA) should also be notified of the proposed development and any proposed cranes. All crane and obstacle notifications to the CAA should be made to the Airspace Coordination and Obstacle Management Service (ACOMS). The registration process is via the CAA customer portal to access the ACOMS service to submit a notification.

APPENDIX A – ASSESSMENT DATA

Footprint Coordinates

The building footprint coordinates used in this assessment are presented in this section. The coordinates are provided in British National Grid.

Reference	Easting	Northing
A1	383401	398371
B1	383442	398387
C1	383486	398357

Proposed development coordinates



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