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Aviation Safety Assessment

Trinity Islands

Renaker Build Limited

June 2025







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ADMINISTRATION PAGE

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Issue	Date	Detail of Changes
1	August 2021	Initial issue
2	June 2025	Updated response from NATS

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EXECUTIVE SUMMARY

Report Purpose

Pager Power has been commissioned to investigate the potential impact of the proposed Trinity Islands development, located at Water Street, Manchester, upon aviation infrastructure in the surrounding area, namely operations at Manchester Airport.

The Proposed Development

The proposed development will consist of four towers (C1, C2, D1 and D2) with a maximum altitude of 207.55m above mean sea level (amsl) and 180.15m above ground level (agl) (tower D1).

Key Aviation Risks

The key aviation risks identified were the potential impact upon the Secondary Surveillance Radar (SSR) at Manchester Airport and the potential infringement of the obstacle limitation surfaces (OLS) at Manchester Airport. Secondary risks included the Instrument Flight Procedures at Manchester Airport and the requirement for aviation lighting.

A permanent infringement of the OLS was calculated for tower D1, and crane usage is expected to add a further temporary infringement during construction. The infringement by tower D1 means it could present a significant obstruction and present a collision risk. A Crane Operations Scheme will likely be requested by Manchester Airport. The infringement of the OLS should be discussed further with Manchester Airport.

The analysis showed that mitigation of the SSR at Manchester Airport would likely be required due to the potential for the towers to create reflection effects. Consultation with NATS, who safeguard the SSR at Manchester Airport, has been undertaken who have confirmed that mitigation will be implemented.

No impact upon the IFPs was identified based on a high-level review.

Aviation lighting will be a requirement for two towers (D1 and D2) regardless of the OLS infringement by D1, because the towers extend above the mandatory aviation lighting threshold of 150m above ground level. Lighting will also be required for any cranes.

The results of this report should be made available to Manchester Airport, NATS and the local planning authority.

A technical breakdown of the results is presented on the following page.

Analysis Results

Manchester Airport's Obstacle Limitation Surfaces

- The proposed development site is beneath the outer horizontal surface (OHS) of Manchester Airport;
- The analysis has shown that tower D1, with a maximum altitude of 207.550m amsl, would infringe the OHS;
- The remaining towers (C1, C2 and D2) would not infringe the OLS. The minimum margin of clearance is 13.3928m;
- Crane usage will need to be considered due to the close proximity and expected infringement of the OHS. It is likely a Crane Operations Scheme will be required;
- Consultation with the safeguarding team at Manchester Airport should be undertaken to discuss the infringement and acceptability of tower D1. Tower D1 will also need to be lit – aviation lighting is discussed within a separate report.

Manchester Airport SSR

- The proposed development is located approximately 15.1km from the SSR at Manchester Airport and will be visible to it;
- The proposed development will not be significantly screened by existing buildings along the line-of-sight path;
- The proposed development will be of similar scale to those in Manchester city centre where mitigation has been required;
- Whilst no significant shadowing effects are anticipated, reflections effects are still possible as the proposed development will introduce new unobstructed 'reflectors' to the line of sight of the SSR;
- Consultation with NATS, who safeguard the Manchester Airport radar, has been undertaken who have confirmed that mitigation will be implemented.

Instrument Flight Procedures at Manchester Airport – High-Level

A high-level review of the IFPs relative to the proposed development indicates sufficient clearances. There are also taller existing buildings in the immediate surrounding area that already co-exist with the current IFPs. Therefore, no impact upon the IFPs is predicted and no detailed IFP assessment is recommended. It is possible however that this could still be recommended by Manchester Airport.

Aviation Lighting Requirement

The towers and associated cranes should be lit with medium intensity aviation lighting, as appropriate, because they extend to 150m agl and above, and due to an infringement of the OLS (tower D1). The specific aviation lighting scheme for each tower is presented separately (Pager Power report 10685B).

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ABOUT PAGER POWER

Pager Power is a dedicated consultancy company based in Suffolk, UK. The company has undertaken projects in 62 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 the proposed Trinity Islands development, located at Water Street, Manchester, upon aviation infrastructure in the surrounding area, namely operations at Manchester Airport. The proposed development will consist of four towers with a maximum altitude of 207.55m above mean sea level (amsl) and 180.15m above ground level (agl).

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 of the aviation constraints for the proposed development. In detail the report includes:

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

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

1.2 Coordinate System

Unless otherwise stated all coordinates used within this report are in British National Grid (OSGB36 datum) or WGS84 latitude and longitude.

2 DEVELOPMENT PLANS

2.1 Development Description

The Site comprises two distinct plots of land, 'Site C' (0.89 hectares) to the north and 'Site D' (0.89 hectares) to the south, divided by the A6042. The Site, until recently, was used as a compound for the Ordsall chord development, however it is currently being used as a surface level car park.

Site C comprises two residential towers of approximately 34 and 42 residential storeys, providing circa 900 residential units. Site D comprises two residential towers of approximately 48 and 57 residential storeys, providing circa 1000 residential units. Each tower sits above a two-deck podium with associated two-storey underground resident parking.

2.2 Proposed Development Elevations

Table 1 below presents maximum elevation above ordnance datum (AOD) and above ground level (agl)[1], and the representative centre points of the towers used within the technical analysis.

Tower	AOD (m)	AGL (m)	Longitude (°)	Latitude (°)
C1	146.875	119.475	-2.260250	53.477205
C2	173.350	145.950	-2.260792	53.476734
D1	207.550	180.150	-2.262160	53.476472
D2	193.300	165.900	-2.261975	53.475931

Table 1 *Proposed development elevations and representative centre points*

[1] Considering a ground level of 27.4m as per drawing 10364-Z1-SHP-G200-SE-0001.

2.3 Proposed Development Boundary

The red line boundary for the proposed development is shown in Figure 1[2] below. The two boundaries are defined as Site C and Site D.

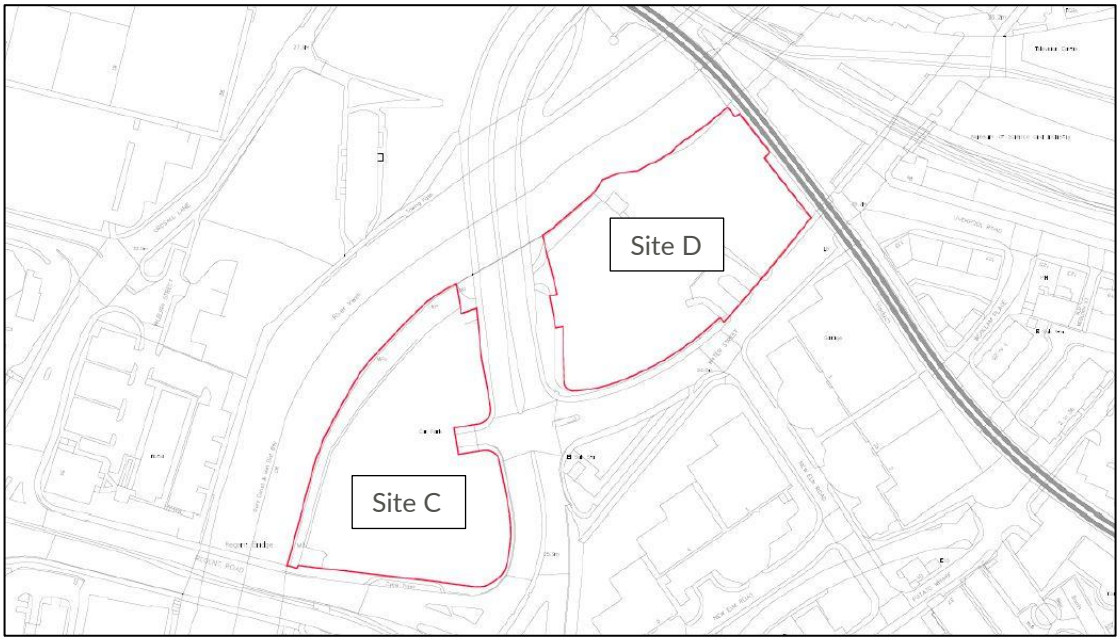


Figure 1 *Proposed development red line boundary*

[2] Source: Simpsonhaugh (cropped).

2.4 Proposed Development Boundary

The red line boundary for the proposed development overlaid on aerial imagery is shown in Figure 2 below.



Figure 2 *Proposed development red line boundary overlaid on aerial imagery*

2.5 Proposed Development Ground Floor Plan and Elevation

The ground floor plan for the proposed development is shown in Figure 3[3] below.

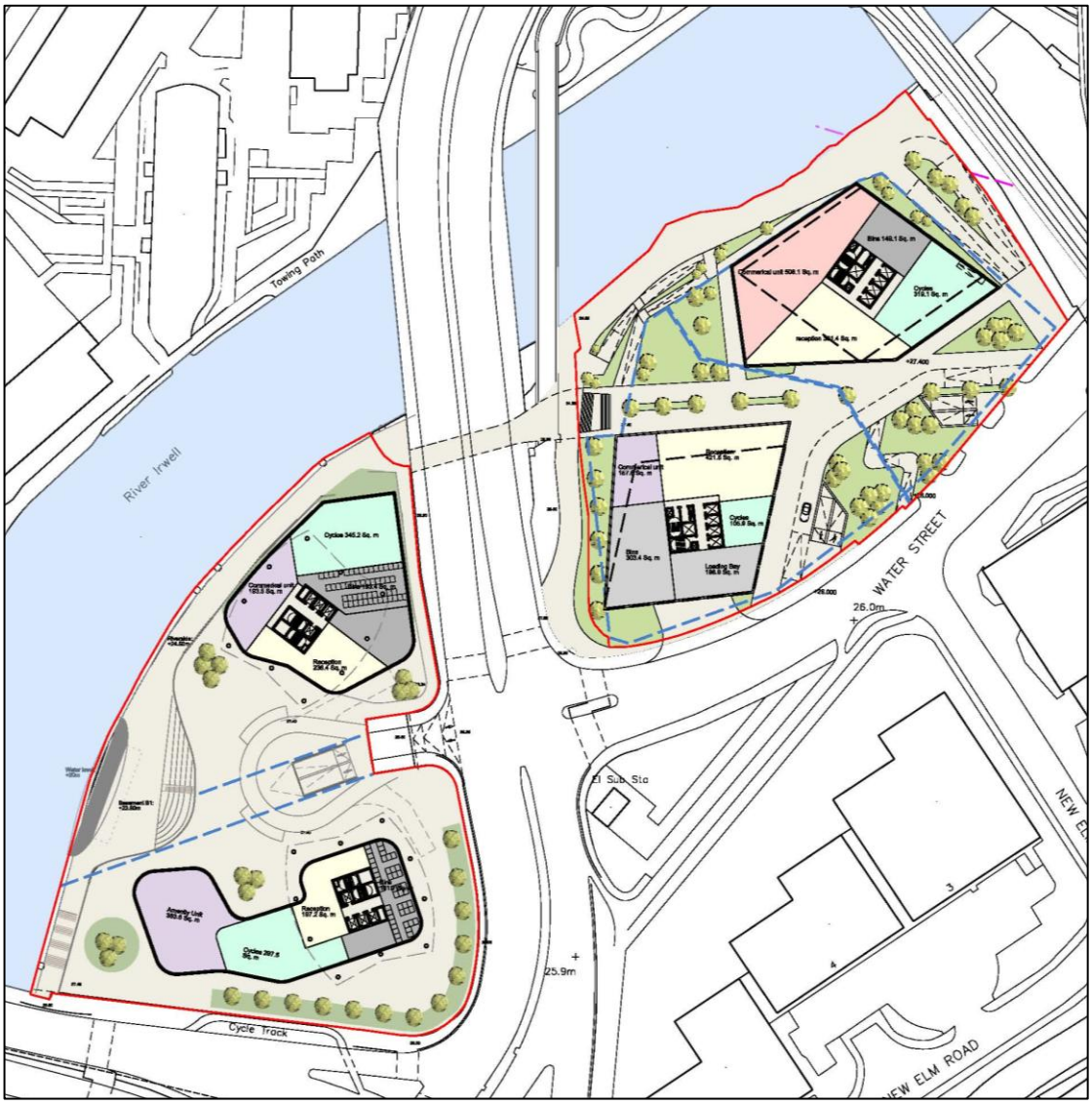


Figure 3 *Proposed development ground floor plan*

[3] Source: Simpsonhaugh (cropped).

2.6 Proposed Development Footprint and Elevations

Figures[4] 4 and 5 below and on the following page show the proposed footprints of each tower with co-ordinates. The maximum elevation of the towers AOD are also shown.

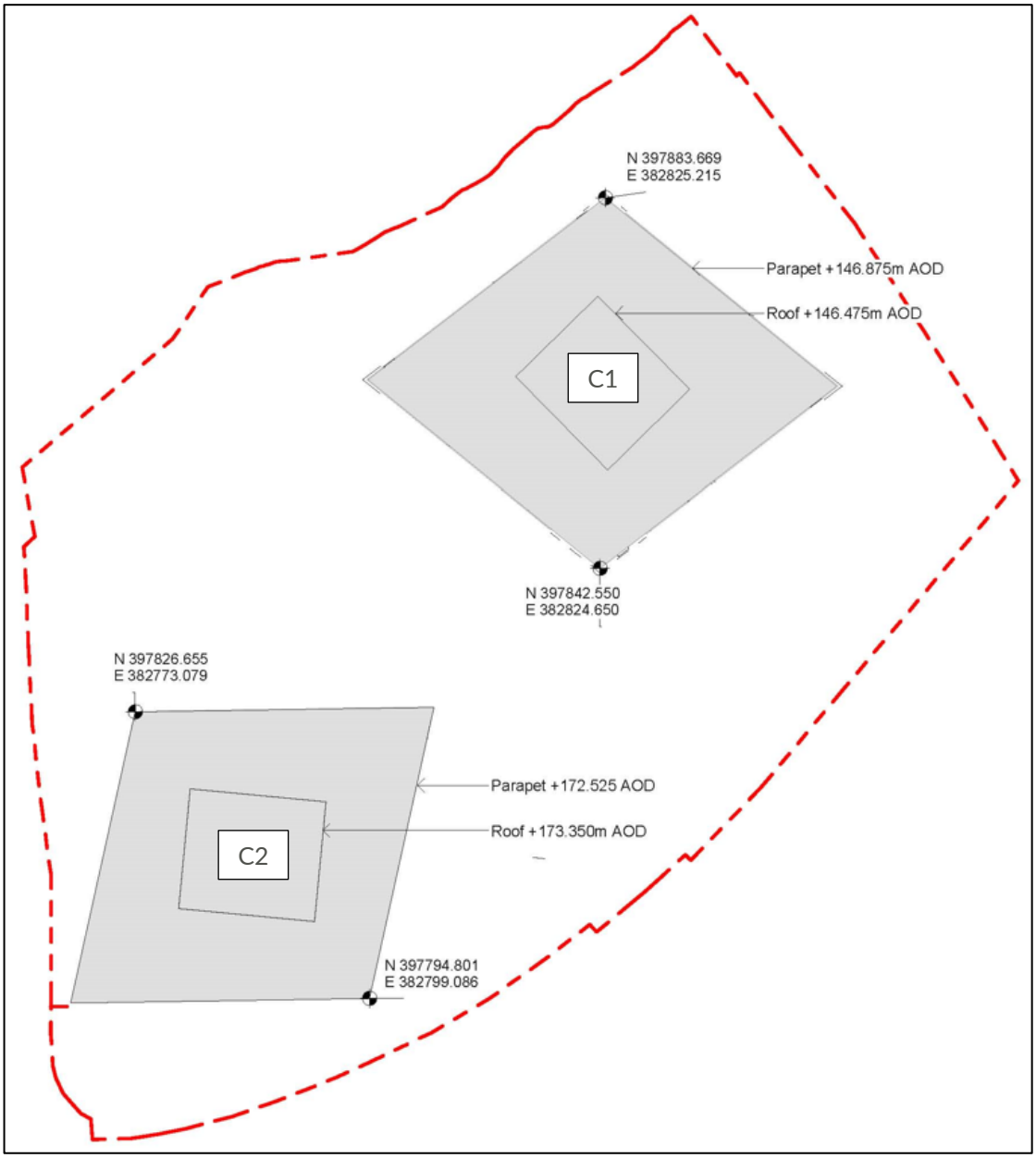


Figure 4 *Proposed development footprint – Towers C1 and C2*

[4] Source: Simpsonhaugh (cropped).

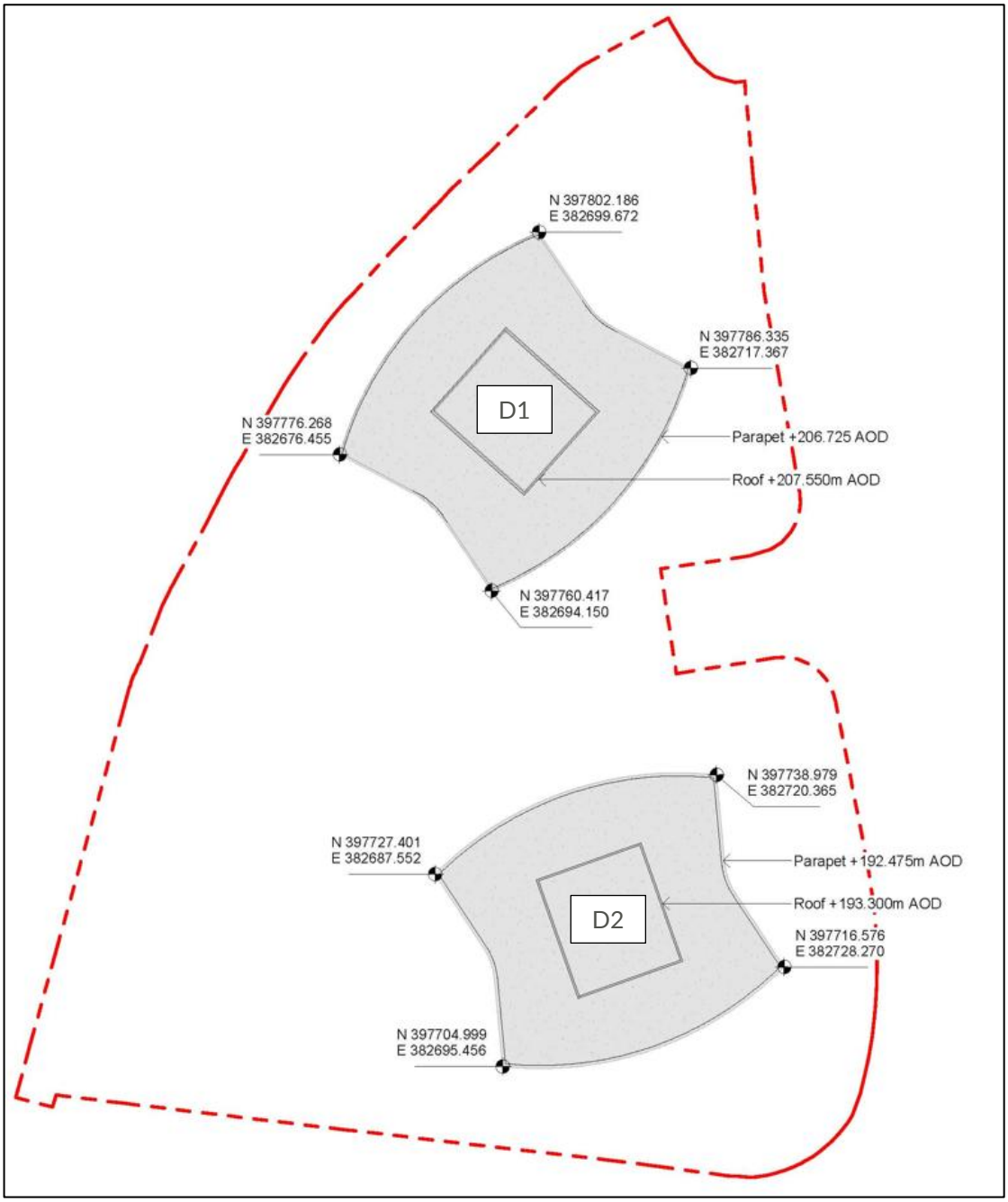


Figure 5 *Proposed development footprint – Towers D1 and D2*

2.7 Proposed Development 3D Representation

Figure 6[5] below shows the 3D representation of the proposed developments. The image is aligned approximately west.



Figure 6 *Proposed development 3D representation*

[5] Source: Simpsonhaugh (cropped).

3 KEY AVIATION RISKS

3.1 Overview

An aviation risk assessment was undertaken to identify the key aviation risk with respect to the proposed development. The results of the analysis are presented in the following sub-sections.

3.2 Identified Infrastructure

3.2.1 Civil Airports and Airport Radar

Aviation Risk	Distance	Risk Level
Manchester PSR	15.1 km	Low PSR concerns for buildings at this range are unlikely.
Manchester SSR	15.1 km	Medium
Manchester Airport	13.7 km	Medium – potential concerns regarding the OLS.
Liverpool John Lennon PSR	42.9 km	Low
Hawarden/ Chester PSR	58.7 km	Low
Leeds Bradford International PSR	58.9 km	Low

Table 2 *Identified airport and rada risks*

3.2.2 NATS En Route

Aviation Risk	Distance	Risk Level
St Annes SSR	58.1 km	Low Radar concerns for buildings at this range are unlikely.

Table 3 *Identified NATS En Route risks*

3.2.3 Unlicensed Airfields

Aviation Risk	Distance	Risk Level
Viking KD Heliport	6.2 km	Low
Manchester Barton, Licensed	8.5 km	Low

Table 4 *Unlicensed airfield risks*

3.2.4 Meteorological Radar

Aviation Risk	Distance	Risk Level
None identified.		

Table 5 *Identified Met Office risks*

3.2.5 MOD - Ministry of Defence Installations

Aviation Risk	Distance	Risk Level
Warton PSR	51.0 km	Low Radar concerns for buildings at this range are unlikely.
Low Flying System	N/A	Low (Area with no military low flying concerns).

Table 6 *Identified MOD risks*

3.3 Aviation Risk Assessment Summary

The initial assessment identified two keys risks; the SSR at Manchester Airport (safeguarded by NATS) and the OLS defined around the airport.

Secondary risks that are not included within the tables include Instrument Flight Procedures (IFPs) with respect to Manchester Airport's operations and the requirements for aviation lighting. These have also been explored.

The following sections provide further details and assessment of each identified risk in greater detail.

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 that is further away. The two predominant forms of interference are considered. These are:

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 7 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.
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.

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

[6] FRUIT – False Replies Unsynchronized in Time

5 RADAR LINE OF SIGHT AND INTERFERENCE ANALYSIS

5.1 Methodology

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

- Radar line of sight assessment based on the representative centre 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.

5.2 Line of Sight Analysis

A radar line of sight assessment was completed for the proposed development – considering the representative location of the four towers presented in Section 2.2.1. Figures 7 to 10 on the following pages show the line-of-sight charts from Manchester Airport SSR to the towers.

The box labelled 'certainty' in the figures provides the distance (in metres) by which the specific tower is within line of sight to the assessed radar (rounded to one decimal place). The proposed development will be visible to the radar. NATS, who safeguard the radar at Manchester Airport, will likely provide an initial objection[7].

[7] Initial inspection shows that the proposed development will not be sufficiently screened.

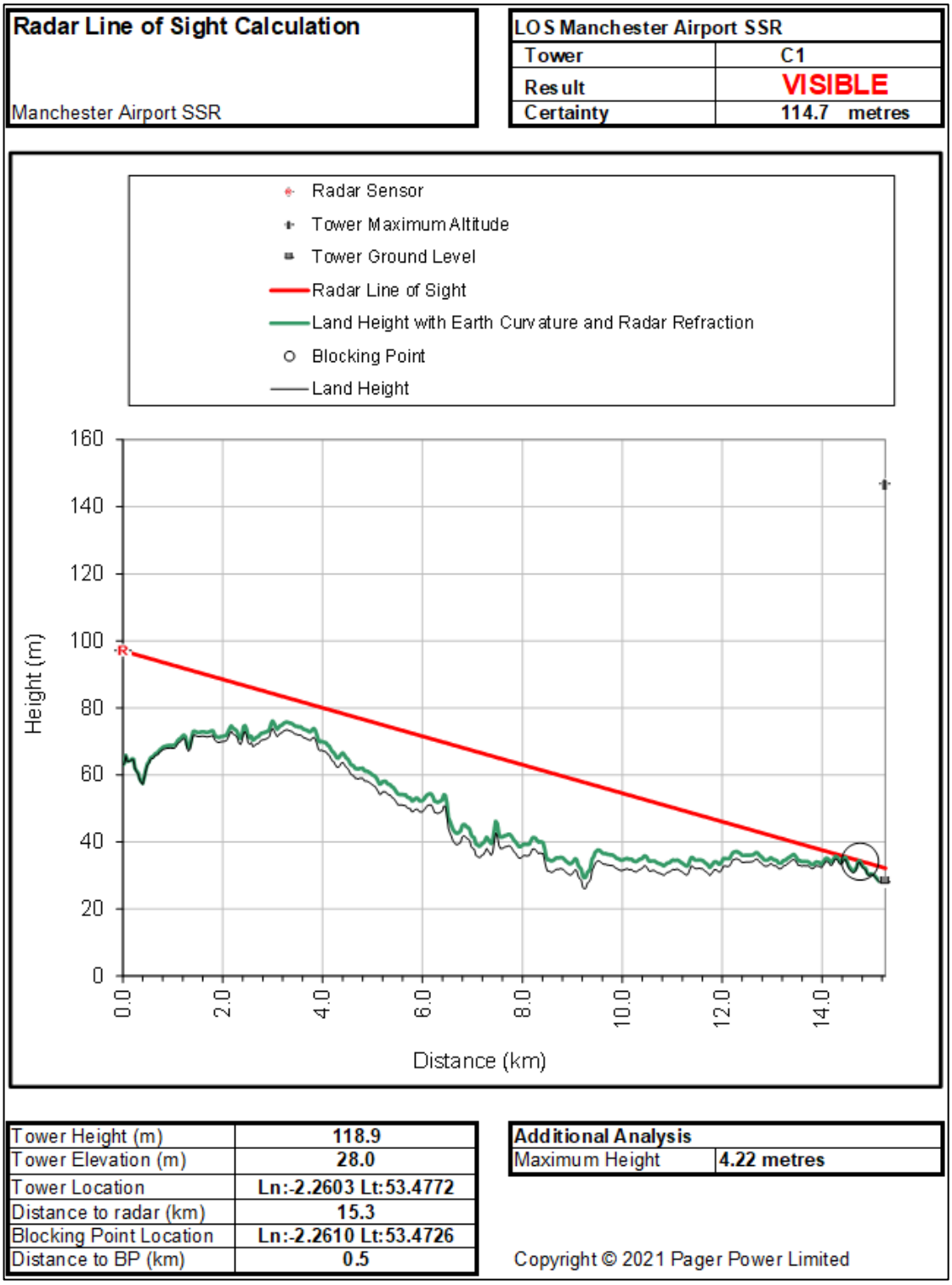


Figure 7 *Manchester Airport SSR visibility for tower C1*

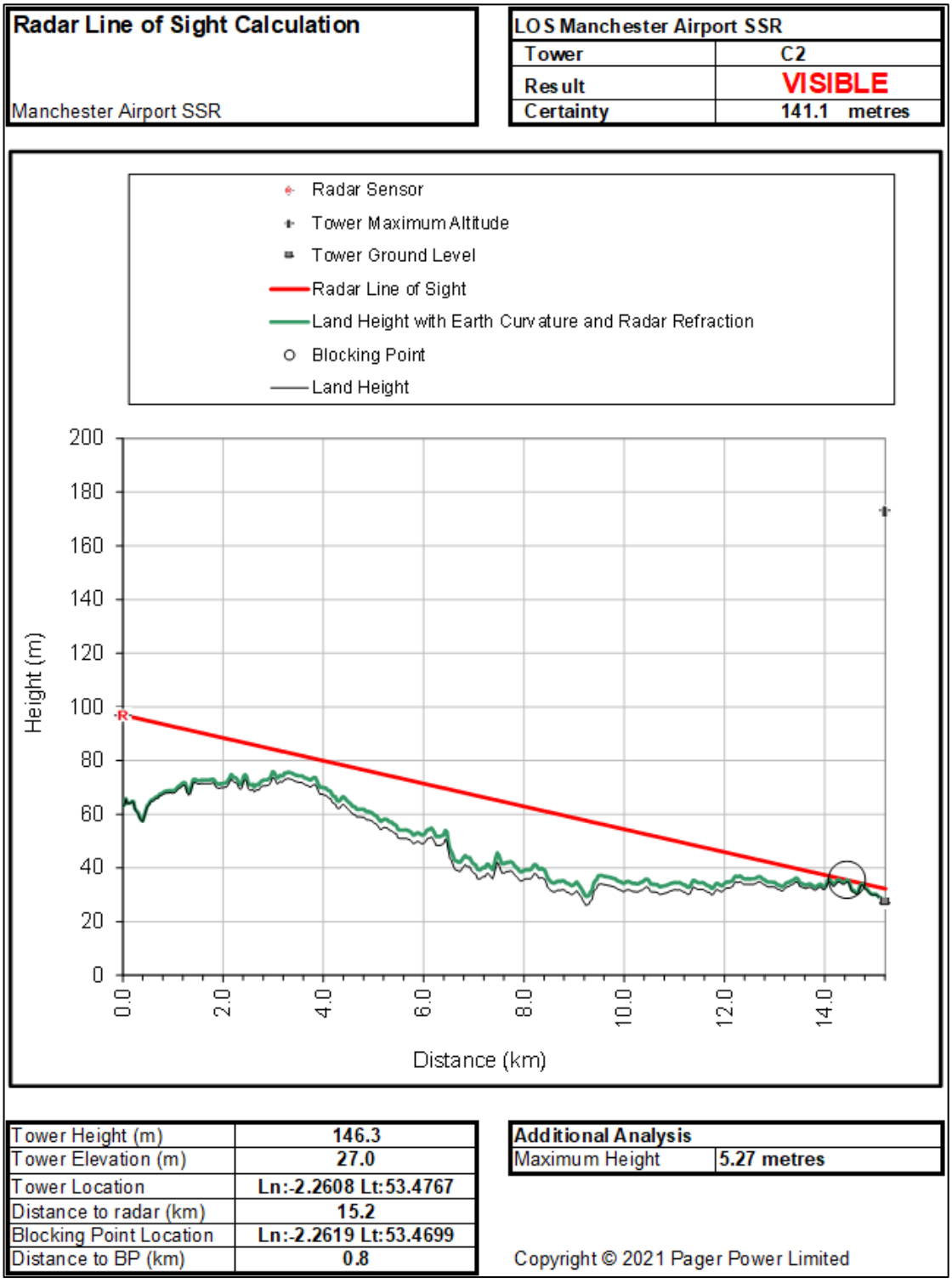


Figure 8 *Manchester Airport SSR visibility for tower C2*

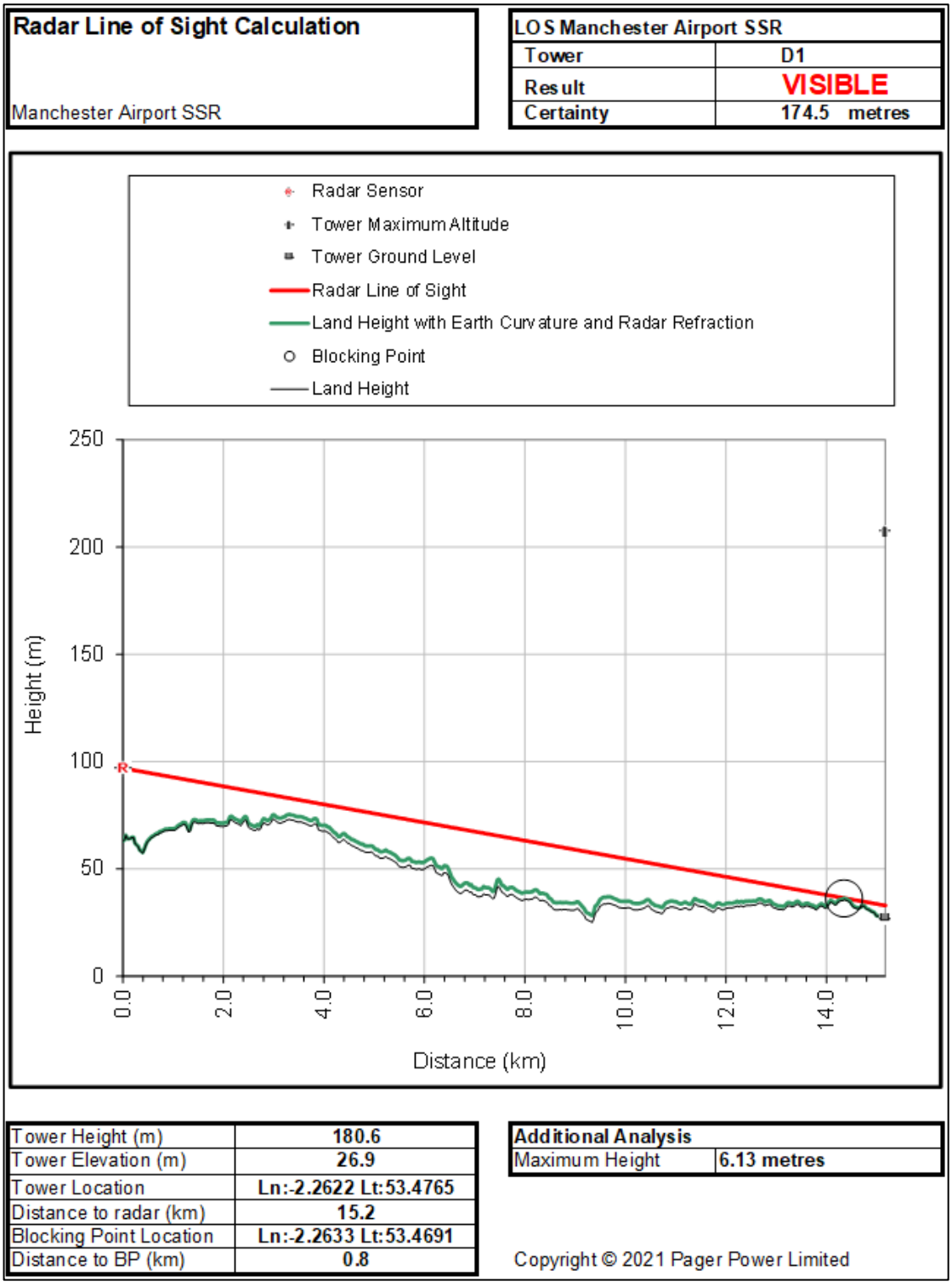


Figure 9 *Manchester Airport SSR visibility for tower D1*

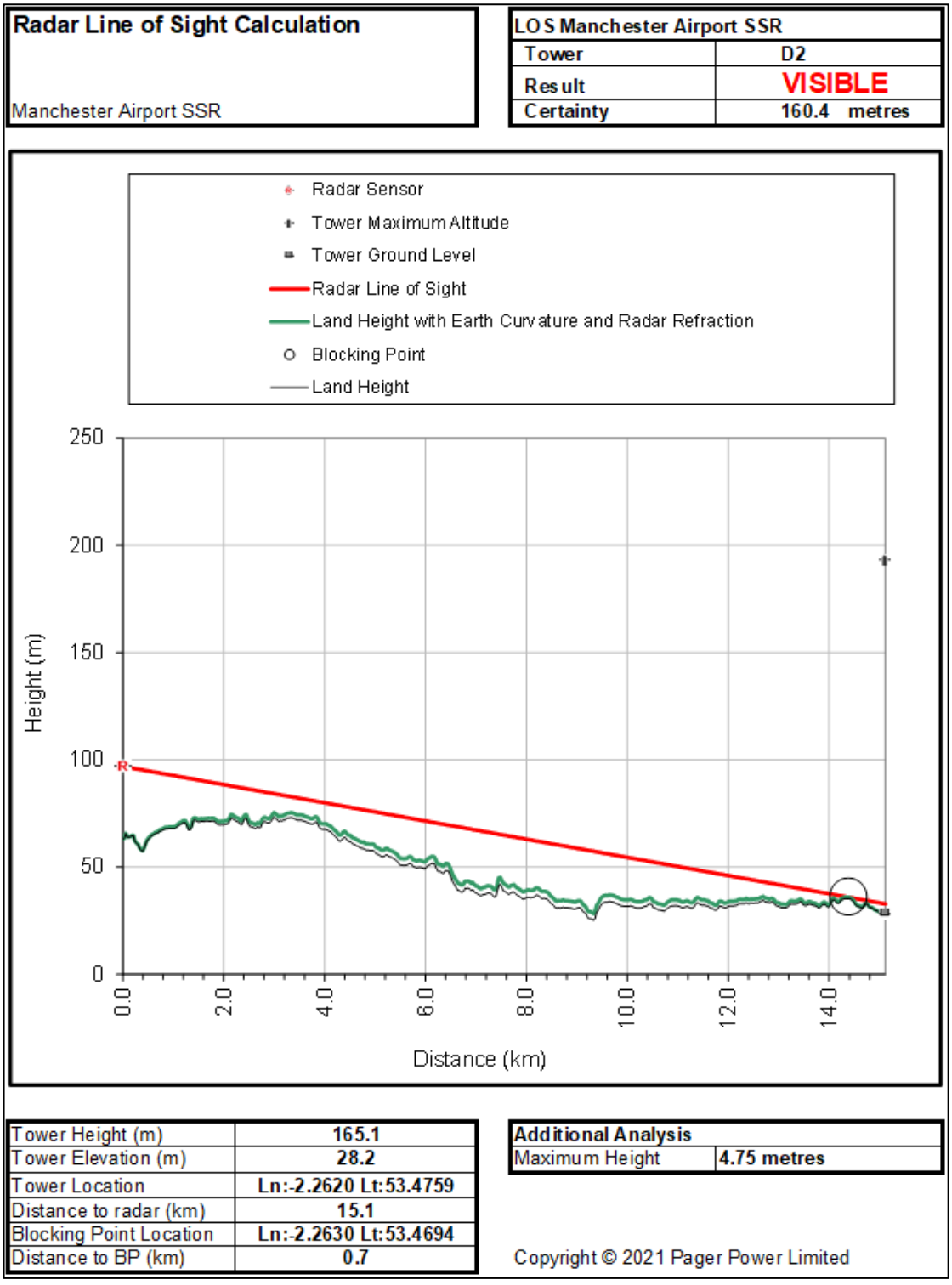


Figure 10 *Manchester Airport SSR visibility for tower D2*

5.2.1 Line of Sight Results – Bare Earth Terrain

The overall results are presented in Table 8 below.

Reference Point	Result and Visibility
C1	114.7 – Tower almost entirely visible
C2	141.1 – Tower almost entirely visible
D1	174.5 – Tower almost entirely visible
D2	160.4 – Tower almost entirely visible

Table 8 *Line of sight results for each assessed tower– bare earth terrain*

5.2.2 Additional Screening

A review of the line-of-sight profiles was undertaken to identify any potential additional screening that may significantly reduce the visibility of the towers to the SSR. The proposed development is located almost independent of other tall buildings within Manchester (relative to the radar) and does not benefit from any significant screening by other existing, under construction or consented developments. Whilst the towers do screen one another to some extent, there is no significant additional screening that warrants incorporation to the line-of-sight profiles.

5.2.3 Radar Line of Sight Conclusions

The results show that the towers would be significantly visible to the SSR at Manchester Airport and therefore technical and subsequent operational impacts upon the radar are possible. These are discussed further in the following section.

5.3 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.

5.3.1 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 must also 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.

Considering the proposed development's location relative to the radar, previous consultation with the airport, the current baseline scenario where taller buildings are already present in the city centre, and a SSR's in-built capability to deal with technical impacts generated by reflections, no significant reflection effects are anticipated that cannot be mitigated.

5.3.2 Shadowing Effects

Shadowing effects are possible that would lead to a potential loss of low-level coverage beyond the towers on the bearing from the radar. Considering existing developments within Manchester city centre, the potential impact of the proposed development on low-level coverage and the typical operation for aircraft over Manchester city centre, no significant impacts with respect to shadowing are anticipated.

5.4 Assessment Conclusions

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

Consultation with NATS, who safeguard the SSR at Manchester Airport, has been undertaken who have confirmed that mitigation will be implemented.

6 OBSTACLE LIMITATION SURFACES

6.1 Overview

The obstacle limitation surfaces (OLS) for Manchester Airport have been modelled with respect to the representative tower centre points presented in Section 2.2.1. The aim is to identify whether the proposed development infringes the OLS at Manchester Airport.

6.2 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 on the following page.

6.2.1 Obstacle Limitation Surfaces at Manchester Airport

The OLS for Manchester Airport have been modelled with respect to the representative tower centre locations. The OLS chart is shown in Figure 11 on the following page. The centre points are shown by the red crosses – due to the scale they appear as a single icon. The coloured lines represent the individual surfaces that make up the OLS for Manchester Airport. The yellow circular line represents the extent of the outer horizontal surface (OHS). The graph's axis are in longitude (x) and latitude (y).

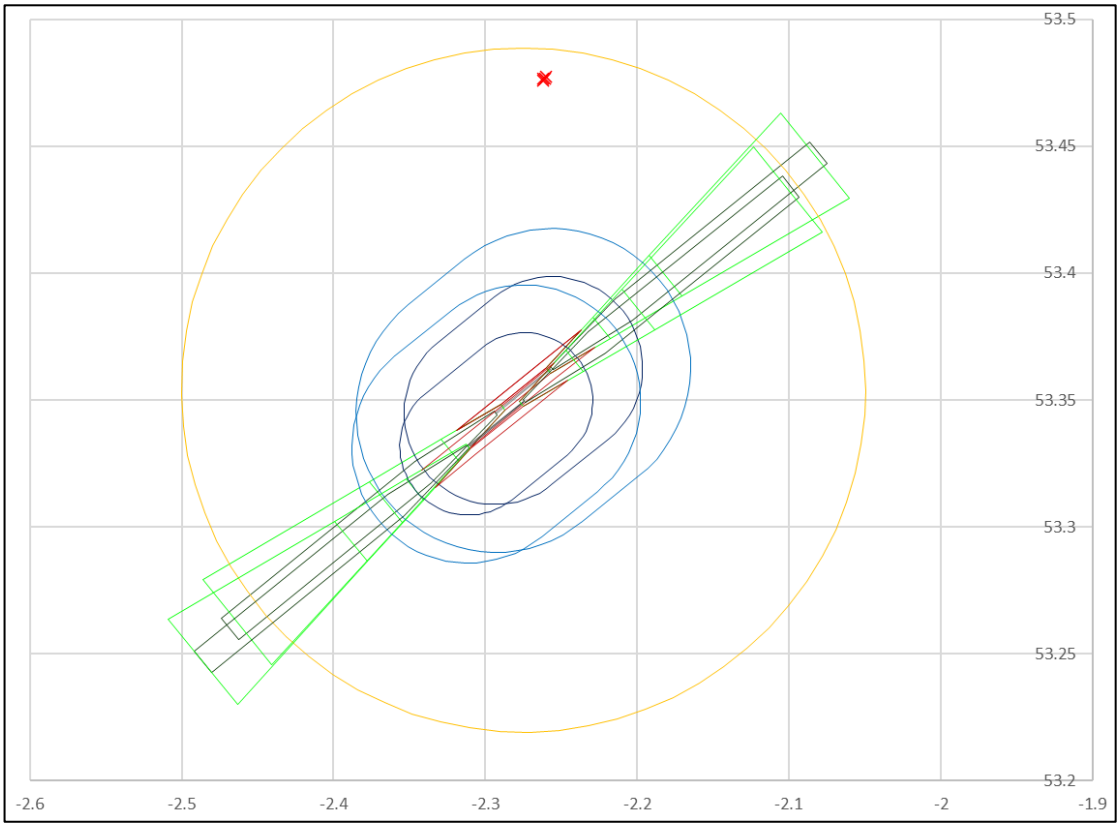


Figure 11 *OLS chart*

The proposed development lies below the OHS. The OHS is a flat surface that has an altitude of 206.69 metres. Table 9 below presents the representative centre points of the towers used within the technical analysis.

Tower	Longitude (°)	Latitude (°)	Altitude (m AOD)	Infringement/Clearance
C1	-2.260250	53.477205	146.875	59.8178
C2	-2.260792	53.476734	173.350	33.3428
D1	-2.262160	53.476472	207.550	-0.8572
D2	-2.261975	53.475931	193.300	13.3928

Table 9 *Detailed OLS assessment results*

6.3 Obstacle Limitation Surfaces Conclusions

The analysis has shown that the proposed development lies beneath the OHS in accordance with Manchester Airport's OLS model. Tower D1 infringes the OHS by 0.8572m. The remaining towers do not infringe the OLS.

Tower D1 will require aviation lighting on the basis of this infringement however the tower is also above 150m agl and, regardless of any infringement, would require lighting in accordance

with CAA guidance. This is the same for tower D2 which is also above 150m agl but does not infringe the OLS. Lighting is discussed further in Section 8 at a high level and separately within a detailed report in which a detailed lighting scheme for the towers has been produced.

Towe D1 represents a potential collision risk due to its height and infringement of the OLS. There are however other examples of infringements within the city centre. The infringement should therefore be discussed further with Manchester Airport to understand its acceptability. Alternatively, the height of the tower should be reduced by 0.8572m to remove the infringement.

6.4 Important Consideration – Crane Usage

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. Tower D1 will have a crane that infringes the OLS unless there is a significant reduction in height. If the cranes for the remaining towers extend to a height that infringes the OLS, then these infringements would also need to be considered alongside consultation with Manchester Airport.

Consultation with Manchester Airport should be conducted regarding crane usage and any temporary infringement of the OLS. Aviation lighting will be required for any infringement of the OLS, even temporary.

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

7 HIGH-LEVEL INSTRUMENT FLIGHT ANALYSIS

7.1 Overview

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

- Impact on Maximum Elevation Figures (MEF) shown on national aeronautical charts;
- 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 Area Minimum Altitude

The Area Minimum Altitude 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 3,400 feet amsl. The proposed development has a maximum altitude of 680.94 feet which is 2,719.06 feet below the Area Minimum Altitude. There are also existing taller and similarly sized buildings, approximately 650m-700m east to south east of the proposed development. 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 sector above is 2,400 feet amsl. The proposed development has a maximum altitude of 680.94 feet. The vertical clearance between aircraft subject to a radar control service and the top of both towers will be at least 1,719.06 feet. This is 735.06 feet greater than the specified clearance of 984 feet[9] 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. It should also be noted that taller and similarly sized structures are in the same area. Figure 12 on the following page shows the ATC Surveillance Minimum Altitude Chart for Manchester Airport. It presents the approximate location of the proposed development (red dot) 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).

[8] AD 2.EGCC-5-1, dated 08 Oct 19. Accessed 17/08/2021 (cropped).
[9] 300 metres

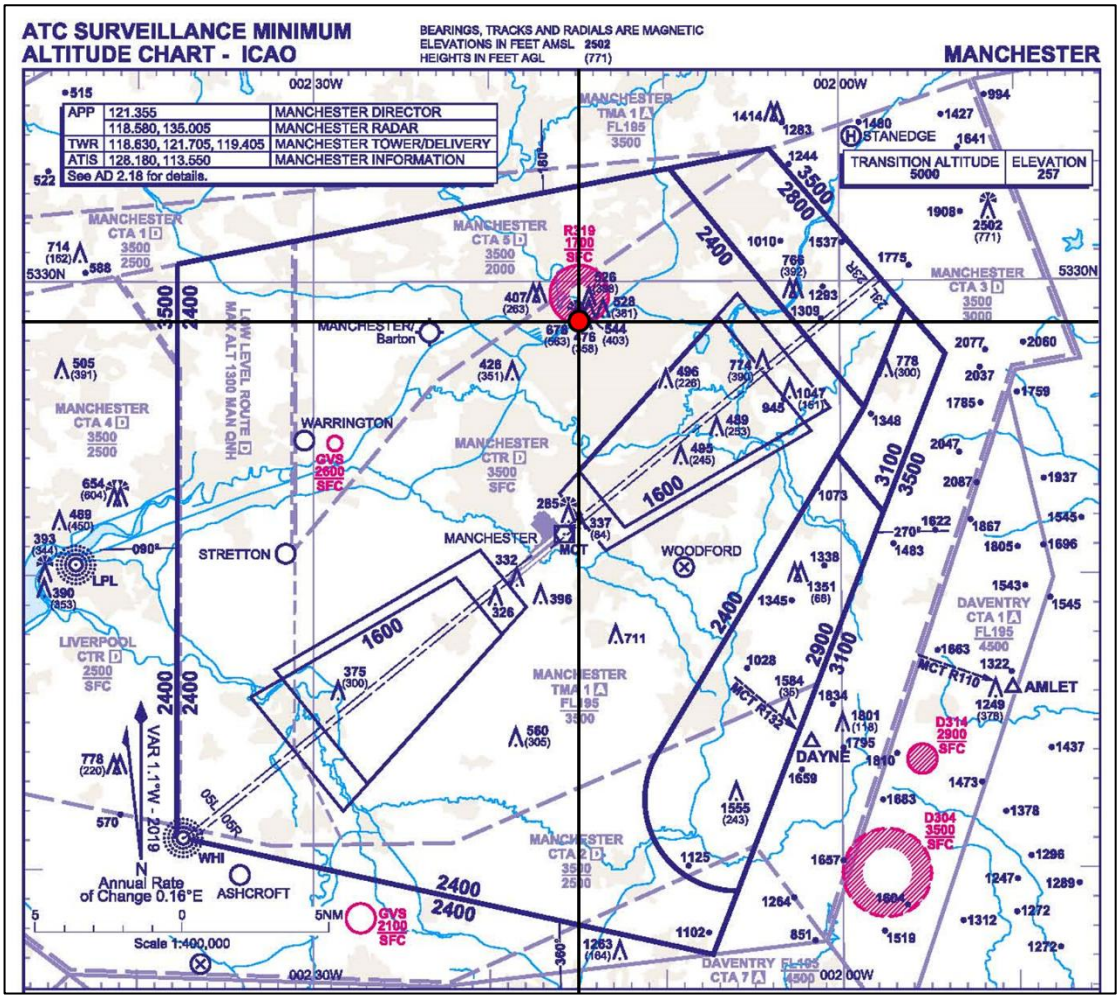


Figure 12 *Manchester Airport ATC Surveillance Minimum Altitude Chart*

7.4 High-level IFP Assessment – Obstacle Clearance Margins

As a general rule Instrument Flight Procedures (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 always 1,000 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 1,000 feet then it will not have a significant safety impact on aircraft flying the route. The maximum altitude of the proposed development is 681 feet[10].

[10] Rounded up to the nearest foot.

This means that aircraft subject to any IFP route or limit which is more than 1,681 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 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[11]. Results of the assessment are shown in Table 10 below.

SID Name	Observations	Assessed Impact	Recommendation
MONTY 1R 1S 1Y 1Z	Passes 2.7 nm to south west.	No impact due to horizontal and vertical clearance.	No further action.
ASMIM 1S 1Z/KUXEM 1R 1Y/EKLAD 1R 1Y	Passes 2.7 nm to south west.	No impact due to horizontal and vertical clearance.	No further action.
LISTO 2S 2Z	Southerly SID. Well clear.	No impact due to horizontal clearance.	No further action.
LISTO 2R 2Y	Southerly SID. Well clear.	No impact due to horizontal clearance.	No further action.
POL 5R 4S 1Y 1Z	Passes more than 5nm to east.	No impact due to horizontal clearance.	No further action.
SONEX 1R 1Y/DESIG 1S 1Z	Minimum altitude 5,000 feet over central Manchester.	No impact due to vertical clearance.	No further action.
SANBA 1R 1Y	South westerly SID.	No impact due to horizontal clearance.	No further action.

Table 10 *Standard Instrument Departure (SID) assessment results*

All towers and associated cranes are likely to present an acceptably low collision risk to aircraft flying all Standard Instrument Departure routes.

[11] The results will be similar for all towers.

7.6 Standard Arrival Charts (STARs)

Manchester Airport has six published Standard Arrival (STARs) Charts. Each of these has been assessed with respect to the proposed development[12]. Results of the assessment are shown in Table 11 below.

STAR Name	Observations	Assessed Impact	Recommendation
via ROSUN (north)	Minimum Altitude FL70	No impact due to vertical clearance	No further action
via DALEY (north)	Minimum Altitude FL70	No impact due to vertical clearance	No further action
via ROSUN (east)	Minimum Altitude FL70	No impact due to vertical clearance	No further action
via DALEY (east)	Minimum Altitude FL70	No impact due to vertical clearance	No further action
via MIRSI	Minimum Altitude 6,000 feet	No impact due to vertical clearance	No further action
via DAYNE	Minimum Altitude FL70	No impact due to vertical clearance	No further action

Table 11 *Standard Arrival Chart (STARs) Assessment Results*

Aircraft flying Manchester Airport's Standard Arrival Routes will be at least 5,319 feet vertically clear of the towers. This means that such aircraft will have an acceptably low collision risk.

[12] The results will be similar for all towers.

7.7 Standard Arrival Charts (STARs)

Manchester Airport has fifteen published Instrument Approach Charts. Each of these has been assessed with respect to the proposed development[13]. 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 12 below. V= vertically and H= horizontally.

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

[13] The results will be similar for all towers.

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

Table 12 *Instrument Approach Charts assessment results*

All towers are likely to present an acceptably low collision risk to aircraft flying all Instrument Approach Procedures. No further action is recommended.

7.8 High-level IFP Assessment – Obstacle Clearance Margins Conclusions

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. 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 no detailed IFP assessment is recommended. It is possible however that this could still be recommended by Manchester Airport.

8 HIGH-LEVEL AVIATION LIGHTING 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[14]. The following section explores the requirement for aviation lighting at a high-level. Separately a detailed lighting scheme has been produced.

8.2 Lighting Requirements

The following is true regarding the proposed towers:

- Two of the four towers extend above 150m agl[15] (D1 = 180.150m and D2 = 165.900m agl);
- Two of the four towers do not extend above 150m agl (C1 = 119.475m and C2 = 145.950 agl);
- One of the towers infringes the OHS of Manchester Airport (D1 by 0.8572m);
- Three of the towers do not infringe the OLS (C1, C2 and D2);
- Cranes are expected to be above 150m agl and infringe the OHS of Manchester Airport.

On this basis, aviation lighting is mandatory as per the associated CAA guidance and because of the infringement of the OLS (tower D1). The following lighting arrangements are therefore recommended:

- The towers will be lit with medium intensity lights;
- Intermediate lights on each tower will be included, as appropriate;
- The top of any associated crane will be lit with medium intensity lights;
- The towers tower will be marked on CAA Aeronautical Charts;
- Any associated crane will be marked on CAA Aeronautical charts or a Notice to Airmen (NOTAM) will have been issued advising of the crane's height and location.

The specific aviation lighting scheme for each tower is presented separately (Pager Power report 10685B).

[14] CAP 168 Licensing of Aerodromes, Edition 11, January 2019. Last accessed 17.08.21.
[15] Based on the ground heights provided within the development plans.

9 CONCLUSIONS

9.1 Analysis Results

9.1.1 Manchester Airport's Obstacle Limitation Surfaces

- The proposed development site is beneath the outer horizontal surface (OHS) of Manchester Airport;
- The analysis has shown that tower D1, with a maximum altitude of 207.550m amsl, would infringe the OHS;
- The remaining towers (C1, C2 and D2) would not infringe the OLS. The minimum margin of clearance is 13.3928m;
- Crane usage will need to be considered due to the close proximity and expected infringement of the OHS. It is likely a Crane Operations Scheme will be required;
- Consultation with the safeguarding team at Manchester Airport should be undertaken to discuss the infringement and acceptability of tower D1. Tower D1 will also need to be lit – aviation lighting is discussed within a separate report.

9.1.2 Manchester Airport SSR

- The proposed development is located approximately 15.1km from the SSR at Manchester Airport and will be visible to it;
- The proposed development will not be significantly screened by existing buildings along the line-of-sight path;
- The proposed development will be of similar scale to those in Manchester city centre where mitigation has been required;
- Whilst no significant shadowing effects are anticipated, reflections effects are still possible as the proposed development will introduce new unobstructed 'reflectors' to the line of sight of the SSR;
- Consultation with NATS, who safeguard the Manchester Airport radar, has been undertaken who have confirmed that mitigation will be implemented by way of a technical fix.

9.1.3 Instrument Flight Procedures at Manchester Airport – High-Level

A high-level review of the IFPs relative to the proposed development indicates sufficient clearances. There are also taller existing buildings in the immediate surrounding area that already co-exist with the current IFPs. Therefore, no impact upon the IFPs is predicted and no detailed IFP assessment is recommended. It is possible however that this could still be recommended by Manchester Airport.

9.1.4 Aviation Lighting Requirement

The towers and associated cranes should be lit with medium intensity aviation lighting, as appropriate, because they extend to 150m agl and above, and due to an infringement of the OLS (tower D1). The specific aviation lighting scheme for each tower is presented separately (Pager Power report 10685B).

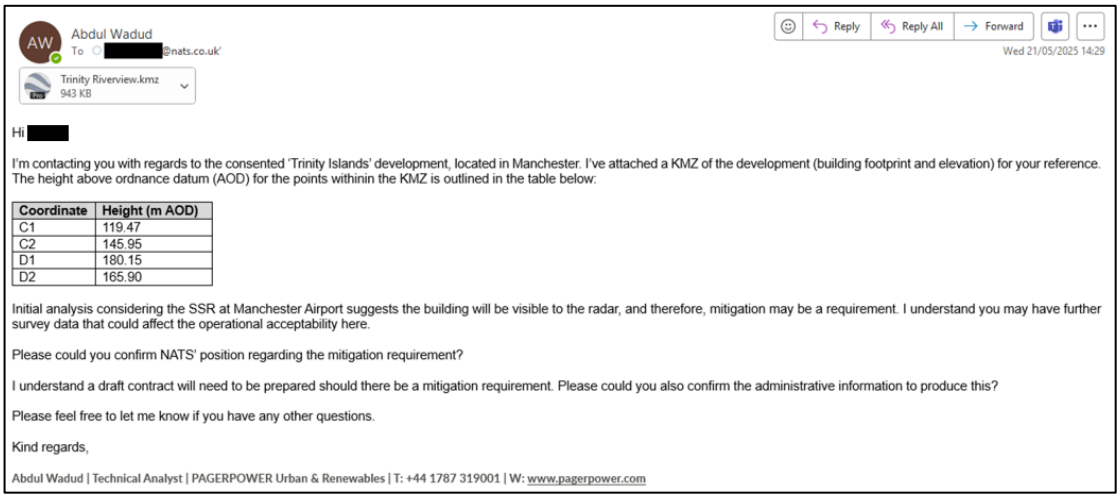
9.2 Overall Conclusions

The results of the analysis revealed that the proposed development would infringe the OLS at Manchester Airport, and therefore it may present a collision risk. Regardless of this infringement, lighting will be required for two towers due to their height above ground level to comply with CAA guidance. The OLS infringement should be discussed further with Manchester Airport.

Consultation with NATS, who safeguard the SSR at Manchester Airport, has been undertaken who have confirmed that mitigation will be implemented.

APPENDIX A – NATS CONSULTATION

The images below are extracts from consultation undertaken with NATS regarding the impact and mitigation requirement.



Abdul Wadud
To [redacted]@nats.co.uk'
Reply | Reply All | Forward
Wed 21/05/2025 14:29

Trinity Riverview.kmz
943 KB

Hi [redacted]

I'm contacting you with regards to the consented 'Trinity Islands' development, located in Manchester. I've attached a KMZ of the development (building footprint and elevation) for your reference. The height above ordnance datum (AOD) for the points withinin the KMZ is outlined in the table below:

Coordinate	Height (m AOD)
C1	119.47
C2	145.95
D1	180.15
D2	165.90

Initial analysis considering the SSR at Manchester Airport suggests the building will be visible to the radar, and therefore, mitigation may be a requirement. I understand you may have further survey data that could affect the operational acceptability here.

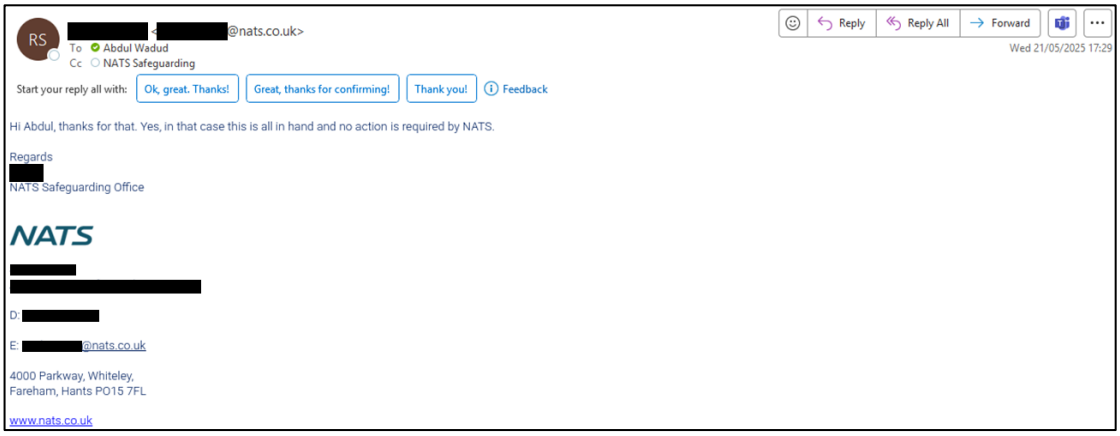
Please could you confirm NATS' position regarding the mitigation requirement?

I understand a draft contract will need to be prepared should there be a mitigation requirement. Please could you also confirm the administrative information to produce this?

Please feel free to let me know if you have any other questions.

Kind regards,

Abdul Wadud | Technical Analyst | PAGERPOWER Urban & Renewables | T: +44 1787 319001 | W: www.pagerpower.com



[redacted] <[redacted]@nats.co.uk>
To Abdul Wadud
Cc NATS Safeguarding
Reply | Reply All | Forward
Wed 21/05/2025 17:29

Start your reply all with: Ok, great. Thanks! | Great, thanks for confirming! | Thank you! | Feedback

Hi Abdul, thanks for that. Yes, in that case this is all in hand and no action is required by NATS.

Regards
[redacted]
NATS Safeguarding Office

NATS

[redacted]
[redacted]

D: [redacted]

E: [redacted]@nats.co.uk

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