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Urban & Renewables

Technical Aerodrome Safeguarding Assessment

Plot 9B, First Street

Vita Meadow Ltd

October 2024







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ADMINISTRATION PAGE

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Issue	Date	Detail of Changes
1	October 2024	Initial issue
2	December 2024	Consideration of development height changes

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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been commissioned to investigate the potential impact of a proposed building development, located at First Street, Manchester, upon aviation infrastructure in the surrounding area. The proposed development is located approximately 13.3km north-east of Manchester Airport.

The proposed development will consist of one building, with a maximum altitude of 131.950m above ordinance datum (AOD) and a maximum height of 97.78m above ground level (agl), based on site drawings and ground height data taken from OSGB 50 DTM data. This assessment is based on a previous design of the development, where the maximum altitude was 130.785m (AOD) and a maximum height of 97.785m agl, the difference between the assessed height and the newly proposed height is 1.165m, it is not predicted that this increase in height will have significantly change the results of this assessment.

Overall Conclusions

The proposed development is expected to only be partially visible to the Secondary Surveillance Radar (SSR) at Manchester Airport, due to screening from an existing building near the airport

A further impact assessment may also be required to determine the extent of the impact and whether mitigation is required. If mitigation is required, the most likely solution would be a technical fix to the radar and implemented by NATS. The solution would define the building as a known reflector and has been implemented for many developments of this type in the vicinity of SSR. It is unlikely that the identified issue would be a 'show stopper' if mitigation is implemented, the fee for implementation would be payable to NATS.

The proposed development is vertically clear of the Obstacle Limitations Surfaces (OLS) for Manchester Airport. The proposed development is vertically clear by a margin of 76.00m, and therefore is not likely to present a collision risk. Any cranes not exceeding 76.00m above the maximum building height will remain clear of the OLS.

The proposed development is not predicted to impact the Instrument Flight Procedures (IFP). It is possible however that a detailed IFP assessment may be requested by Manchester Airport Group (MAG), who safeguard Manchester Airport. If a detailed IFP assessment is required, details of any proposed crane locations, heights, and jib radius will need to be provided.

Considerations of aviation lighting indicates that aviation lighting is unlikely to be required for the proposed development, based on the proposed height of the development.

An aviation lighting scheme for cranes is likely to be required for any cranes at 150m agl or above. A lighting scheme will need to be agreed with the CAA and MAG.

It is recommended that this report is provided to Manchester Airport and NATS for their comment and position on the proposed development.

Technical Summary

Manchester Airport SSR

The proposed development is located approximately 14.7km from the SSR at Manchester Airport and is predicted to be partially visible to the radar. Existing structures have been identified that significantly obstruct the line-of-sight to the proposed development.

The proposed development will be of similar scale to those surrounding it. No significant shadowing effects are anticipated.

The radar has specific features that reduce the radar's susceptibility to interference from buildings.

Whilst the impact is predicted to be relatively 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. Therefore, mitigation may be required.

If mitigation is required, the most likely solution would be a technical fix to the radar and implemented by NATS. The solution would define the building as a known reflector and has been implemented for many developments of this type in the vicinity of SSR.

Consultation with NATS, who safeguards the Manchester Airport radar, is recommended.

Manchester Airport's Obstacle Limitation Surfaces

- The proposed development is vertically clear of the Obstacle Limitation Surface (OLS) and beneath the Outer Horizontal Surface (OHS) for Manchester Airport;
- The analysis has shown that the proposed development, with a maximum altitude of 130.785m AOD, is vertically clear of the OHS. The minimum margin of clearance is 76.00m.
- Any cranes less than 76.00m above the maximum height of the development will also be clear of the OHS.

Instrument Flight Procedures at Manchester Airport – High-Level

A high-level review of the IFP 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 IFP is predicted. It is possible however that a detailed IFP assessment may be requested by MAG. If a detailed IFP assessment is required, details of any proposed crane locations, heights, and jib radius will need to be provided.

Aviation Lighting and Crane Usage

- The proposed development does not extend above 150m agl or infringe the OLS. Therefore aviation lighting will not be required for the building structure itself;
- As long as cranes do not extend 52.7m above the maximum height of the proposed development would extend above 150m agl, or infringe the OLS;
- Aviation lighting marking the crane tower and arm may be required;
- It is possible that MAG may request a crane operations scheme despite cranes being unlikely to breach the OLS.

LIST OF CONTENTS

Administration Page 2
Executive Summary 3
Report Purpose 3
Overall Conclusions 3
Technical Summary 4
List of Contents 5
List of Figures 7
List of Tables 7
About Pager Power 8
1 Background 9
1.1 Introduction 9
1.2 Proposed Development Site Plan 10
1.3 Proposed Development Site Layout – Aerial Image 11
2 Manchester Airport Details 12
2.1 Aerodrome Details 12
3 Radar Information 15
3.1 Radar Data 15
3.2 Radar Types and Usage 15
3.3 SSR Location 15
4 Radar Interference 17
4.1 Overview 17
4.2 Interference 17
4.3 SSR Capabilities 17
5 Radar Line of Sight Analysis 20
5.1 Methodology 20
5.2 Radar Line of Sight Analysis 20
5.3 Line of Sight Results – Bare Earth Terrain 22
5.4 Additional Screening Analysis 22

5.5 Radar Line of Sight Conclusions 26
5.6 Interference Assessment 26
5.7 Assessment Conclusions 27
6 Obstacle Limitation Surfaces Assessment 28
6.1 Overview 28
6.2 Manchester Airport Obstacle Limitation Surfaces 28
6.3 Obstacle Limitation Surfaces Conclusions 29
7 High-Level Instrument Flight Analysis 30
7.1 Overview 30
7.2 Minimum Obstacle Clearance 31
7.3 Surveillance Minimum Altitude Chart (SMAC) 31
7.4 High-level IFP Assessment – Obstacle Clearance Margins 32
7.5 Minimum Sector Altitudes (MSAs) 33
7.6 Standard Instrument Departures (SIDs) 33
7.7 Standard Arrival Charts (STARs) 34
7.8 Instrument Approach Charts 35
7.9 High-level IFP Assessment – Obstacle Clearance Margins Conclusions 38
8 High-level Aviation Lighting and Crane Usage Considerations 39
8.1 Overview 39
8.2 Lighting Requirements 39
8.3 Crane Operations Scheme 39
9 Conclusions 40
9.1 Manchester Airport SSR 40
9.2 Manchester Airport's Obstacle Limitation Surfaces 40
9.3 Instrument Flight Procedures at Manchester Airport – High-Level 40
9.4 Aviation Lighting and Crane Usage – High-Level 41
9.5 Overall Conclusions 41
Appendix A – Coordinate Data 42
Assessed Building Points 42

LIST OF FIGURES

Figure 1 Proposed development site plan....10
Figure 2 Proposed development site layout (grey) – aerial image....11
Figure 3 3D building representation....11
Figure 4 Location of Manchester Airport relative to the proposed development....12
Figure 5 Aerodrome Chart for Manchester Airport....14
Figure 6 Location of the SSR within Manchester Airport....16
Figure 7 Radar line of sight chart....21
Figure 8 Point-of-view from the SSR at Manchester Airport....23
Figure 9 Close view of the existing building development partially obscuring line-of-sight from the SSR – 3D view....24
Figure 10 Line of sight from the SSR with consideration of identified screening....25
Figure 11 Manchester Airport Obstacle Limitation Surfaces chart....28
Figure 12 Instrument Flight Procedure Minimum Obstacle Clearances....31
Figure 13 Manchester Airport ATC Surveillance Minimum Altitude Chart....32

LIST OF TABLES

Table 1 Manchester Airport SSR radar location details....15
Table 2 Radar features for reducing interference....19
Table 3 Line of sight results for each assessed building point – bare earth terrain....22
Table 4 OLS detailed results....29
Table 5 Standard Instrument Departure (SID) assessment results....34
Table 6 Standard Arrival Chart (STARs) Assessment Results....35
Table 7 Instrument Approach Charts assessment results....37

ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 59 countries within Europe, Africa, America, Asia and Australasia.

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 BACKGROUND

1.1 Introduction

Pager Power has been commissioned to investigate the potential impact of a proposed building development, located at First Street, Manchester, upon aviation infrastructure in the surrounding area. The proposed development is located approximately 13.3km north-east of Manchester Airport.

The proposed development will consist of one building, with a maximum altitude of 131.950m above ordinance datum (AOD) and a maximum height of 97.78m above ground level (agl), based on site drawings and ground height data taken from OSGB 50 DTM data. This assessment is based on a previous design of the development, where the maximum altitude was 130.785m (AOD) and a maximum height of 97.785m agl, the difference between the assessed height and the newly proposed height is 1.165m, it is not predicted that this increase in height will have significantly change the results of this assessment.

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 and radio systems. This assessment has identified and assessed all the aviation constraints for the proposed development.

In detail the report includes:

- Proposed development details;
- Manchester Airport details;
- Secondary Surveillance Radar (SSR) impact assessment including:
    - Line of sight analysis;
    - Additional screening analysis;
- Obstacle Limitation Surfaces (OLS) assessment for Manchester Airport;
- High-level Instrument Flight Procedures (IFP) assessment;
- High-level comments regarding aviation lighting and crane usage.

Following the technical analysis, the overall conclusions and recommendations are presented.

1.2 Proposed Development Site Plan

The development footprint for the proposed development is shown in Figure 1[1] below.

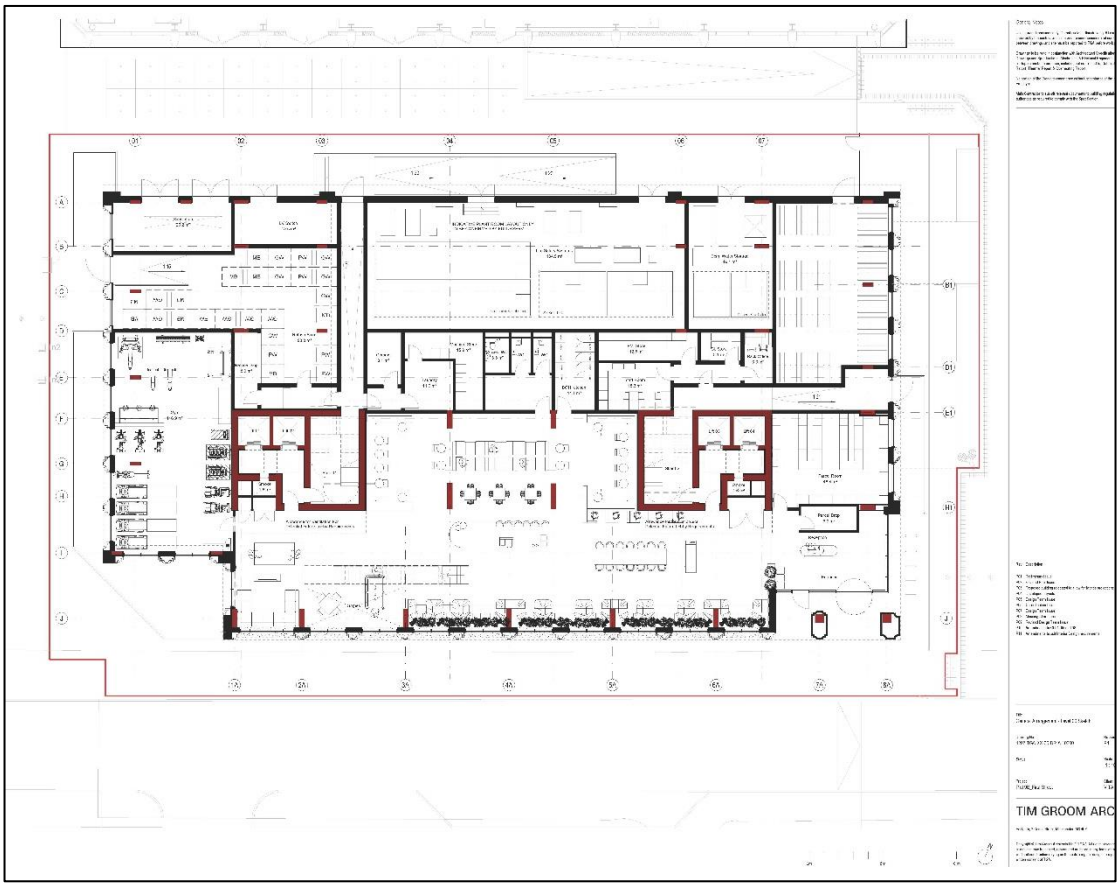


Figure 1 *Proposed development site plan*

[1] Source: 10359-SHP-Z0-A-G100-PL-XX-002_DRAFT_040924.pdf (copped)

1.3 Proposed Development Site Layout – Aerial Image

The approximate proposed development footprint overlaid on aerial imagery is shown in Figure 2 below. Figure 3 below shows the 3D model of the proposed development within the existing surrounding area. Building plot coordinates extrapolated from the site drawing are presented in Appendix A.

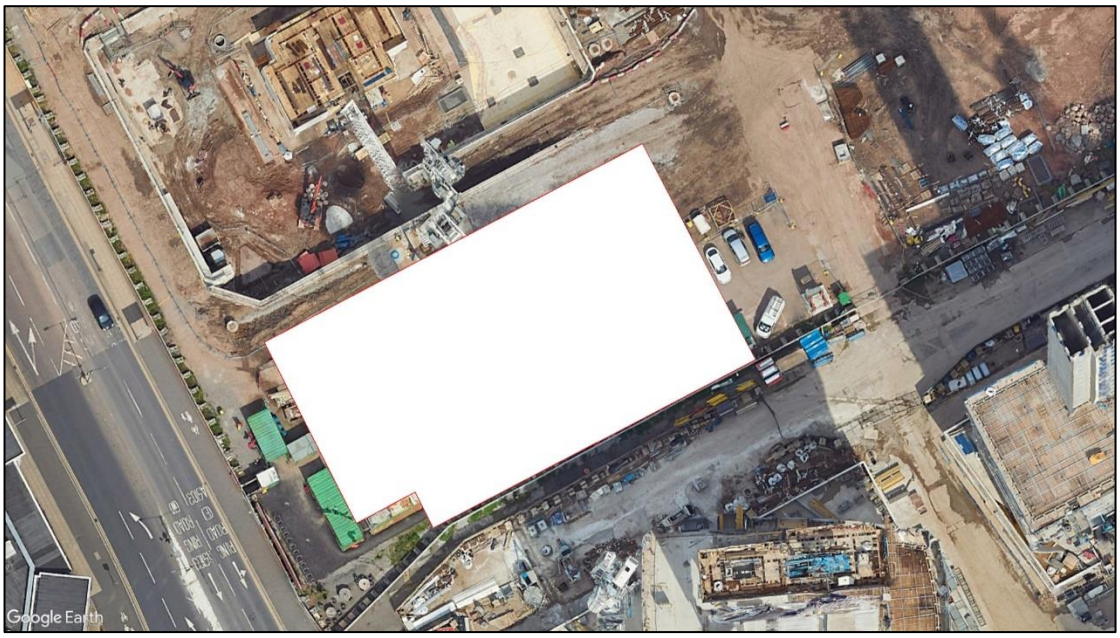


Figure 2 *Proposed development site layout (grey) – aerial image*



Figure 3 *3D building representation*

2 MANCHESTER AIRPORT DETAILS

2.1 Aerodrome Details

Manchester Airport is approximately 13.3km south of the proposed development. The location relative to the proposed development is shown in Figure 4 below.

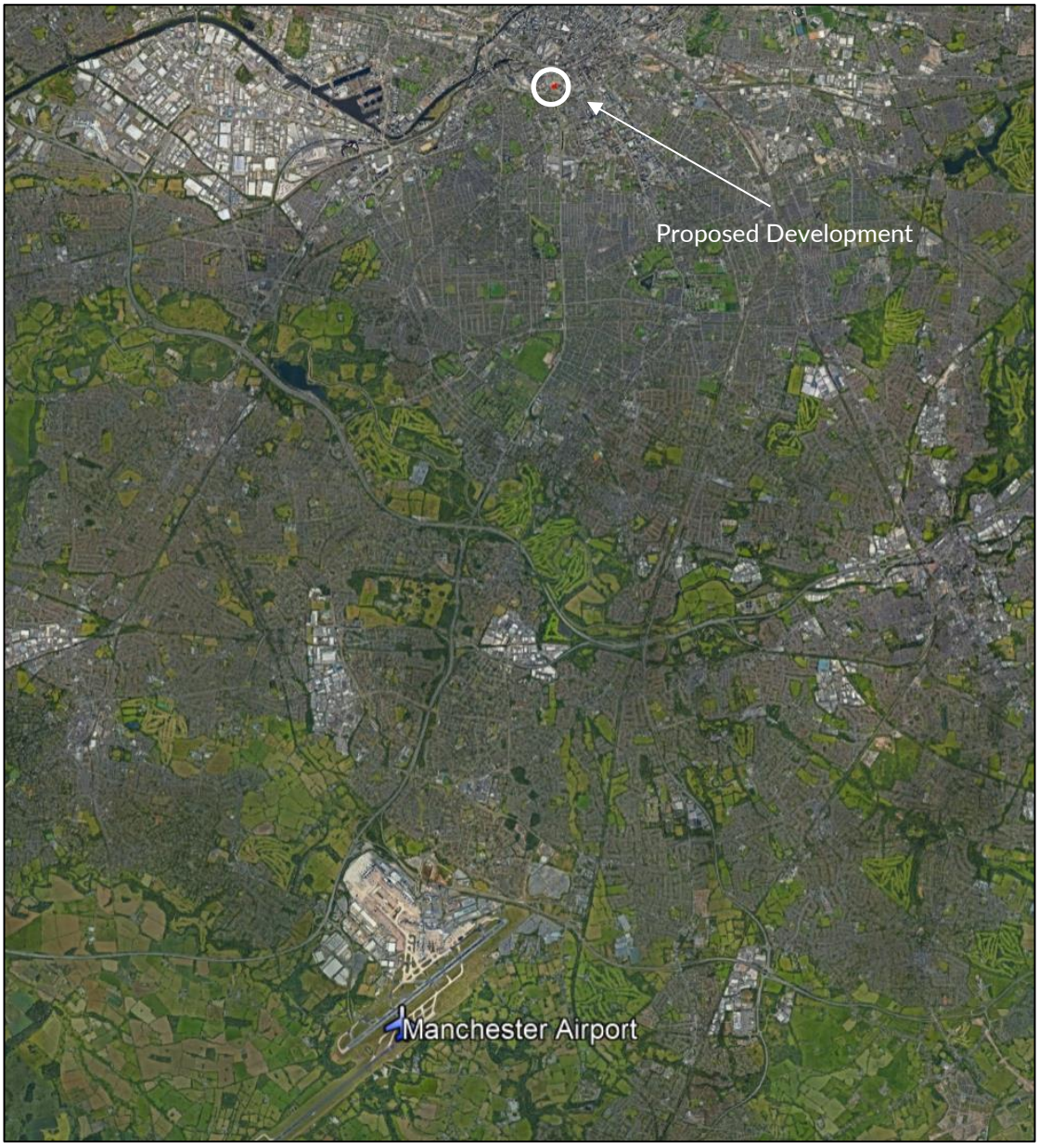


Figure 4 *Location of Manchester Airport relative to the proposed development*

Manchester Airport is a CAA licenced airport with an ATC Tower and two runways. The runway details[2] 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 5 on the following page.

[2] NATS AIP, effective 15th June 2023

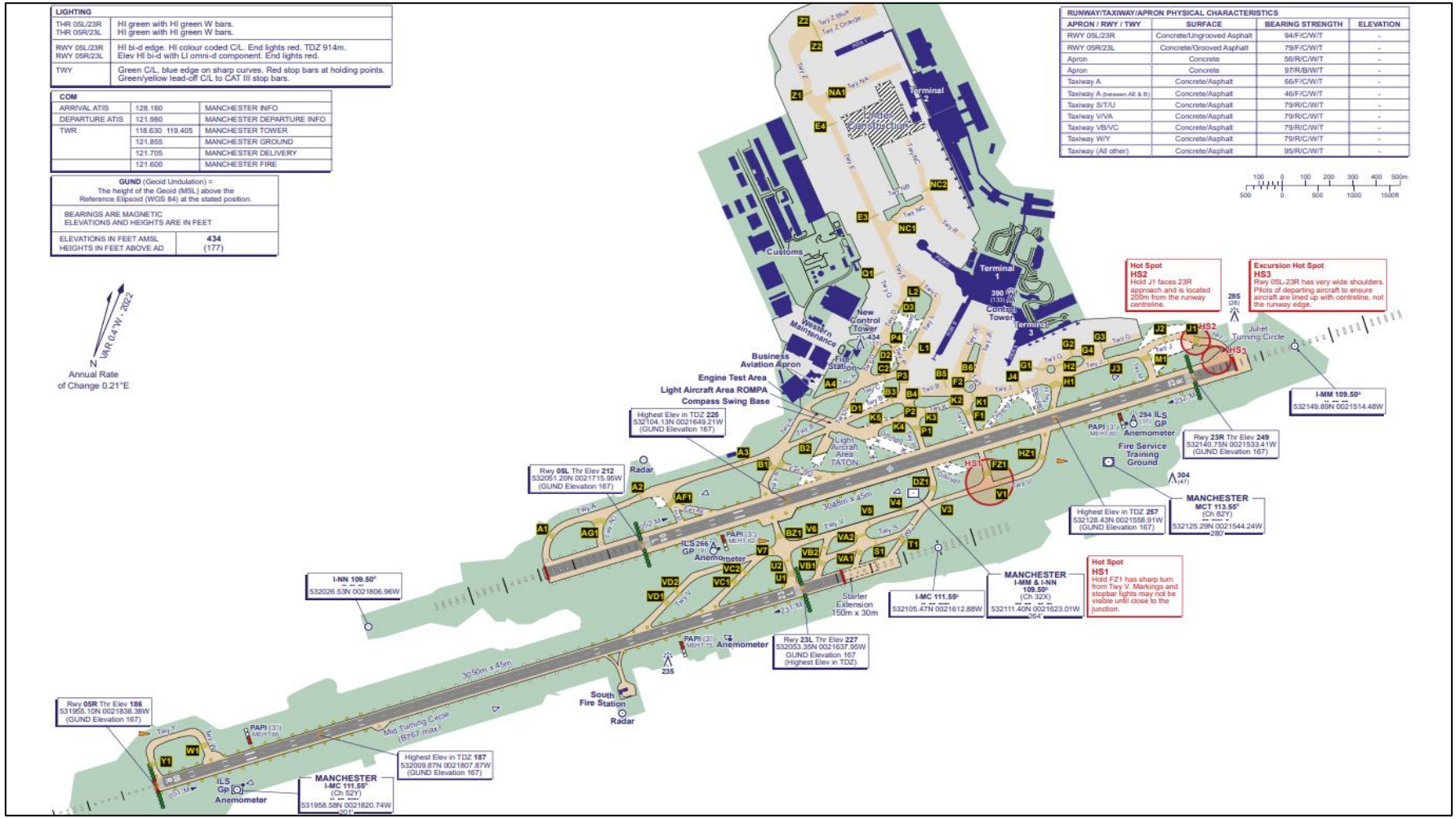


Figure 5 *Aerodrome Chart for Manchester Airport*

3 RADAR INFORMATION

3.1 Radar Data

Table 1 below provides the details for the assessed Manchester Airport SSR radar. All data has been provided by NATS.

Radar	Secondary Surveillance Radar (SSR)
Overall radar altitude above mean sea level	97 m
Distance between the proposed development and radar	14.7km
Average grid bearing from radar to proposed development	13.7°

Table 1 *Manchester Airport SSR radar location details*

3.2 Radar Types and Usage

There are two radar situated upon the metal lattice tower. The lower radar is a non-cooperative PSR, the taller is the co-operative SSR which has been assessed within this report.

SSR 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 direction the antenna is orientated and the time taken to receive a response from the interrogation.

Both radar will be used by air traffic controllers to provide approach services to aircraft landing at and departing Manchester Airport. Both radar will also be used by air traffic controllers at national air traffic control centres to provide services to en-route aircraft.

The radar of significance with respect to the predicted impact is the SSR. The PSR is not expected to be significantly affected.

3.3 SSR Location

The location of SSR within Manchester Airport is shown in Figure 6 on the following page.



Figure 6 *Location of the SSR within Manchester Airport*

4 RADAR INTERFERENCE

4.1 Overview

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

4.2 Interference

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. These are listed in the following sub-sections.

4.2.1 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 mis-manage 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.

4.2.2 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.

4.3 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 2 on the following page.

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.
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[3] 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

[3] FRUIT – False Replies Unsynchronized in Time

Feature	Form of interference	How feature reduces interference	Additional Information
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
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 2 *Radar features for reducing interference*

5 RADAR LINE OF SIGHT ANALYSIS

5.1 Methodology

The approach taken within this report is presented in the following section.

5.1.1 Technical Assessment

- Radar line of sight assessment based on the tower co-ordinates 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.

5.1.2 Cumulative Assessment

- Assessment of the predicted impact in the context of the existing environment has been undertaken.

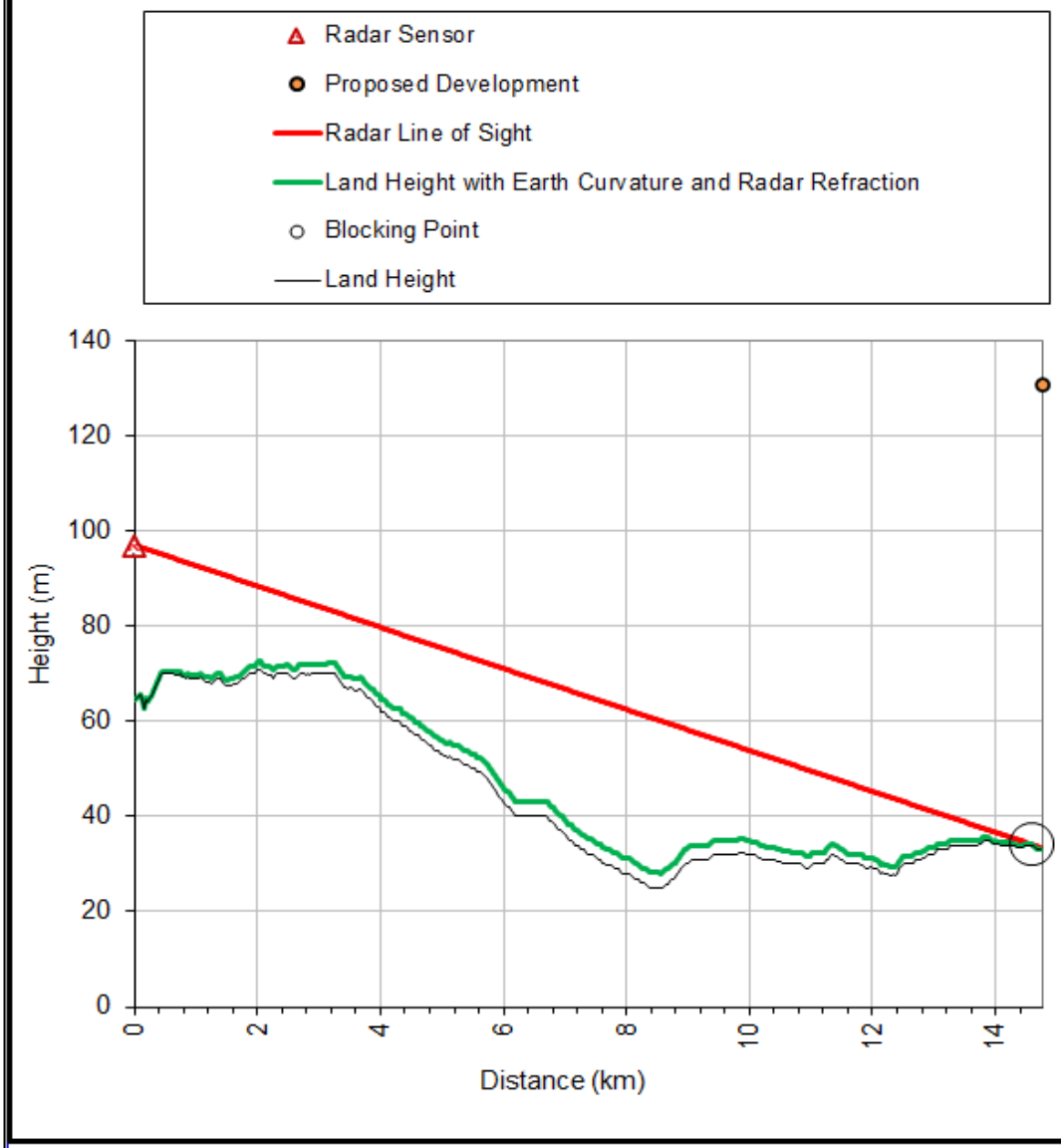
5.2 Radar Line of Sight Analysis

Figure 7 on the following page shows the line of sight chart for building point 4 (the point of the tallest section of the building which is located closest to the SSR). Information regarding the methodology or the additional line of sight charts can be provided upon request. The tower height above ground level has been adjusted to account for the terrain height based on OSGB36 terrain data at that particular location. The overall altitude of the proposed development is as assessed later in the report with respect to obstruction risk.

Radar Line of Sight Calculation

Manchester Airport SSR

13394 Plot 9B	
Building	4
Result	VISIBLE
Certainty	97.3 metres



Building Height (m)	97.785
Base Elevation (m)	33.0
Building Location	E383729 N397207
Distance to radar (km)	14.7
Blocking Point Location	E383709 N397091
Distance to BP (km)	0.1

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Figure 7 *Radar line of sight chart*

5.2.1 Line of Sight Chart Results Description

The box labelled 'certainty' in Figure 8 provides the distance (in metres) by which the proposed development is or is not within line of sight to the assessed radar.

In this case the proposed development would be fully visible considering bare earth terrain.

5.3 Line of Sight Results – Bare Earth Terrain

The overall results for the assessed points that outline the building footprint are presented in Table 3 below. All results are shown in the table, but in practice only points 1, 2 and 4 would be visible to the SSR, based on bare earth terrain, as these points will screen the remaining assessed points.

Building Points	Result (Bare earth terrain)
1	The building is visible by a margin of 97.3m
2	
3	
4	

Table 3 *Line of sight results for each assessed building point – bare earth terrain*

5.4 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 8 on the following page shows the line of sight towards the proposed development from the SSR. Figure 9 on page 24 shows a closer view of the existing building (Radisson Blu Hotel Building) near the airport which would partially obscure visibility from the SSR to the proposed development. Figure 10 on page 25 shows the line of sight with the consideration of the identified screening, which shows the remaining visible section of the proposed development will be approximately 9m (rounding up to be conservative).

Overall, it is expected that the proposed development would have a low technical impact on the radar.



Figure 8 *Point-of-view from the SSR at Manchester Airport*

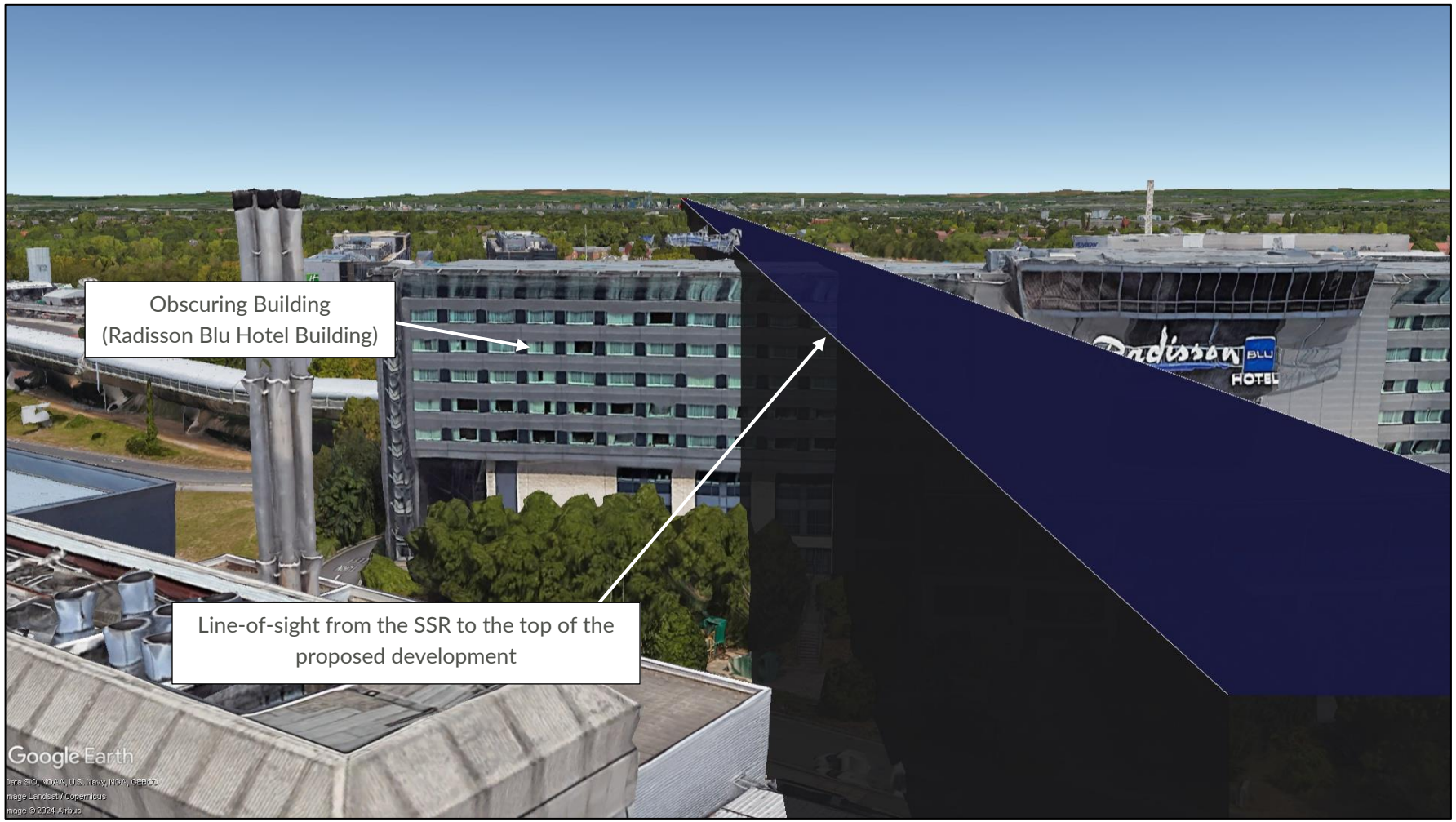


Figure 9 *Close view of the existing building development partially obscuring line-of-sight from the SSR – 3D view*

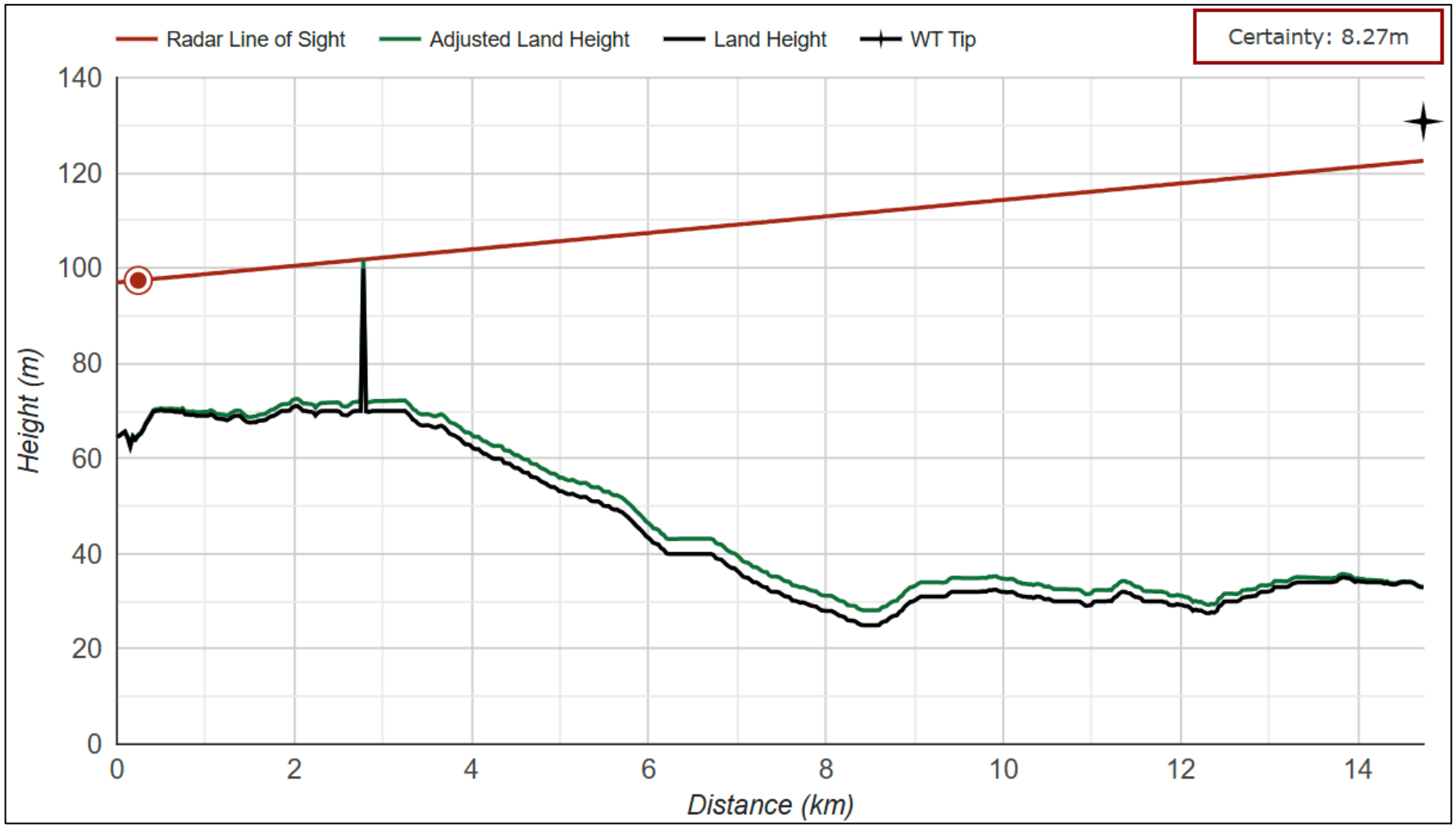


Figure 10 *Line of sight from the SSR with consideration of identified screening*

5.5 Radar Line of Sight Conclusions

The results show that the proposed development would be significantly screened from the SSR at Manchester Airport. A 9m tall section of the proposed development will be visible to the SSR and therefore a technical impact upon the radar is considered possible. These are discussed further in the following subsection. Due to the location of the proposed development within Manchester Airport's operational airspace (see Figure 11 on page 33), a operational impact is predicted.

A technical and operational impact is predicted, and mitigation may be required.

5.6 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.

5.6.1 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.

A 9m tall section of 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 are shown in Section 4.3.

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 at this range from modern SSR is a software-based solution whereby the building information, specifically coordinates and altitudes of each building corner, are 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 5 metres above ground prior to installation of the mitigation solution (i.e. within six months of signing the mitigation agreement).

5.6.2 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 Owen Street Development that consists of four towers. These towers have a similar bearing as the proposed development relative to the SSR.

5.7 Assessment Conclusions

The modelling has revealed that the proposed development will be partially screened up to a certainty of 9m from 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 (see Section 4.3), the potential for some adverse effects on the radar cannot be conclusively ruled out.

Consultation with NATS, who safeguards the radar, is recommended to confirm their position on the proposed development . Mitigation is expected to be requested at the cost of the developer.

6 OBSTACLE LIMITATION SURFACES ASSESSMENT

6.1 Overview

The Obstacle Limitation Surfaces (OLS) for Manchester Airport have been modelled with respect to the building plot coordinates. The aim is to identify whether the proposed development would infringe the OLS at Manchester Airport.

6.2 Manchester Airport Obstacle Limitation Surfaces

Obstacle Limitation Surfaces 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.

The OLS for Manchester Airport are presented in Figure 11 below. The proposed development building plot coordinates are shown by the red crosses at the top of the chart, due to the scale these icons overlap.

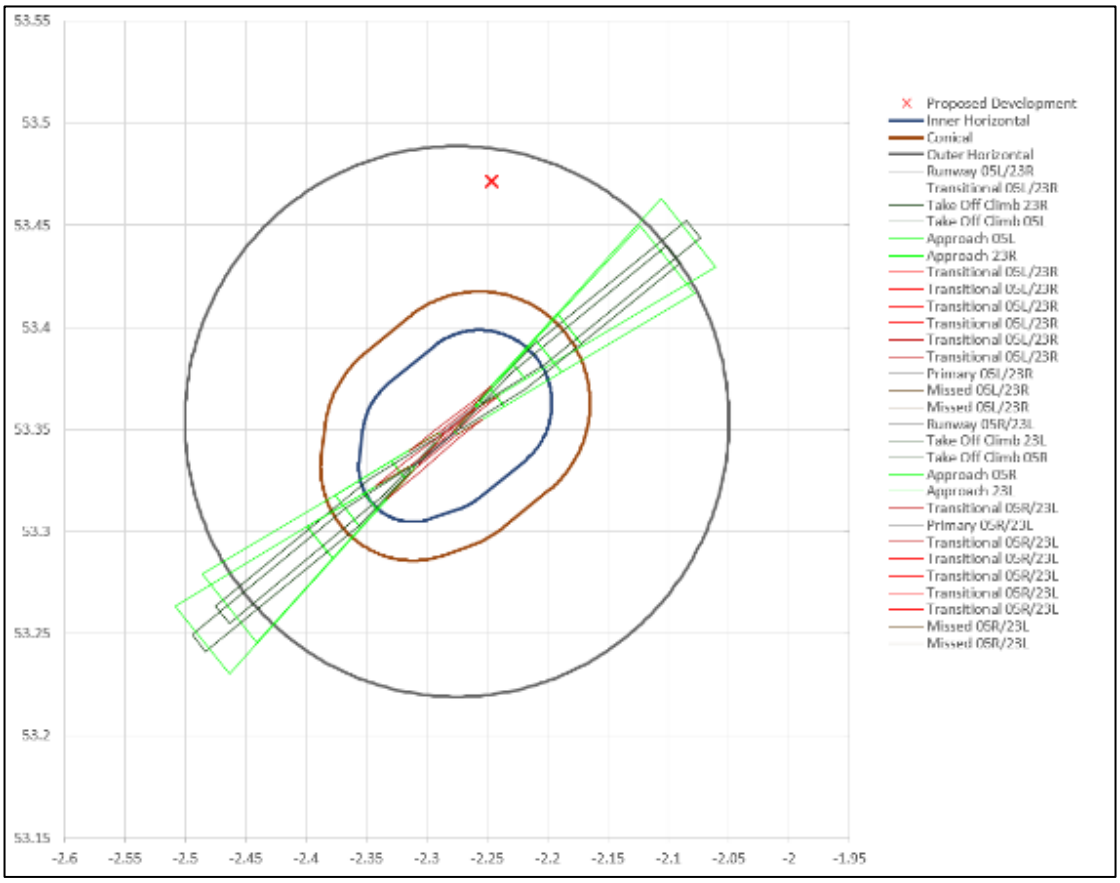


Figure 11 *Manchester Airport Obstacle Limitation Surfaces chart*

Table 2 below presents a summary of the OLS assessment results.

Building Points	Altitude above mean sea level (amsl) (m)	Relevant Surface	Vertical Clearance[4,5] (m)
1	130.785	Outer Horizontal Surface (OHS)	76.00
2			
3			
4			

Table 4 *OLS detailed results*

6.3 Obstacle Limitation Surfaces Conclusions

The analysis has shown that the proposed development does not infringe the OLS at Manchester Airport. The building is clear of the most restrictive surface (OHS) by a minimum of 76 metres[6]. No physical safeguarding concerns with respect to the OLS and the building structure itself are predicted. Despite the proposed development's clearance of the OHS, cranes may breach the OLS during construction. It is possible that a crane operation scheme will need to be agreed with Manchester Airport and aviation lighting for cranes and the proposed development (discussed further in Section 8)

[4] Vertical clearance between the top of the assessed building and the Outer Horizontal Surface.
[5] These calculations have been based on an Outer Horizontal Surface of 206.6928m Above Ordnance Datum (AOD).
[6] Rounded down to remain conservative

7 HIGH-LEVEL INSTRUMENT FLIGHT ANALYSIS

7.1 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)[7] 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 429.1 feet. This means that aircraft subject to any IFP route or limit which is more than 1,413 feet will not be affected. Key IFPs are discussed in the following subsection.

[7] 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.'*

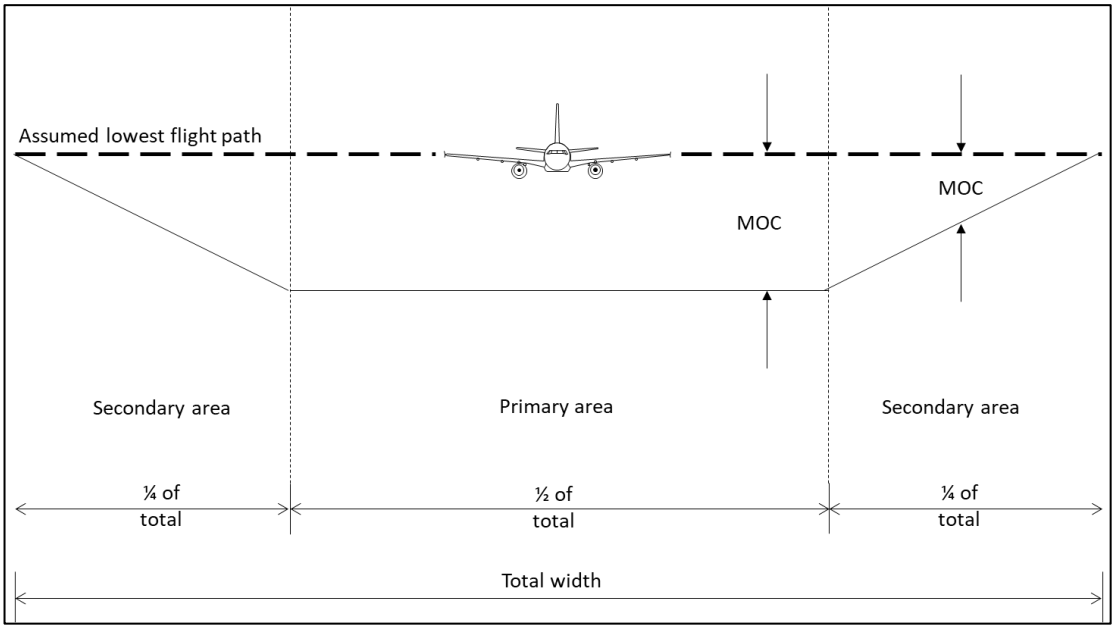


Figure 12 *Instrument Flight Procedure Minimum Obstacle Clearances*

Aircraft flying 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.

7.2 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 429.1 feet AMSL which is 3,070.9 feet below the Area Minimum Altitude. The proposed development will therefore not affect the current Area Minimum Altitude.

7.3 Surveillance Minimum Altitude Chart (SMAC)

Surveillance Minimum Altitude Charts (SMAC)[8] 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 a buffer of 5NM of the proposed development. The proposed development has a maximum altitude of 429.1 feet. The vertical clearance between aircraft

[8] NATS AIP, AD 2.EGCC-5-1 (cropped)

subject to a radar control service and the top of both buildings will be at least 1,970.9 feet. This is 986.9 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 dot) as well as the area of tall buildings present in the surrounding city centre.

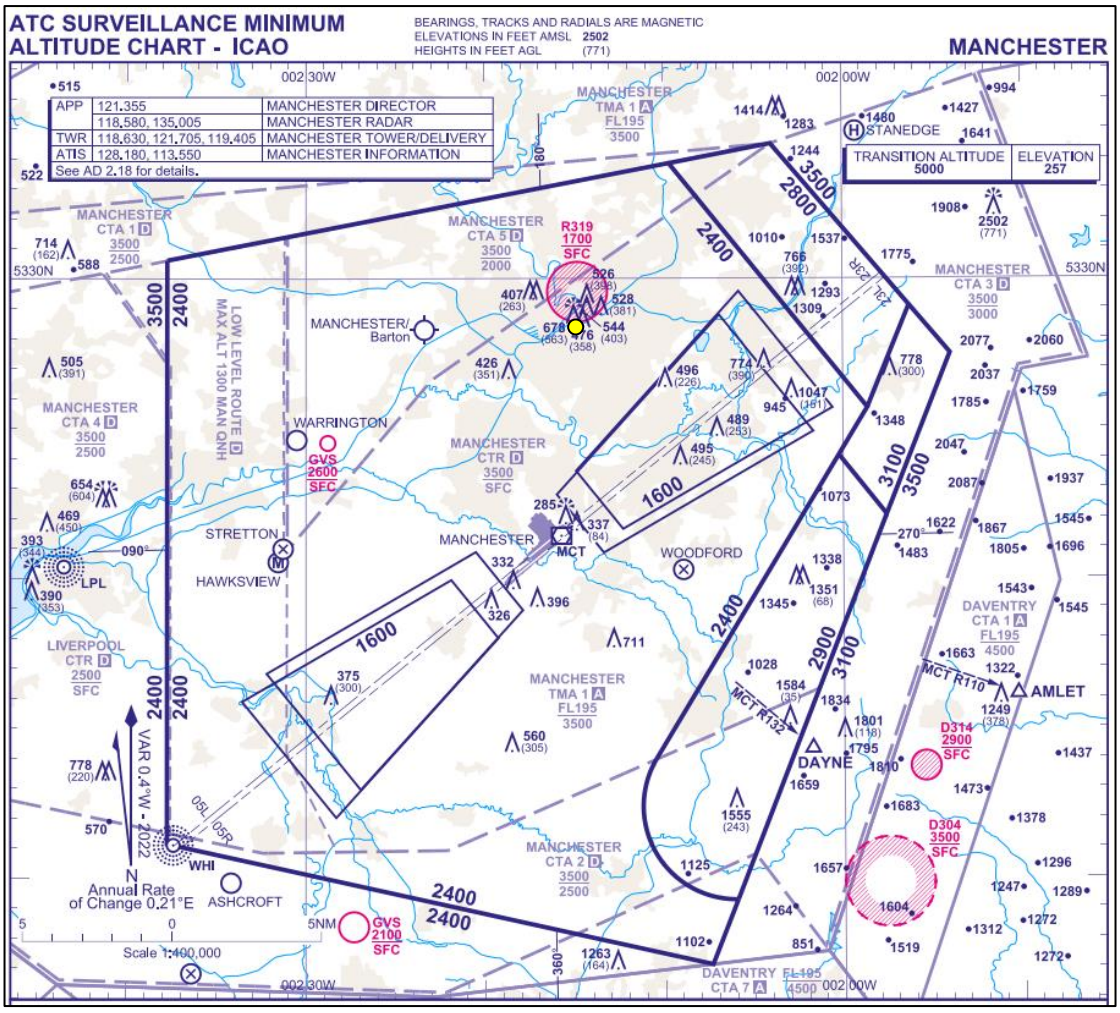


Figure 13 *Manchester Airport ATC Surveillance Minimum Altitude Chart*

7.4 High-level IFP Assessment – Obstacle Clearance Margins

As a general rule, Instrument Flight Procedures (IFP) 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 always 984 feet or less (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

984 feet then it will not have a significant safety impact on aircraft flying the route. The maximum altitude of the proposed development is 429.1 feet[9] amsl.

Therefore, aircraft subject to any IFP route or limit which is more than 1,413 feet will have an acceptably low collision risk. A detailed IFP assessment is not recommended considering the results of this high-level assessment.

7.5 Minimum Sector Altitudes (MSAs)

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

The MSA[10] 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 therefore will not impact the MSA.

7.6 Standard Instrument Departures (SIDs)

Manchester Airport has seven published Standard Instrument Departure procedures (SIDs). Each of these has been assessed with respect to the proposed development. Results of the assessment are shown in Table 5 below.

SID Name	Observations	Assessed Impact	Recommendation
MONTY 1R 1S 1Y 1Z	SID is laterally 2.7NM 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 2,070 ft vertically clear of the proposed development	No further action
ASMIM 1S 1Z/KUXEM 1R 1Y/EKLAD 1R 1Y	SID is laterally 2.7NM 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 2,070 ft vertically clear of the proposed development	No further action
LISTO 2S 2Z	SID is laterally 5.8NM south of the proposed development	No impact. The development is significantly horizontally clear of this SID	No further action

[9] Rounded up to the nearest foot.
[10] MSA 25NM NDB(L) BHX and MSA 25NM ARP.

SID Name	Observations	Assessed Impact	Recommendation
LISTO 2R 2Y	Runway threshold is 7.6NM 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 5.1NM south-east of the proposed development	No impact. The development is significantly horizontally clear of this SID	No further action
SONEX 1R 1Y/DESIG 1S 1Z	SID is laterally 1.1NM north of the proposed development, At this point of the procedure, aircraft will be at a minimum altitude of 5,000ft	Aircraft will be 4,570 ft vertically clear of the proposed development	No further action
SANBA 1R 1Y	Runway threshold is 7.6NM to the south-west. SID tracks south-west	No impact. The development is significantly horizontally clear of this SID	No further action

Table 5 *Standard Instrument Departure (SID) assessment results*

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

7.7 Standard Arrival Charts (STARs)

Manchester Airport has four published Standard Arrival (STARs) Charts. Each of these has been assessed with respect to the proposed development. Results of the assessment are shown in Table 6 below.

STAR Name	Observations	Assessed Impact	Recommendation
via ROSUN (north)	Minimum Altitude FL70	Aircraft will be 69,570 ft vertically clear of the proposed development	No further action
via ROSUN (east)	Minimum Altitude FL90	Aircraft will be 89,570 ft vertically clear of the proposed development	No further action

STAR Name	Observations	Assessed Impact	Recommendation
via MIRSI	Minimum Altitude 6,000 feet	Aircraft will be 5,570 ft vertically clear of the proposed development	No further action
via DAYNE	Minimum Altitude FL70	Aircraft will be 69,570 ft vertically clear of the proposed development	No further action

Table 6 *Standard Arrival Chart (STARs) Assessment Results*

Aircraft flying Manchester Airport's Standard Arrival Routes will be at least 5,570 feet vertically clear of the building. This means that such aircraft will have an acceptably low collision risk.

7.8 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 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 7 on the following page.

V = vertically and H = horizontally.

The proposed development is not likely 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 7 *Instrument Approach Charts assessment results*

7.9 High-level IFP Assessment – Obstacle Clearance Margins 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. 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.

8 HIGH-LEVEL AVIATION LIGHTING AND CRANE USAGE CONSIDERATIONS

8.1 Overview

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 more[11]. The following section explores the requirement for aviation lighting at a high-level.

8.2 Lighting Requirements

The following is true regarding the proposed development:

- The structure itself does not extend above 150m agl (the building has a maximum height of 130.785m agl);
- The building does not infringe the OLS;
- The top of any associated crane that breaches the OHS or is 150m agl or taller will require aviation lighting.

On this basis, aviation lighting is not mandatory for the building structure as per the associated Air Navigation Order guidance.

8.3 Crane Operations Scheme

It is possible that MAG may request a crane operations scheme despite cranes being unlikely to breach the OLS.

The Civil Aviation Authority (CAA) should also 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). The registration process is via the CAA customer portal to access the ACOMS service to submit notification.

It is recommended that the developer applies for a crane permit from the CAA 8 weeks in advance. It is likely that MAG may request a crane operations scheme.

[11] Air Navigation Order, 2016. There is a requirement unless the CAA allow otherwise. Last accessed 26.10.22.

9 CONCLUSIONS

9.1 Manchester Airport SSR

The proposed development is located approximately 14.7km from the SSR at Manchester Airport and is predicted to be partially visible to the radar. Existing structures have been identified that significantly obstruct the line-of-sight to the proposed development.

The proposed development will be of similar scale to those surrounding it. No significant shadowing effects are anticipated.

The radar has specific features that reduce the radar's susceptibility to interference from buildings.

Whilst the impact is predicted to be relatively 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. Therefore, mitigation may be required.

If mitigation is required, the most likely solution would be a technical fix to the radar and implemented by NATS. The solution would define the building as a known reflector and has been implemented for many developments of this type in the vicinity of SSR.

Consultation with NATS, who safeguards the Manchester Airport radar, is recommendedd.

9.2 Manchester Airport's Obstacle Limitation Surfaces

- The proposed development is vertically clear of the Obstacle Limitation Surface (OLS) and beneath the Outer Horizontal Surface (OHS) for Manchester Airport;
- The analysis has shown that the proposed development, with a maximum altitude of 130.785m AOD, is vertically clear of the OHS. The minimum margin of clearance is 76.00m.
- Any cranes less than 76.00m above the maximum height of the development will also be clear of the OHS.

9.3 Instrument Flight Procedures at Manchester Airport – High-Level

A high-level review of the IFP 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 IFP is predicted. It is possible however that a detailed IFP assessment may be requested by MAG. If a detailed IFP assessment is required, details of any proposed crane locations, heights, and jib radius will need to be provided.

9.4 Aviation Lighting and Crane Usage – High-Level

- The proposed development does not extend above 150m agl or infringe the OLS. Therefore aviation lighting will not be required for the building structure itself;
- As long as cranes do not extend 52.7m above the maximum height of the proposed development would extend above 150m agl, or infringe the OLS;
- Aviation lighting marking the crane tower and arm may be required;
- It is possible that MAG may request a crane operations scheme despite cranes being unlikely to breach the OLS.

9.5 Overall Conclusions

The proposed development is expected to only be partially visible to the Secondary Surveillance Radar (SSR) at Manchester Airport, due to screening from an existing building near the airport

A further impact assessment may also be required to determine the extent of the impact and whether mitigation is required. If mitigation is required, the most likely solution would be a technical fix to the radar and implemented by NATS. The solution would define the building as a known reflector and has been implemented for many developments of this type in the vicinity of SSR. It is unlikely that the identified issue would be a 'show stopper' if mitigation is implemented, the fee for implementation would be payable to NATS.

The proposed development is vertically clear of the Obstacle Limitations Surfaces (OLS) for Manchester Airport. The proposed development is vertically clear by a margin of 76.00m, and therefore is not likely to present a collision risk. Any cranes not exceeding 76.00m above the maximum building height will remain clear of the OLS.

The proposed development is not predicted to impact the Instrument Flight Procedures (IFP). It is possible however that a detailed IFP assessment may be requested by Manchester Airport Group (MAG), who safeguard Manchester Airport. If a detailed IFP assessment is required, details of any proposed crane locations, heights, and jib radius will need to be provided.

Considerations of aviation lighting indicates that aviation lighting is unlikely to be required for the proposed development, based on the proposed height of the development.

An aviation lighting scheme for cranes is likely to be required for any cranes at 150m agl or above. A lighting scheme will need to be agreed with the CAA and MAG.

It is recommended that this report is provided to Manchester Airport and NATS for their comment and position on the proposed development.

APPENDIX A – COORDINATE DATA

Assessed Building Points

The assessed building has a maximum altitude of 130.785m above mean sea level (amsl). The coordinates outlining the tallest section of the building are given below.

Building Points	Longitude (°)	Latitude (°)	Assessed Height (m AOD)
1	-2.24598	53.47154	130.785
2	-2.24609	53.47166	
3	-2.24670	53.47148	
4	-2.24659	53.47135	

Building Point Coordinates

PAGERPOWER

Urban & Renewables

Pager Power Limited
Stour Valley Business Centre
Sudbury
Suffolk
CO10 7GB

Tel: +44 1787 319001 **Email:** info@pagerpower.com **Web:** www.pagerpower.com