8.0 AVIATION

INTRODUCTION

8.1 This Chapter of the ES assesses the potential of likely significant impacts of the proposed development on the civil and military aviation operational environment and on civil and military aviation radar and radio infrastructure. The Chapter is supported by Figure 8.1: Civil Aviation Authority (CAA) 250K Chart Extract and Figure 8.2: Civil Aviation Authority (CAA) 500K Chart Extract and describes the methods used to assess the impacts, the baseline conditions currently existing at the site and in the surrounding area, the mitigation measures required to prevent, reduce or offset any significant adverse effects and the likely residual impacts after these measures have been adopted.

8.2 The interaction between turbines and aviation is well-documented and publicised. In assessing the potential effects which may result from the proposed development, the primary consideration is that of the safety of aviation operations, both civil and military. In this context the following delineation applies:

- civil aviation interests, include "*En Route*" facilities managed and operated by National Air Traffic Services (En Route) Ltd (NERL), airports, licensed and unlicensed aerodromes, light aircraft landing strips, microlight sites, parachute, gliding sites, and

- military facilities including Ministry of Defence (MOD) Airfields and military Air Traffic Control (ATC) facilities, Air Defence Radars, Danger Areas and Ranges and low flying operations.

8.3 This Aviation Chapter has been produced by Wind Farm Aviation Safeguarding Ltd (WFAS), a specialist technical aviation windfarm consultancy. The Managing Director and Senior Consultant within WFAS is Cdr Shane Savage, BSc. RN (Rtd). He has over 35 years' experience as an Air Traffic Controller and Aviation Regulator and his extensive experience includes an appointment within the Ministry of Defence responsible for Defence Windfarm Policy, RN Airspace Policy and airspace regulatory issues. His naval career culminated in leading both the ATC and Fighter Control specialisations as Head of Operations Support to the Fleet Air Arm. With almost unrivalled continuous MOD wind farm experience, lasting for most of the 12-year period to 2011, he was latterly the Royal Navy's Desk Officer for aviation infrastructure including airfields, radars and radio sites as well as being the RN Safeguarding Authority for aviation. As a co-author of the initial MOD Guidelines for Wind Farm Developers, as the Ministry of Defence Desk Officer responsible for military Wind farm policy, he has represented Defence and the Royal Navy at every level of wind farm assessment and policy formulation both offshore and onshore. Since 2011 he has provided advice on the interaction between wind turbines and aviation including assessing over 2000 wind turbine proposals and giving evidence at Planning Inquiries and Appeals in the UK and Ireland. He has also advised several Local

Authorities on this issue. His team includes experts on radar propagation and modelling and low flying operations.[1]

8.4 A Telecommunications Statement is included as Appendix 8.1 of this chapter.

POLICY AND LEGISLATIVE CONTEXT

National Planning Policy

8.5 There are a number of aviation publications relevant to the interaction of aviation and wind turbines which contain regulation, legislation and guidance which, combined, account for all aspects of aviation operations within the UK. These publications include:

- Civil Aviation Publication (CAP) 764 Civil Aviation Authority (CAA) Policy and Guidance on Wind Turbines, Version 6, Feb 2016;
- CAP 168 Licensing of Aerodromes, Version 12 corr, Jan 2022;
- CAP 670 ATS Safety Requirements, Issue 3 Am 1/2019, June 2019;
- CAP 774 UK Flight Information Services, Version 4, Dec 2021;
- CAP 738 Safeguarding of Aerodromes, Version 3, Oct 2020;
- CAP 793 Safe Operating Practices at Unlicensed Aerodromes, Ed 1, July 2010;
- CAP 493 Manual of Air Traffic Services Part 1, Version 10, Feb 2022.
- CAP393 The Air Navigation Order and Regulations (CAA 2016), Version 6, Feb 2021;
- CAP 660 Parachuting, Version 5, March 2020;
- CAP 1096 Guidance to crane users on the crane notification process and obstacle lighting and marking, Version 2.2, April 2021;
- Military Aviation Authority Traffic Management (3000 series) Instructions;
- Military Aviation Authority Regulatory Article 2330 (Low Flying);
- UK Aeronautical Information Publications (AIP);
- CAA 1:250,000 and 1:500,000 VFR Charts; and
- CAA Policy Statement: Lighting of En-Route Obstacles and Onshore Wind Turbines Apr 2010.

[1] Since this aviation chapter was compiled some of the turbine positions have been subjected to very minor amendment due to topographical and siting constraints; it is not anticipated that these small alterations will result in significant changes to the modelling results.

ASSESSMENT METHODOLOGY

8.6 This section provides an outline description of the methodology and significance criteria used to assess any effects that the proposed development would have on aviation operations in the area. The study area for the aviation assessment was based upon standard practice as laid down in CAA CAP 764 as detailed in paragraph 8.4.

8.7 The civil and military aviation assessment study area is dependent on the maximum operating ranges of each of the radar systems either in the vicinity of the proposed development or considered to have the range to survey the airspace over the site. The ranges of those radars, and the subsequent study area, depends on the technical specification of the systems and, possibly, different installations of the same system.

8.8 The operational range of the radar system is dependent on the function of the radar, the operational requirement of the radar and on the type of radar used. Consequently, the study area is defined in relation to the varying radar systems in operation in the extended area surrounding the proposed development area including civil, military and national air traffic services facilities and following relevant guidance within civil and military guidance.

8.9 The assessment of possible effects of the proposed development is based upon the guidance laid down in CAA Publication CAP 764 'Policy and Guidelines on Wind Turbines' Version 6 Dated February 2016, with the consultation criteria for aviation stakeholders defined in Chapter 4 of that document. These distances inform the size of the study area and include:

- Airfield with a surveillance radar – within 30 km;
- Non radar licensed aerodrome with a runway of more than 1,100 m – within 17 km;
- Non radar licensed aerodrome with a runway of less than 1,100 m – within 5 km;
- Licensed aerodromes where the turbines would lie within airspace coincidental with any published Instrument Flight Procedure (IFP);
- Unlicensed aerodromes with runways of more than 800 m – within 4 km;
- Unlicensed aerodromes with runways of less than 800 m– within 3 km;
- Gliding sites – within 10 km; and
- Other aviation activity such as parachute sites and microlight sites within 3 km – in such instances developers are referred to appropriate organisations.

8.10 CAP 764 goes on to state that these distances are for guidance purposes only and do not represent ranges beyond which all wind turbine developments will be approved or within which they will always be objected to. These ranges are intended as a prompt for further consultation between developers and aviation stakeholders and which may result in the

study area being modified as required based on specific airspace and operational considerations.

8.11 It is also necessary to take into account the aviation and air defence activities of the Ministry of Defence (MOD) as safeguarded by the Defence Infrastructure Organisation (DIO). The types of issues that are addressed in this chapter include:

- MOD Airfields, both radar and non-radar equipped;
- MOD Air Defence Radars;
- MOD (now UK Met Office) Meteorological Radars; and
- Military Low Flying.

8.12 Military radars are not subject to any stated range within which developments have to be considered for possible effects.

8.13 It is also necessary to take into account the possible effects of wind turbines upon the NERL communications, navigation and surveillance systems – a network of primary and secondary radars and navigation facilities around the country.

8.14 As well as examining the technical impact of wind turbines on Air Traffic Control (ATC) facilities, it is also necessary to consider the physical safeguarding of ATC operations using the criteria laid down in CAP 168 Licensing of Aerodromes to determine whether the proposed development will breach obstacle clearance criteria.

Assessment and Evaluation of Effects

8.15 Assessment of potential effects has been undertaken by identifying whether impacts are anticipated upon aviation and radar infrastructure and, therefore, whether aviation stakeholders are anticipated to object to the proposed development.

Requirement for Mitigation

8.16 Should effects upon aviation operations and aviation radar/radio infrastructure from the proposed development be identified, mitigation measures will be identified and reported.

Assessment of Residual Effects

8.17 As per the assessment of potential effects the assessment will not determine significance but whether the proposed development will give rise to a residual effect or not.

Assessment and Evaluation of Effects

8.18 Based on the baseline conditions details, the effects of turbines on either civil or military aviation safeguarding fall into two categories:

- effects on an aerodrome and the associated safeguarded surfaces which surround it i.e. the presence of structures and obstacles that could potentially cause physical

harm through risk of collision or lead to an increase in instrument approach minima; and

- effects on the communications, navigation and surveillance (CNS) systems used to enable the provision of air traffic control (airport terminal and “en route” navigational services) and air defence.

8.19 This assessment considers all aviation radar and radio systems that are predicted to be impacted by the detectability of wind turbines placed within the site for both civil and military operations. For each identified receptor, the physical obstruction and/or radar or radio effect and then, subsequently, the operational impacts are considered along with any other potential effects. This assessment has been informed by the results of baseline studies, results of a radar LoS analysis and responses to consultation and with reference to the existing evidence regarding the effects of onshore wind farm development.

8.20 Primary radar relies on transmitted and reflected electromagnetic radiation and does not require any cooperation or response by the aircraft target under surveillance. The radar emits a signal and times how long it takes the signal to be reflected which allows the system to measure the distance between the radar and the object. The amount of energy that is reflected back by that object is a result of the object’s Radar Cross Section (RCS). Where the time for the reflected energy to be received by the radar is constant i.e the object is stationary, then algorithms are employed within the radar system to remove that from the airspace information displayed on an air traffic controller’s radar screen.

8.21 In consideration of rotating wind turbines, these are moving objects and, generally, the larger a turbine is, the larger its RCS will be. Once the wind turbine is operational and rotating, the moving blades will result in more energy being reflected and an increased chance of it creating unwanted returns, known as ‘clutter’ to be presented on the radar display. Under some circumstance/conditions ATC operators cannot differentiate between clutter and real aircraft and are required to assume that the clutter is an aircraft and to a minimum separation on that or, for larger developments, that an aircraft return could be masked by turbine returns and avoid the development as a whole. Additionally, turbines may represent a physical obstruction to flight in the area.

8.22 Furthermore, where turbines are in the vicinity of air to ground transmitters and receivers, they can give rise to degradation of air/ground communications due to an effect called multi-path scattering. That multi-path scattering or propagation results in a delayed version of the required signal to arrive at the receiver. In simple terms, the larger the RCS of the turbine and the closer that turbine is to a Receiver (Rx) or Transmitter (Tx), then the greater potential for interference.

Significance criteria

8.23 In assessing the significance of the effects from the proposed development on aviation operations, it is necessary to undertake an assessment of the potential technical effects on CNS systems and to then determine if the technical effect would lead to a significant effect on operations or flight safety.

8.24 The analysis completed involved a thorough review of aviation charts, our aviation database and the regulations and guidance. Having identified all potential aviation stakeholders and potential effects on their operations the assessment then focussed on any possible options that could mitigate the effect on those operations, if required.

8.25 The sensitivity of a receptor is subjective in aviation terms and therefore difficult to quantify. The fact that a wind farm might affect the performance of a radar system for example, does not always lead to the conclusion that there will be a significant effect. The guidance laid down in CAP 764 encourages a dialogue between the developer and aviation stakeholders to agree what effect, if any, there will be on operations, to determine if that effect is acceptable within an operational context and, if not, then to agree mitigation if any is feasible.

8.26 To determine the potential effects of the proposed development on aviation operations, the sensitivity of each receptor was considered in relation to the magnitude of effect. Tables 8.1 - 8.3 provide the definition of terms relating to the assessment of aviation effects and the sensitivity of aviation receptors.

8.27 The 'magnitude of impact' for the proposed development is based on potential radar and operational impacts.

Table 8.1: Sensitivity of Receptor

Sensitivity	Criteria
High	Affected facility or airspace user has no capacity to accommodate the proposed form of change.
Medium	Some restrictions on the stakeholders' ability to provide full and unrestricted ATC services or to conduct aviation operations across the area.
Low	Minor restrictions on the stakeholders' ability to provide full and unrestricted ATC services or to conduct aviation operations across the area.
Very Low	Very minor restrictions on the stakeholders' ability to provide full and unrestricted ATC services or to conduct aviation operations across the area.

Table 8.2: Aviation Magnitude of Impact

Magnitude	Criteria
High	Total compromise on aviation operations or to receptor's CNS ability to continue safe operations or safe provision of air navigation services.
Moderate	Significant compromise on aviation operations or to receptor's CNS ability to continue safe operations or safe provision of air navigation services.
Minor	Some restrictions on aviation operations or on receptor's CNS ability to continue safe operations or safe provision of air navigation services.

Magnitude	Criteria
Negligible	Very minor or no restrictions on aviation operations or on receptor's CNS ability to continue safe operations or safe provision of air navigation services.

Table 8.3: Overall Significance of Effect

Sensitivity of Receptor/Magnitude of Effect	High	Medium	Low	Very Low
High	Major	Moderate	Minor	Negligible
Moderate	Moderate	Moderate	Minor	Negligible
Minor	Minor	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

8.28 The definitions of the effects in Table 8.3 are:

- **Major**: a significant restriction on the ability of the Air Navigation Service Provider (ANSP) to continue to ensure safety and/or provide unrestricted air traffic services,
- **Moderate**: a possible restriction on the ability of the ANSP to continue to ensure safety and/or provide unrestricted air traffic services but which might be mitigated by changes to operating procedures or technical mitigation,
- **Minor**: a possible restriction on the ability of the Air Navigation Service Provider to continue to provide unrestricted air traffic services but which is manageable with little change to existing operating procedures, and
- **Negligible**: any effect should be completely manageable within current operating practices and without any requirement for change to procedures.

Limitations and Assumptions

8.29 The civil and military aviation assessment is based on the following key assumptions:

- the maximum number of turbines will be 22;
- the maximum turbine diameter will be 61m; and
- the maximum blade tip height will be 115m above ground level (agl).

8.30 The aviation infrastructure and receptors considered for the assessment of effects were based upon detailed desktop screening exercises and modelling. Each receptor has been considered and scoped in or out based on the results on the radar modelling/effect–receptor pathway, professional knowledge, data confidence and the development layout. There are no limitations in the completion of the assessment, however LoS conclusions are based on theoretical radar modelling results.

Consultation

8.31 Aviation consultation has been undertaken with the following consultees in accordance with the regulations and guidance detailed at 8.3 and as summarised within Table 8.4.

Table 8.4: Summary of Consultations

Summary of Matter Raised	Reference in ES Chapter
Ministry of Defence - Defence Infrastructure Organisation (DIO)	
The MoD (DIO) do not formally comment on any proposed development until a Planning Application for that proposal has been submitted; any consultation prior to that should be regarded as pre-planning and informal. In their Pre-Application response (DIO10054077, dated 2 February 2022) DIO raised potential for concerns regarding the proposal in respect of: • Wembury Radar • Portreath ADR • Military Low flying The response also highlighted the need for consultation with the Met Office in relation to their radar network.	Paragraph 8.56
NERL	
There has been extensive pre-application consultation with NATS Safeguarding, on behalf of NERL, in order to account for the proximity of the proposed development to the Davidstow (Tichbarrow) Tx and Rx and to afford the opportunity for NATS' requirements to be reflected in the final layout such that potential radio interference could be minimised. The layout is based on NATS requirements and one which reduces anticipated effects on the Tx and Rx to below an acceptable threshold. It is anticipated that, as a result of consultation and that NATS required design layout, the application will not be objected to by NERL. (Email NATS Safeguarding 06 April 2022 @ 16:23.)	Paragraph 8.66
Newquay Cornwall Airport (NCA)	

Summary of Matter Raised	Reference in ES Chapter
Although outside of the stipulated consultation distance within CAP 764, NCA were consulted on all possible original 33 positions and were provided details of the conducted, detailed radar modelling. In their response NCA stated that "*At that range and that elevation the turbines are not of any significance to the Airport and will not effect the obstacle limitation surfaces or interfere with the instrument approach procedures"* (sic) and that there would be *"no objection to any of the proposed locations",* email NCA 20 September 2021 @ 15.16.	Paragraph 8.36

BASELINE CONDITIONS

8.32 The attached charts included within Figures 8.1 and 8.2 illustrate the surrounding airspace environment. The proposed development is located within quite a complex aviation environment with over-lapping radar coverage from civil and military facilities and with significant areas of military operation and Danger Areas to be considered.

8.33 Figures 8.1 and 8.2 illustrate that the site is within Class G, the least regulated airspace, which extends from ground level to Flight level (FL) 195 (approximately 19,500ft). The closest regulated airspace is Class A controlled airspace above that and to the east of the site within the Berry Head Control Area, shown on Figure 8.2 with a thick purple boundary. The nearest civil radar equipped airport is at Newquay Cornwall Airport which is shown by a ring of purple dots with the Instrument Landing System approaches to the main runway shown by the lines of chevrons aligned northwest/southeast.

8.34 In military terms, to the west of the location and marked by hashed blue lines are the overlapping military danger areas of D001 and the D064 complexes. Additional military danger areas are similarly marked to the south, or bottom of the chart and which are associated with military activity in the English Channel. Beyond Newquay, to the south-west, the line of blue diamonds in the bottom left-hand corner represents the boundary of the Culdrose Area of Intense Aerial Activity (AIAA). A long-range Air Defence Radar (ADR) facility is located at Porthreath.

8.35 Interspersed around the south-west area the numerous unlicensed airfields annotated with a white small white circle edged in blue such as those at Davidstow, Truro, Perranporth, Bodmin, Sheepwash and St Merryn.

8.36 A number of receptors and consultees were scoped out from the final assessment of effects process due to:

- the system/stakeholder is located outside of the standard consultation distances stated in CAP 764,
- conclusions of radar Line of Sight (LoS) analysis indicate that assessed radar systems would not detect the proposed development turbines; and
- Initial consultation responses provided.

Licensed Aerodromes

8.37 There are no licensed radar equipped aerodromes within 30 km. The closest is Newquay Cornwall Airport 40 km to the south-west. Radar modelling shows there is no possibility of the radar being affected. There is no statutory requirement to consult with Newquay Cornwall Airport but, at the suggestion of Cornwall Council, the safeguarding authorities at the airport were informed of the development and provided with the radar modelling results indicating that there could be no LoS from their radar to the proposed development.

8.38 There are no licensed non-radar equipped aerodromes within 17 km.

Unlicensed Aerodromes

8.39 There is a private airstrip at North Tregeare Farm approximately 1.5 km north-east of the nearest turbine within the proposed development.

8.40 Davidstow Moor is just outside the 3 km distance from the closest of the turbines within the proposed development.

Ministry of Defence - Air Traffic Control radars

8.41 The military ATC radar at Royal Naval Air Station Culdrose 82 km to the south-west adjacent to the town of Helston. Detailed radar modelling illustrates that there is no possibility that the radar will be able to detect the turbines and the radar has been scoped out from further consideration.

Ministry of Defence - Air Defence Radar

8.42 The UK maintains an Air Defence Radar (ADR) network covering the whole of UK airspace. The radar pictures from the network are related to the Air Defence Control and Reporting Centres which continually monitor that airspace for potential intruding aircraft. The closest ADR to the proposed development is located at Portreath, 66 km to the south-west. Radar modelling illustrates that there should be no LoS between the radar and any of the turbines within the proposed development. However, in the pre-planning response to the initial layout under consideration DIO raised concerns regarding one single turbine (turbine 27); that turbine has been removed from the extant layout and the radar has been removed from further consideration.

Met Office Radars

8.43 The Met Office safeguards its network of radars using a European methodology known as OPERA. In general, they will object to any turbine within 5 km in LoS and will examine the impact of any turbines within 20 km. Where a site is within 20 km, the Met Office will undertake an operational assessment based on three main criteria, having determined if there is a technical effect on the radar. The factors they will consider include the following:

- proximity to airports;
- river catchment response times; and

- population density.

8.44 In this case the closest Met Office radar is at Predannack airfield 86 km to the south-west and well beyond the 20 km assessment distance. On this basis, there will be no Met Office radar objection to the proposed development and the radar has been scoped out from further consideration and consultation is not required.

NERL

8.45 An assessment has been conducted to determine any effect of the proposed development on NERL communications, navigation and surveillance infrastructure (CNS). The closest NERL radar is located at Burrington, 50 km to the north-east.

8.46 The radar modelling results demonstrate that there will be LoS between the proposed development and the Burrington radar. However, due to internal NATS procedures for controlling aircraft within the area there should be No Change to NATS operations and the radar has been scoped out from further consideration.

Receptor Sensitivity

8.47 When comparing the receptors to Table 8.3, It is considered that the receptors detailed above have the following sensitivity classifications:

- Licensed Aerodromes: High
- Unlicensed Aerodromes: High
- Ministry of Defence - Air Traffic Control radars: High
- Ministry of Defence - Air Defence Radar: High
- Met Office Radars: High
- NERL: High

CONSTRUCTION PHASE EFFECTS AND MITIGATION MEASURES

8.48 The fact that any tall object can represent a vertical obstacle to flight and, potentially, pose a flight safety risk is self-evident. Throughout the construction phase, and up to including any testing and subsequent commissioning of the proposed development, there will be additional vertical obstacles in the form of cranes and static turbines as they are added.

8.49 During construction, and prior to testing/commissioning, the wind turbine blades will not be rotating; there will be no prospect of any turbines, either assembled or being assembled, of being detected by any radar and presented on to controllers' radar display

screens at Plymouth Military Radar. There will be no radar impacts during the construction phase.

8.50 During construction, and prior to testing/commissioning, the wind turbine blades will not be rotating; there will be no prospect of any turbines, either assembled or being assembled, of contributing to any interference experienced at the Davidstow Tx and Rx. There will be no NERL radio impacts during the construction phase.

8.51 There is one potentially significant effect on aviation during the construction phase of the proposed development:

- Visual flight operations, including military low flying.

Vertical Obstruction to Aircraft in flight

8.52 Each vertical object can represent an obstacle to flight depending on location such as close to airports and airfields or as a potential obstruction to en-route flying across country. During construction, the operation of cranes and the actual turbines as they are added could be considered as a hazard to navigation. These effects become heightened when considered against military low flying, day and night.

8.53 Depending on their position in relation to airports/airfields the magnitude of the effect of turbines as a vertical obstruction to aircraft can range from **High** to **Negligible** when assessed against the flight profiles of civil and military aircraft in the area.

Mitigation Measure

8.54 To facilitate safe flight, day or night, there are regulations governing the procedures that must be followed to ensure the timely dissemination of information regarding the construction of anemometer masts and wind turbines. Information regarding any such construction must be passed to the Defence Geographical Centre (DGC) and the General Aviation Awareness Council (GAAC) in advance of the commencement of turbine construction and then be updated regarding location, height and lighting type. Information will then be promulgated within the civil UK Integrated Aeronautical Information Package (UK IAIP), the main resource for information for all of the UK airspace, as well as the Military Aeronautical Information Publications. Furthermore, the guidance on the use of cranes is contained within CAP 1096. Essentially, cranes are considered as another tall object but are subject to separate requirements due to the fact that they can move. Notification of the erection and operation of any crane is to be made to the CAA at least eight weeks in advance of the commencement of any before any crane erection begins detailing position, height, lighting etc.

8.55 With mitigation the effect during construction will be **Negligible** and there will be no residual effect.

OPERATIONAL PHASE EFFECTS AND MITIGATION MEASURES

8.56 There are four potentially significant effects on aviation during the operational phase of the proposed development, these are as follows:

- Interference on the Wembury radar;
- Interference on the NERL Tx and Rx;
- Military Low Flying; and
- North Tregeare Fam private airstrip.

Interference on the Wembury radar

8.57 The closest military ATC radar facility is at Wembury Point, Devon, 48 km to the south-east which is used to provide air traffic control services to aircraft operating within the Danger Area complexes in the English Channel and South Coast exercise areas. It also provides air traffic services to aircraft transiting the airspace over the south-west of England.

8.58 The radar calculation results shown in this assessment have been produced using specialist propagation prediction software (RView Version 5). Developed over a number of years, it has been designed and refined specifically for the task. RView uses a comprehensive systems database which incorporates the safeguarding criteria for a wide range of radar and radio navigation systems. RView models terrain using the Ordnance Survey (OS) Terrain 50 digital terrain model, which has a post spacing of 50 m and has a root mean square (RMS) error of 4 m. The results are verified using the Shuttle Radar Topography Mission (SRTM) dataset, a separate smoothed digital terrain model with data spacing of 3 arc seconds. By using two separate and independently generated digital terrain models, anomalies are identified and consistent results assured. RView models the refractive effects of the atmosphere on radio waves and the First Fresnel Zone. A feature of RView is that as well as performing calculations in the manner believed to be most appropriate it also allows comparison with results from simpler models. For example, RView can perform calculations using the true Earth Radius at the midpoint between the radar and the wind turbine or the simplified 4/3 Earth Radius model. If needed, RView is also capable of modelling a range of atmospheric refractive conditions. RView models the trajectory of radar signals at different elevations, enabling modelling of both volume surveillance and pencil beam radars as well as the effects of angular sterilisation as applied, for example, in Met Office radars.

8.59 The positions subjected to radar modelling are shown in Table 8.5.

Table 8.5: Wembury radar – turbine positions subjected to radar modelling

Turbine ID	E/N Grid	N	Turbine ID	E/N Grid	N
2	218683	86492	**17**	222441	85938
3	218994	86413	**18**	222000	84733
7	220390	87111	**19**	221807	85031
8	220644	86950	**22**	221356	85686
9	220920	86823	**23**	221358	87000

Turbine ID	E/N Grid	N	Turbine ID	E/N Grid	N
10	221084	86567	**24**	220000	85311
11	221202	86297	**25**	219908	85686
12	221493	86174	**26**	219976	86136
14	222152	86088	**30**	219652	86149
15	222572	86297	**31**	218734	86191
16	221786	87571	**33**	218979	85422

8.60 The figures in Table 8.6 illustrate the lowest height that the radar can theoretically see at each turbine position (Hlosmagl). However, under some specific circumstances, turbines can be located slightly above radar LoS and still not be visible to the radar due to increased attenuation of the radar signal close to the ground or the shape of the terrain. The value for Hf06 represents that for the first Fresnel Zone for the radar, the base of solid radar cover and the height at which it can be assumed that the radar will detect the turbine under normal conditions.

8.61 The radar modelling results for the proposed turbine positions are shown within Table 8.6.

Table 8.6: Wembury radar – radar line of sight values to the turbine positions.

Turbine ID	Turbine (Km)	Hf06 magl	Hlos magl	Turbine ID	Turbine (Km)	Hf06 magl	Hlos magl
2	49.191	99.1	46.9	**17**	46.437	115.9	72.9
3	48.933	118.9	73.0	**18**	45.743	106.8	64.6
7	48.609	115.6	69.4	**19**	46.097	106.3	63.3
8	48.326	113.9	68.1	**22**	47.111	108.8	64.7
9	48.058	115.9	70.3	**23**	47.032	109.0	65.5
10	47.755	115.2	70.2	**24**	47.287	109.9	66.2
11	47.469	108.3	63.7	**25**	47.551	93.8	49.7
12	47.194	95.9	51.5	**26**	47.837	88.3	43.9
14	46.729	105.7	66.0	**30**	48.312	105.4	60.3
15	46.648	159.5	116.3	**31**	48.927	83.8	34.8
16	48.141	153.9	108.8	**33**	48.18	58.4	23.3

8.62 It should be expected that these radar LoS values will result in the controllers' radar displays and create clutter under normal circumstances. The effect significance of clutter on radar screens is **High**.

8.63 Wembury Radar is considered to have 'high' sensitivity classification in accordance with Table 8.3. The magnitude of the effect of interference on Wembury Radar is considered to be **Moderate** and therefore this will result in an overall **Moderate** effect significance prior to any mitigation measures being undertaken.

Mitigation Measure

8.64 Plymouth Military Radar utilises the Wembury radar, primarily, to provide air navigation services to aircraft operating in the Royal Navy Danger Area complex in the English Channel, to aircraft operating in the south-western approaches and to civilian aircraft looking to transit those areas. An additional service provided by the radar unit is that of a Lower Airspace Radar Service (LARS) to any aircraft, civil or military, which is transiting through the airspace over the southwest of England.

8.65 The CAA have previously stated that they would not support any objection to a wind turbine proposal on the basis of an impact solely resulting from the provision of LARS.

8.66 Furthermore, within the radar algorithms and data processing there is the possibly of removing any radar clutter from the radar displays. This would be a possibility available singularly at this military unit and due to the operational methods employed in the provision of those air navigational services. This a matter which will constitute the consultation with MoD (DIO) if an objection is forthcoming and, with such technical and/or procedural mitigation in place, the effect would be considered to be **Negligible** and with **Negligible** residual effect.

Interference on the NERL Tx and Rx

8.67 The NERL Tx and Rx at Davidstow are, in terms of aviation, considered to be very close to the proposed development and it was anticipated that there would be some interference at these sites as a result of the Laneast turbines. Line of Sight between all possible locations was taken and, whilst there are some differences between radar and radio propagation, the LoS modelling is a very good illustration of the extent of potential effect. The results of the LoS modelling are shown in Tables 8.7 and 8.8.

Table 8.7: NERL Tx – line of sight values to the turbine positions.

Turbine ID	Turbine (Km)	Hf06 magl	Hlos magl	Turbine ID	Turbine (Km)	Hf06 magl	Hlos magl
2	5.196	20.6	3.7	**17**	8.957	92.0	42.3
3	5.51	40.5	20.4	**18**	8.651	61.2	2.1
7	6.947	26.2	0	**19**	8.426	44.0	0.2
8	7.183	36.3	9.2	**22**	7.691	34.5	0.6
9	7.448	58.6	28.4	**23**	7.323	44.3	10.2
10	7.598	63.4	29.7	**24**	6.998	43.4	13.2
11	7.711	45.5	12.1	**25**	6.674	29.6	2.7
12	8.003	50.8	13.1	**26**	6.619	21.3	0.5
14	8.663	86.8	39.3	**30**	6.163	32.0	0
15	9.081	118.9	65.3	**31**	5.244	17.3	0.8
16	8.393	82.8	30.1	**33**	5.557	47.8	0

Table 8.8: NERL Rx – line of sight values to the turbine positions.

Turbine ID	Turbine (Km)	Hf06 magl	Hlos magl	Turbine ID	Turbine (Km)	Hf06 magl	Hlos magl
2	4.424	34.1	1.5	**17**	8.099	106.7	44.1
3	4.739	58.4	16.2	**18**	8.179	47.7	2.8
7	5.793	39.6	3.0	**19**	7.879	44.1	0.3
8	6.08	46.5	4.3	**22**	6.955	44.6	7.2
9	6.38	65.3	19.0	**23**	6.771	50.8	17.7
10	6.612	70.1	20.2	**24**	6.457	45.2	16.9
11	6.811	57.9	13.1	**25**	6.14	26.3	3.5
12	7.126	63.6	15.7	**26**	5.953	27.5	0.9
14	7.777	100.2	39.0	**30**	5.442	43.7	0.0
15	8.114	122.8	54.1	**31**	4.619	17.0	0.1
16	7.07	103.6	38.5	**33**	5.255	23.1	0.0

8.68 The results for initial prospective positions have also been modelled internally by NATS Safeguarding. From the outset of the project, there has been extensive consultation with NATS regarding the turbine positions which would ensure that any interference experienced at the Tx and Rx is below the maximum acceptable interference threshold.

8.69 This has resulted in the turbine positions, considered by NATS to be those causing maximum interference, being removed from consideration for the development during the master planning process. Furthermore, the proposed turbine positions have been amended to increase the respective distances from the turbines to the Tx and Rx to reduce that potential interference even further below the acceptable threshold.

8.70 On this basis, the layout reflects NATS' requirements in relation to interference on the NERL Tx and Rx and therefore the magnitude of the effect is considered to be **Negligible,** thus resulting in a **Negligible** effect significance and no further mitigation measures are required as there will be no further adverse impacts.

Military Low Flying

8.71 The United Kingdom Low Flying System (UKLFS) covers the open airspace of the whole UK below 2,000 ft agl. Low Flying by military aircraft is permitted within established low flying areas which exclude large urban areas. The proposed development is close to the boundary between MoD Low Flying Area (LFA) 2 and 3. These areas cover the south-west of England and are predominantly, but not exclusively, used by helicopters and for night flying the areas become a single Night Rotary Region. This configuration of low flying airspace means that the area around the proposed development is an important training facility for both fixed wing aircraft and rotary wing helicopters both day and night.

8.72 Whilst the potential effects during construction will be mitigated, the same issues of visibility and promulgation of the turbines will persist through the operational phase.

8.73 The magnitude of the effect of military low flying on aircraft is considered to be **Moderate** and therefore this will result in an overall **Moderate** effect significance prior to any mitigation measures being undertaken.

Mitigation Measure

8.74 It should be expected that, during consultation, the MoD (DIO) will require that the turbines be lit with NVG compatible aviation lighting. The MoD and the CAA lighting requirements differ; the proposed turbines will not have to be lit in accordance with CAA policy due to their tip height being below the required level but the MoD policy differs.

8.75 Military low flying is conducted at various heights by day and at night. In many circumstances, aircrew use devices such as Night Vision Goggles (NVG) to see wind turbines at night at long distance. Nonetheless, whilst low flying at night, it is important that aircrew can guarantee to see the turbines at a minimum 5 km range. Early detection is important especially if the aircraft is manoeuvring hard and the air temperature or prevailing weather profile causes the turbines to blend into the background. Suitable lighting is necessary for flight safety.

8.76 Infra-red lights have been developed to be invisible to the public but detectable by aircrew wearing NVG. It is anticipated that during consultation with the MoD (DIO) they will require aviation/NVG compatible lighting to be fitted lighting. If required, a lighting assessment can be conducted to determine the optimum lighting arrangement which will comply with MoD lighting requirements. After mitigation with such an MoD compliant lighting scheme any effect with be **Negligible** and with **Negligible** residual effect.

North Tregeare Farm Private Airstrip

8.77 A detailed desk-based search has been conducted for any private landing strips within the vicinity of the proposed development but not all such strips are listed in publications or marked on charts.

8.78 From available satellite imagery there would appear the be a private landing strip at North Tregeare Farm, north of Tresmeer and approximately 1.5km from the nearest turbine within the proposed development. There is little readily available information on this facility within aviation documentation or on public web-sites but from that same imagery the airstrip seems to be approximately 320 m long.

8.79 CAP 793 (Safe Operating Practices at Unlicensed Aerodromes) states that if any *aerodrome "….is to be used for more than 28 days in a calendar year (and this might be expected for flying training operations) it is likely that specific planning permission will be required."*[2] and that airstrip operators should establish a dialogue with the Local Authority in order to establish "unofficial safeguarding" procedures. CAP 738 (Safeguarding of Aerodromes) states that the CAA will not hold a view on safeguarding of non-licensed sites but that that responsibility rests with the operator through such measures as safeguarding maps, dialogue etc.

[2] Chapter 2 para 2.1

8.80 It has not been possible to find any planning permission or details of any safeguarding dialogue within the Cornwall Council website and, consequently, it is not possible to comment accurately on the nature and frequency of flying activities from the North Tregeare Farm private airstrip; this will have to be concluded through consultation with the airstrip owner/operator. However, even if the airstrip is used for more than 28 days per year it is considered that the proposed development will have a **Negligible** effect on such activity and with **Negligible** residual effect

CUMULATIVE EFFECTS

8.81 In the context of aviation cumulative effects refer to potential effects upon receptors arising from the proposed development when considered in conjunction with any existing or planned projects which have or may have comparable effects on radar and aviation interests.

8.82 The only ATC radar that could be capable of detecting the turbines (Wembury) will need to be subject to mitigation, either technical or procedural. Similarly, the proposed layout has been designed with input from NATS Safeguarding in order to ensure that any interference is below the maximum acceptable threshold for NATS Tx and Rx. Given that the proposed development will, after mitigation, not affect operations, be visible to any ATC radars, will not unacceptably affect any other civilian CNS systems or have a physical safeguarding effect on any aerodrome or airfield, there is no cumulative impact to assess in a civilian or military aviation or ATC context either during construction or operation of the proposed development.

SUMMARY AND RESIDUAL EFFECTS

8.83 There are three potential effects which could result from the proposed development. Of those the most significant, that of interference with the NERL infrastructure, has been addressed by prior and ongoing consultation and has resulted in the proposed layout which benefitted from NATS Safeguarding input and which should be accepted by NERL as the embedded mitigation for the anticipated effects.

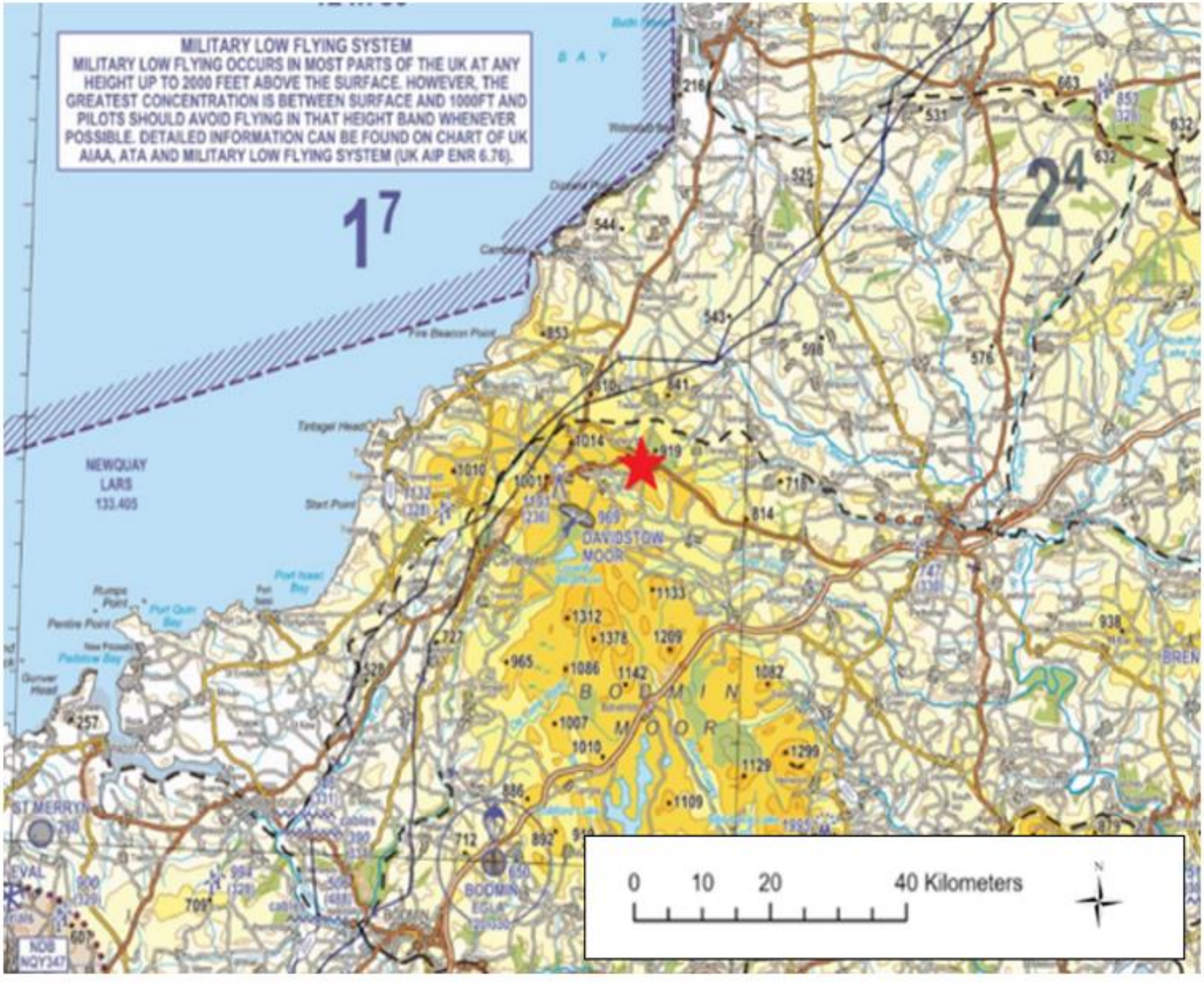
8.84 It should be possible to address any effects on the Wembury radar either through technical or procedural measures.

8.85 Flying activities from North Tregeare Farm private airstrip should not be affected and this will be confirmed through consultation.

8.86 It is anticipated that any potential risk posed to aviation activities and operations and to civil and military radar systems would be wholly and successfully mitigated through the application of operational or technical mitigation solutions. Following the application of the mitigation solutions the overall impact to civil and military operations in the area would be **Not Significant** in EIA terms.

Table 8.9: Summary and Residual Effects

Effect	Sensitivity of Receptor	Magnitude of Effect	Effect Significance (pre-mitigation)	Mitigation measures	Residual Effect Significance (post-mitigation)
Construction Phase					
Use of cranes/vertical obstruction to flight	Very Low	Negligible	Negligible	Compliance with notification procedures for usage of cranes and vertical objects construction.	Negligible
Operational Phase					
Interference on Wembury radar	Low	Negligible	Negligible	Application of radar services compliant with operations in the area. Technical mitigation within existing radar parameters.	Negligible
Military Low Flying	Very Low	Negligible	Negligible	Lighting in accordance with MoD policy and requirement.	Negligible
Interference on NERL Davidstow Tx and Rx	High	High	Major	The layout for the proposed development, when formally accepted by NATS Safeguarding, is the mitigation; it will ensure that interference is below the maximum permitted threshold.	Negligible
Flying activity from North Tregeare Farm private airstrip.	Very Low	Negligible	Negligible	None Required	Negligible



Key

Refer to Para 8.32 of Chapter 8.

Figure 8.1:	**CAA 1:250K VFR Chart Extract showing aviation details close to the site up to 5,000ft**
Client:	**WMW Consultants Ltd**
Project:	**Repowering and Replacing of 22 Turbines**
Project No:	**C2330**

RMA ENVIRONMENTAL

Drawn:	Checked:	Date:	Scale:
ST	SS	22/11/2019	NTS

Key

Refer to Para 8.32 of Chapter 8.

Figure 8.2:	**CAA 1:500K VFR Chart Extract showing the area up to 10,000ft**
Client:	**WMW Consultants Ltd**
Project:	**Repowering and Replacing of 22 Turbines**
Project No:	**C2330**

RMA ENVIRONMENTAL

Drawn:	Checked:	Date:	Scale:
ST	SS	22/11/2019	AS SHOWN