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Chapter 13

Existing Infrastructure and Aviation

Contents

List of Abbreviations

Abbreviation	Description
ATC	Air Traffic Control
ANO	Air Navigation Order 2016
CAA	Civil Aviation Authority
CAP	Civil Aviation Publication
DIO	Defence Infrastructure Organisation
IFP	Instrument Flight Procedure
LFA	Low Flying Area
MOD	Ministry of Defence
MRT	Multi Radar Tracker
NATS	National Air Traffic Services Ltd
Natural Power	Natural Power Consultants Limited
NERL	NATS En Route Ltd
OS	Ordnance Survey
RLOS	Radar Line of Sight
SRTM	Shuttle Radar Topographical Mission
TMA	Terminal Area
TOPA	Technical and Operational Assessment (NATS)
TTA	Tactical Training Area (MOD)
VFR	Visual Flight Rules

13.1 STATEMENT OF COMPETENCE

13.1.1 This chapter of the Environmental Impact Assessment Report (EIAR) reporting upon Aviation has been written by Commander John Taylor RN (Ret) and Squadron Leader Mike Hale MBE MSc CFS RAF (Ret). Their competence to write this chapter of the EIA Report is demonstrated below:

13.1.2 Cdr John Taylor RN (Ret) - after a career in the Royal Navy specialising in Air Traffic Control (ATC), Airspace Management and Air Defence which culminated in leading both the ATC and Fighter Control Specialisations, John worked for Lockheed Martin UK for three years as a Principal Consultant and Business Area Manager responsible for Air Traffic Management Consultancy, including the provision of advice to wind farm developers. In 2008 he founded WPAC Ltd and since then he and his team have provided aviation advice in relation to over 2000 wind farm and wind turbine sites, given evidence at a number of planning inquiries and enabled many sites to overcome aviation objections where it was feasible to do so. He and his team have also provided advice to a number of Local Planning Authorities, Renewable UK and the Aviation Fund Management Board, including organising workshops and the provision of guidance documents. John also advises planners and developers in relation to physical and technical safeguarding of non-wind farm developments such as business parks and blocks of flats in the vicinity of aviation facilities.

13.1.3 Sqn Ldr Mike Hale RAF (Rtd) has over 45 years, piloting, instructing and examining experience on numerous military fast jet aircraft through to a range of civilian and military general aviation training aircraft and gliders. He has held many posts including Flying Instructor, Training Officer, Flight Commander, Squadron Commander and Principal Tornado AD Force Examiner. He has amassed over 10,000 flying hours of experience when operating at many locations around the world. In parallel to his flying duties, Mike held the post of Officer Commanding the MOD Low Flying Operations Squadron (OC LFOS). In this post he was both Low Level Airspace Manager for the MOD & Wind-Farm Subject Matter Expert for the Defence Infrastructure Organization (DIO). During that period, he assessed over 14,000 wind-farm pre-applications and 2000 full applications against low flying, weapons range, specialist airspace, local community and aerodrome safeguarding criteria. Mike also instigated two Qinetiq ground based Infra Red obstruction lighting trials. These were followed by instigating and managing the MOD Infra Red/Low Intensity (Henlow) flight trials and the CAA/MOD/Trinity-House/RUK off-shore IR/Morse (North Hoyle) flight trials. In conjunction, Mike organised numerous and various supporting trials including night vision equipment compatibility and detailed lighting beam overspill analysis (where light is emitted outside the required specification envelope). In 2012, he was awarded an MBE for generating a proactive and mutually successful working relationship between the Wind Power Industry and the MOD Air Staff.

13.2 INTRODUCTION

13.2.1 This chapter summarises the potential effect of the Proposed Development on aviation, existing infrastructure, shadow flicker and telecommunications. Stakeholders have been consulted during the EIA process, a summary of consultation responses are listed in Table 13.1. An assessment of the potential effect on the public road network is provided in Chapter 11: Traffic & Transport.

13.3 AVIATION

13.3.1 This section of the chapter assesses the potential for the Proposed Development to affect aviation communications, navigation and surveillance infrastructure in the vicinity of the Proposed Development Area. The following are considered:

- Civil aviation interests, including ‘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 and 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.

Baseline Description

13.3.2 The Proposed Development is located in an area that is relatively remote from significant aviation facilities. It is 65 km to the south-east of Glasgow Prestwick Airport, 70 km south-west of Edinburgh International Airport and 80 km south of Glasgow International Airport. In military terms it is 45 km north-west of the Spadeadam Electronic Warfare Range but in an area where Spadeadam aircraft operate. Lowther Hill Radar is approximately 9.5 km north west of the Proposed Development. Figure 13.1 shows that the Proposed Development Area is located under the Scottish Terminal Control Area (TMA) a busy section of Class D controlled airspace used extensively by aircraft arriving and departing from the main Scottish Airports.

Legislation Policy and Guidance

13.3.3 There are a number of aviation publications relevant to the interaction of wind turbines and aviation containing guidance and legislation, which cover the complete spectrum of aviation activity in the UK as shown below.

Reference Documents

A. Civil Aviation Publication (CAP) 764 Civil Aviation Authority (CAA) Policy and Guidance on Wind Turbines Version 6, Feb 2016

B. CAP 168 Licensing of Aerodromes, Version 11 March 2019

C. CAP 670 ATS Safety Requirements Version 3 June 2019

D. CAP 774 UK Flight Information Services, Ed 3 May 2017

E. CAP 738 Safeguarding of Aerodromes Version 2 Dec 2006

F. CAP 793 Safe Operating Practices at Unlicensed Aerodromes Ed 1 July 2010

G. CAP 493 Manual of Air Traffic Services Part 1 Ed 7.0 2017

H. CAP 660 Parachuting Ed 5 March 2020

I. Military Aviation Authority Regulatory Article 2330 (Low Flying)

J. UK Military Aeronautical Information Publication (MIL AIP)

K. UK Aeronautical Information Publications (AIP)

L. CAA 1:250,000 and 1:500,000 VFR Charts

M. CAA Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level dated 01/06/17

Assessment Methodology

13.3.4 CAP 764 states the distances from various types of airfields where consultation should take place. These distances include:

- Airfield with a surveillance radar – 30 km;
- Non radar licensed aerodrome with a runway of more than 1,100 m – 17 km;
- Non radar licensed aerodrome with a runway of less than 1,100 m – 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 – 4 km;
- Unlicensed aerodromes with runways of less than 800 m – 3 km;
- Gliding sites – 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.

13.3.5 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 discussion between developers and aviation stakeholders. As well as examining the technical impact of wind turbines on ATC facilities, it is also necessary to consider the physical safeguarding of ATC operations using the criteria laid down in CAP 168 (Ref B), to determine whether a proposed development will breach obstacle clearance criteria.

Ministry of Defence

13.3.6 It is necessary to take into account the aviation and air defence activities of the MOD. The types of issues that will be addressed include:

- MOD Airfields, both radar and non-radar equipped;
- MOD Air Defence Radars;
- MOD Meteorological Radars; and
- Military Low Flying.

National Air Traffic Services Ltd (En Route) NERL Facilities

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

Radar Projection Information

13.3.8 Radar modelling has been undertaken using WPAC's 'RView' system which utilises a comprehensive systems database incorporating the safeguarding criteria for a wide range of radar and radio navigation systems. RView models terrain using the latest Ordnance Survey (OS) Terrain 50 digital terrain model, which has a post spacing of 50 metres and has a root mean square (RMS) error of 4 metres. The results are verified using the Shuttle Radar Topographical Mission (SRTM) dataset, a separate smoothed digital terrain model with data spacing of 3 arc seconds.

13.3.9 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. 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.

Consultation Methodology

13.3.10 Consultation and discussions with aviation stakeholders are ongoing and it is likely that the outcome of these discussions will result during the determination of the Proposed Development. Currently there are continuing discussions with Glasgow Prestwick Airport (GPA) and NERL. The initial scoping responses are listed in Table 13.1 and addressed later in the EIA Report.

Table 13.1: Summary of Consultation Responses

Consultee	Response
Glasgow Airport response to scoping dated 28 January 2019	"*This proposal is located outwith our consultation zone. We therefore have no comment to make and need not be consulted further*"
Glasgow Prestwick Airport response to scoping dated 11 February 2019	"*Should the proposed rotating turbines be seen by our primary radar – GPA will be obliged to object to the development (on the grounds on aviation safety) unless a wind turbine radar mitigation scheme can be realised to deal with the turbine clutter on radar displays for the proposed 35 years lifespan of the windfarm*"
Glasgow Prestwick Airport response to WPAC consultation of 17 July 2020 dated 21/09/20	"*Initial LoS analysis on this development suggests that the turbines (based on the information provided below) will not be visible to Glasgow Prestwick Airport's primary radars – and as such – if this proposed development comes to formal planning – it is unlikely that GPA will object on aviation safety concerns*."
MOD DIO10045032 dated 05 August 2020	"*I can confirm that the MOD would object to the finalised site design proposal in its current form*"……..This is based upon the effect on the Eskdalemuir Seismological Array. In aviation terms the only MOD comment is: "*The development site occupies Tactical Training Area 20T (TTA 20T) therefore in the interests of air safety, the MOD would request that the development be fitted with MOD accredited aviation safety lighting in accordance with the Civil Aviation Authority, Air Navigation Order 2016*."
NERL Scoping Response dated 12 February 2019	"*We refer to the application above. The proposed development has been examined by our technical safeguarding teams and conflicts with our safeguarding criteria.* *Accordingly, NATS (En Route) plc objects to the proposal. The reasons for NATS's objection are outlined in the attached report TOPA SG06997*"
NERL response to further consultation dated 04 August 2020	"*early high level analysis advise Daer would benefit from Lowther Indra solution*".

Source: WPAC

Assessment of Potential Effects

Civil Aviation – Radar Equipped Licensed Aerodromes

13.3.11 Taking into account the criteria for consultation, there are no radar equipped licensed aerodromes within consultation distance, however, the closest is at GPA, 66 km to the north-west, which was consulted about the Proposed Development at scoping. Radar modelling has been undertaken which demonstrates that radar line of sight (RLOS) is in excess of 500 metres above ground level (AGL) and there is no prospect of the Proposed Development affecting either the Primary Surveillance Radar (PSR) at GPA or the new Terma Scanter 4002 that has recently been installed there. Discussions with GPA have taken place and it has confirmed that it is unlikely to object to the Proposed Development.

13.3.12 Glasgow Airport safeguarding department was also consulted at scoping and confirmed that as the site is well outside its safeguarding zone it offered no comment on the proposal. For completeness radar modelling was also undertaken against the radars at Edinburgh Airport, again there is no RLOS below 500 metres AGL.

Civil Aviation – Non-radar Equipped Licensed Aerodromes

13.3.13 There are no non-radar equipped licensed aerodromes within consultation distance of the Proposed Development, in fact there are none in the entire region.

Civil Aviation – Unlicensed Aerodromes, Microlight and Parachute Sites

13.3.14 There are no unlicensed aerodromes, microlight or parachute sites listed in any publications or marked on aviation charts within consultation distance. The closest is a small grass strip at Stonehill, over 20 km to the north, consultation is not required and the airstrip will be unaffected.

Civil Aviation – NATS En Route Ltd (NERL)

13.3.15 NATS En Route Ltd (NERL) operates a network of long-range ATC radars throughout the country in addition to other communications, navigation and surveillance systems. Whether or not they would object to any turbine development depends upon whether the turbines show on any of their radars and what type of airspace is above the Site or if the turbines will be likely to infringe upon the technical safeguarded criteria for other systems. In this case, the closest radar is located at Lowther Hill, 11 km to the north-west. Radar modelling undertaken by WPAC with the results in Table 2 show that all of the turbines will be visible to the radar and will generate an area of 'clutter' on the displays at the Scottish Air Traffic Control Centre at Prestwick. NERL have concluded that the effect would be 'unacceptable' in the Scoping Response.

Table 13.2 Radar Line of Sight Results NERL Lowther Hill (metres AGL)

Turbine	Radar Line of Sight	Turbine	Radar Line of Sight
1	0	10	77.1
2	0	11	75.8
3	0	12	21.2
4	0.1	13	53.3
5	15.3	14	46.6
6	8.2	15	70.2
7	23.4	16	140.6
8	2.1	17	110.9
9	9.4		

Source: WPAC

MOD Aviation/Radar/Low Flying

13.3.16 The closest military ATC radar is located at RAF Spadeadam, known as the Deadwater Fell radar. It is used to provide ATC services to aircraft operating in and around the Spadeadam Electronic Warfare Training Facility. Radar modelling has been undertaken by WPAC with the results shown in Table 13.3. The results show that only one turbine may be visible to the radar at a distance of over 65 km (Turbine 12).

Table 13.3 Radar Line of Sight Results RAF Spadeadam Deadwater Fell Radar (metres AGL)

Turbine	Radar Line of Sight	Turbine	Radar Line of Sight
1	324.9	10	295.8
2	311.6	11	191.9
3	343.3	12	68.3
4	355.7	13	185.5
5	413.4	14	279.1
6	238.4	15	247.9
7	412.9	16	332.7
8	415.6	17	243
9	359.5		

Source: WPAC

13.3.17 The MOD response dated 05 August 2020 confirms that they have no objection to the Proposed Development in relation to ATC radar and no mitigation is therefore required.

13.3.18 The closest Air Defence Radar is located at Brizlee Wood, near Alnwick, Northumberland and well over 125 km to the east. Radar modelling shows that radar line of sight is in excess of 500 metres AGL and the Proposed Development will have no effect on the radar. The MOD confirmed in their 05 August 2020 letter that there was no air defence radar objection.

13.3.19 The Proposed Development is within MOD Low Flying Area 16 and Tactical Training Area 20. The MOD 05 August 2020 response states that Infra-Red lighting will be required and goes on to state: "*the MOD would request that the development be fitted with MOD accredited aviation safety lighting in accordance with the Civil Aviation Authority, Air Navigation Order 2016.*" A lighting design that will be compliant with both MOD and CAA requirements is proposed in the mitigation section of this chapter.

Potential Effects

13.3.20 The Proposed Development will be visible to the NERL Lowther Hill PSR, the main 'en route' radar used to provide surveillance information in this location to the London and Scottish Area Control Centres. NERL undertook a Technical and Operational Assessment (TOPA) as part of its Scoping Response and concluded that the effect of the turbines on the Lowther Hill radar would be unacceptable as they would create an area of 'clutter', again leading to the possibility of a reduction in the probability of detection of aircraft in the vicinity of the Proposed Development. The magnitude of the effect would be high without mitigation.

Mitigation

Aviation Lighting

13.3.21 Aviation lighting issues are addressed in the technical appendix to this Chapter. There are two separate but related aviation lighting requirements to take into account. The first is based on the requirements laid down in CAP 764 as defined in Reference M and the second on the MOD requirement for Infra-Red lighting. CAP 764 has been redrafted and an updated version was due to be issued in October 2020 and the draft changes to lighting requirements have been issued for comment. However, due to regulatory demands of Brexit, the CAA have yet to finalise the change to the documentation. Extensive discussions with the CAA have revealed that the draft guidance will not be changing substantively, wording may change to clarify the intent but the policy is now established. WPAC have used the new guidance, further informed by detailed exchanges of information between Sqn Ldr Hale and the CAA to propose a lighting scheme that will be compliant with CAA policy and guidance.

13.3.22 The factors affecting the lighting design and the methodology for determining which turbines should be lit is contained in the lighting report at the appendix to this chapter. The layout of the lights is also shown in Figure 13.2. Table 13.4 below identifies which turbines will be lit with either Air Navigation Order (ANO 2016) compliant 2000 candela lights and MOD compliant Infra-Red lights.

13.3.23 In addition the CAA have stated a requirement for 32 candela fixed red lights to be fitted on the turbine towers of the lit turbines halfway between the hub and the ground.

Table 13.4 Turbine Lighting Layout

Turbine	CAA 2000cd ANO Light	MOD Infra-red
1	X	X
2	X	X
3		
4		X
5		
6	X	X
7	X	X
8		X
9		
10	X	X
11		
12		X
13		
14	X	X
15	X	X
16	X	X
17	X	X

Source: WPAC

NERL Lowther Hill Radar

13.3.24 It will be necessary to mitigate the effect of the turbines on the performance of the Lowther Hill radar. The radar is one of several which feed into the 'multi radar tracking system' (MRT) at the Scottish Area Control Centre at Prestwick. The MRT has the capability to combine a finite number of primary and secondary radar feeds, which can be managed so that the area of the Lowther Hill radar affected by Proposed Development can be blanked out, and surveillance information from other unaffected sources introduced into the blanked area, provided that the other radar or radars have sufficient coverage to fulfil the operational requirement.

13.3.25 Discussions are under way with NERL, who have been considering the best method of mitigating a number of other existing and proposed wind farms in the area. NERL have recently announced the decision to acquire and install a new 'wind farm tolerant' Indra Lanza radar at Lowther Hill. NERL anticipate that the radar will be in service by the end of 2021. They have advised that the contract for the new Lowther Hill radar has now been signed and have also advised that the new radar would provide suitable mitigation for the Proposed Development. They have also confirmed that a planning condition is appropriate for the Proposed Development.

13.3.26 In any case, it will be necessary to agree a planning condition that protects NERL's interests. A suspensive condition would be appropriate and to discharge any such condition will require the developer to sign a Radar Mitigation Scheme contract which will cover NERL's requirements for the life of the Proposed Development.

Residual Effects

13.3.27 Provided the effects on the NERL Lowther Hill PSR are mitigated as discussed above, there will be no residual aviation effects.

Aviation Summary

13.3.28 The Proposed Development has been assessed from an aviation perspective taking into account all of the criteria laid down in CAP 764. The Proposed Development will affect the NERL radar at Lowther Hill. It will be necessary to agree a technical mitigation scheme for the radar and to protect the interests of the aviation stakeholders through the imposition of suitably worded conditions. With mitigation in place, no significant effects upon aviation interests will arise.

13.4 OTHER INFRASTRUCTURE

13.4.1 This section of the chapter summarises the potential effect of the Proposed Development on 'other infrastructure'.

Statement of Competence

13.4.2 The section of the chapter has been drafted by Natural Power's Planning & Environment team. It is accredited by the Institute of Environmental Management and Assessment and within it include Chartered Town Planners and Chartered Land Agents. The team has managed EIA and written EIA Report chapters on other infrastructure for onshore wind developments across the UK.

Eskdalemuir Seismic Array

13.4.3 The Proposed Development is within the 50 km consultation zone for the MOD's Eskdalemuir Seismic Array monitoring station, situated approximately 29 km away. The station is used for monitoring nuclear weapons firing and the MOD has applied a 'noise' budget it deems necessary to protect the effective operation of the array.

13.4.4 In its Scoping Opinion, dated 19 February 2019, the MOD stated that the current noise budget had already been allocated and therefore as matters stand it would object to an application for the Proposed Development. The MOD further noted that if this matter could be overcome then it would require aviation lighting on the turbines, as discussed earlier in this chapter.

13.4.5 Since the Scoping Opinion was issued, there have been several wind farm projects proposed within the consultation zone and under this present situation will receive an automatic objection from the MOD. However, a court ruling on 23 December 2020 quashed the MOD's current policy on allocating Eskdalemuir noise budget[1] and it is understood that the MOD will consult on a new approach.

13.4.6 The Eskdalemuir Working Group has been set up which includes the Scottish Government to investigate the noise budget and work with the MOD to find a practicable working solution to the array and its noise budget. It has already provisionally identified a range of feasible options encompassing potential changes to methodology for calculating the noise budget and consultation distances, which if changed could create "headroom", as well as technical solutions, such as dampening.

13.4.7 Owing to the relatively long period of time before the Proposed Development might be built with its grid connection for 2027, it is reasonable to consider that, with the court ruling and investigations already underway, a workable solution could be established for the Proposed Development and its potential effects upon the array. As such, it would be appropriate to attach an appropriately worded suspensive planning condition to facilitate reaching an agreed position with the MOD prior to operation of the Proposed Development. The Little Hartfell Wind Farm is an example of a project granted planning permission by DGC with such a condition attached.

Microwave Fixed Links

13.4.8 Fixed microwave links are direct line-of-sight communication links between transmitting and receiving dishes placed on masts generally located on hilltops that vary in length from a few kilometres to over 70 km. They are used for the transmission of information to broadcasting masts for TV and radio and for the mobile telephone networks.

13.4.9 Telecommunications and broadcasting network operators were consulted during the scoping exercise. Openreach responded to confirm that the Proposed Development should not cause interference to BT's current and presently planned radio network. The Joint Radio Company Limited also responded to scoping indicating that links would not be affected. It is acknowledged that the turbine layout has changed since scoping however it appears that these particular assets do not feature within the Proposed Development Area and therefore it is expected that these stakeholders will remain unaffected.

13.4.10 A desk-based study of potential microwave links was also undertaken using information already held by Natural Power. It identified a micropath link traversing the site from southwest to northeast (license no. 0038021/1). The stakeholder was consulted during summer 2020 to establish the status and appropriate buffer to apply. Despite some correspondence, no confirmation was provided. The Applicant maintained a conservative 'soft' buffer of 200 m which had been applied for design layout purposes. The final layout was able to avoid potential direct effects on this link with only Turbine no.10 encroaching the buffer. Nonetheless this turbine is still more than 100 m from the micropath and is not anticipated to affect its operation (see Figure 1.3 for example).

13.4.11 With the information available to the Applicant, the Proposed Development does not directly affect microwave fixed links and the potential effect on microwave fixed links is not significant. Pre-construction checks would be undertaken to ensure this still remains the case nearer the time of construction.

Other Radio Communication Networks

13.4.12 Where turbines with low amount of metal in the blades are used, as is envisaged for the Proposed Development, there is little evidence of adverse interactions with radio transmission and reception, including domestic radio service, Citizen's Band (CB) and services communications due to the low frequency of the signals.

13.4.13 Therefore, the potential effect of the Proposed Development is considered to be not significant with respect to other radio communication networks.

Shadow Flicker

13.4.14 Wind turbines are tall structures which can cast long shadows when the sun is low in the sky. Given a conjunction of certain meteorological conditions (clear skies, enough wind for the turbines to be rotating and a low angle of the sun in the sky), observers close to a wind farm could experience a phenomenon commonly known as "shadow flicker", where the rotating turbine blades pass between the sun and the observer creating an intermittent shadow. It is, however, part of the nature of long shadows that they pass any particular point relatively quickly and the effect, if present, lasts a short period of time, due to the movement of the sun across the sky. They are generally only observed in the period after dawn and before sunset as the sun is rising and setting.

13.4.15 A technical paper by A D Clarke[2] (the Clarke Report) indicates that dwellings situated within ten times the diameter of the wind turbine rotor could potentially experience annoyance from shadow flicker and reflectivity and therefore recommends a separation distance between the nearest turbine and properties of at least 10 rotor diameters.

[1] Available online: https://www.scotcourts.gov.uk/docs/default-source/cos-general-docs/pdf-docs-for-opinions/2020csoh107.pdf?sfvrsn=0 (last accessed 17/02/2021)

[2] A.D. Clarke 'A Case of Shadow Flicker/Flashing: Assessment and Solution', Technology Policy Unit, Open University, Walton Hall, Milton Keynes, UK.

Scottish Government guidance[3] advocates that beyond this distance, shadow flicker should not be a problem. UK Government guidance[4] also states that 'only properties within 130 degrees either side of north, relative to the turbines can be affected at these latitudes in the UK – turbines do not cast long shadows on their southern side'.

13.4.16 The candidate turbines under consideration for use at the Proposed Development have a maximum rotor diameter of 155 m making the separation recommended by Clarke between the property and the nearest turbine 1550 m. Figure 13.3 identifies 5 properties in the immediate area which are within 1550 m of proposed turbine(s), 4 of which are financially involved with the Proposed Development.

13.4.17 A report produced for the Department of Energy and Climate Change[5] explains different approaches to assessing shadow flicker across Europe citing a commonly used guide by Predac, (a European Union sponsored organisation that promotes best practice in Energy use and supply) which recommends that shadow flicker does not exceed 30 hours per year of 30 minutes per day. As can be seen from Figure 13.3, which is based on 'worst case' scenario for shadow flicker conditions, none of the identified properties are assessed to experience shadow flicker beyond that threshold. It is therefore concluded that the Proposed Development would not cause a significant effect upon amenity due to shadow flicker.

13.4.18 Potential effects upon residential visual amenity are also assessed in Chapter 5: LVIA.

Outdoor Access - Public Rights of Way

13.4.19 The Southern Upland Way (SUW) passes through the Proposed Development Area in the north. An exclusion zone of 180 m (maximum tip height) was included at the design stage on either side of the SUW as a topple distance buffer to ensure that the presence of the turbines would not interfere directly with its use. The Scottish Rights of Way Society (ScotWays) provided a consultation response during the scoping exercise. It also recommended this as a minimum buffer. ScotWays also included in its response, identifying Right of Way 'SL170' which follows the existing track to the west of the Proposed Development and is outwith the Proposed Development Area. The SUW also crosses the proposed access from the public road however this is an existing track and therefore not considered to introduce any new effects other than temporary management of its access during construction for health & safety purposes.

13.4.20 The final design has ensured that the proposed turbines are at least topple distance away from the SUW and Right of Way SL170 thus avoiding any potential for direct adverse effects during operation.

13.4.21 Although members of the public have the right to roam land in Scotland under the Land Reform (Scotland) Act 2003 there will be restricted access during the construction phase for Health & Safety purposes. It is expected that the Proposed Development Area will be managed during the construction phase under the Construction (Design and Management) Regulations 2015.

13.4.22 The potential visual effects on the (users of) the SUW have been assessed in Chapter 5. Nonetheless, the placement of the proposed turbines has avoided any direct effects and there are no significant adverse effects on these assets.

Draft Outdoor Access Plan

12.1.1 In its Scoping Opinion, SLC requested a draft outdoor access plan. Below are details of improvements to outdoor access which the Applicant would provide funding for through the community benefit fund associated with the Proposed Development should the consent be granted.

Wanlockhead – A702 Road

12.1.2 This section crosses the rounded summits of Lowther Hill and Comb Hill before descending towards the A702 road following well worn rough tracks, the surface of which could be improved.

Daer Reservoir - A702 Road

12.1.3 The route follows the A702 road for a short section before threading its way eastwards between hills through an area of moorland, forestry and recently planted broad leaf woodland managed by Tillhill. The route then follows an existing rough farm track, before reaching the made road on the west side of the reservoir. This section of the track is easy to follow and includes several interpretation boards providing information about cultural heritage assets.

12.1.4 Potential improvements along this section include:

- Diverting the path from the A702 road with a short section of track or erecting signage warning drivers of pedestrians on the busy road.
- When approaching the made road on the western side of the reservoir, OS plans indicate that the SUW heads north along the road around the waterworks, whilst the promoted route is south along the road for a short section before heading east across the reservoir. Improved signage would be beneficial here and is an issue flagged by ScotWays within its scoping opinion, see Technical Appendix 1.2.

Daer Reservoir

12.1.5 This section crosses the reservoir and forms an interesting section of the walk, with the reservoir to the south, and the waterworks to the north.

12.1.6 Improvements in this section could include better signage at the historic access gates onto the reservoir.

Hods Hill – Rivox Forest

12.1.7 This section rises from the reservoir, firstly through a tricky ascent between woodland and a post and wire fence before following a stone wall and fence to Hods Hill, then heads south adjacent to the ruins of the boundary wall entering the Rivox Forest at Ferny Craig.

12.1.8 This section is fairly straightforward, although the short section rising from the reservoir would benefit from some steps to make the ascent or descent easier as it is slippery in wet weather.

Ferny Craig – Kinnelhead

12.1.9 This section goes through forestry passing the bothy at Brattlebury and Rivox Bunkhouse, before crossing rough pasture between Rivox and Holmshaw and back into forestry emerging on the minor road at Easter Earshaig.

12.1.10 This section has had some modifications with interpretation boards and picnic benches close to the parking area at Easter Earshaig, plus stiles and footbridges over watercourses.

13.4.23 Local monuments and signage can be found at this section but would benefit from some maintenance to improve their condition.

13.4.24 The details presented above or suitable alternative proposals would be agreed with relevant stakeholders and submitted in an updated outdoor access plan prior to such work undertaken. In this sense, it is considered the Proposed Development would provide positive effects upon outdoor access.

13.4.25 Furthermore, appropriate Health & Safety signage will be erected in the Proposed Development Area during construction and operation.

[3] Available online: https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/ (last accessed 26/11/2020)

[4] "Planning practice guidance for renewable and low carbon energy" available online: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/225689/Planning_Practice_Guidance_for_Renewable_and_Low_Carbon_Energy.pdf (last accessed 26/11/2020)

[5] Available online: {C8444A91-2117-4480-9667-44570C9D279D}.pdf (last accessed 16/02/2021)

Water Supply

13.4.26 Scottish Water provided a consultation response during the scoping exercise and as a landowner and key stakeholder for the Proposed Development, has been consulted throughout the EIA process. As such and described in Chapter 2, Scottish Water's Guidance has been followed during the design process. The potential effects upon Hydrology are assessed in Chapter 8. Scottish Water has also approved a Pollution Prevention, and Incident Plan which has been produced for the Proposed Development and provided as Technical Appendix 8.5.

13.4.27 There should therefore be no significant adverse effect upon Scottish Water assets and the public water supply. The potential effects upon private water supplies is assessed in Chapter 8.

Underground Assets

13.4.28 According to data held by Natural Power and provided by landowner, Scottish Water, there is a high-pressure gas pipeline that runs underground through the northern tip of the Proposed Development Area. This was given a topple distance buffer of 180 m and it was decided during the design process to keep proposed infrastructure to the south of it in order to avoid having to cross it. Thus, the Proposed Development has avoided any direct effects on this asset. Pre-construction checks would be undertaken to ensure no new assets have been developed and that this still remains the case prior to construction.

Unexploded Ordnance

13.4.29 A desk-based study was commissioned early in the design process to establish the risk of presence of UXO in the Proposed Development Area. This is provided in Technical Appendix 13.1. It identified a potential risk for UXO particularly in the southern end of the Proposed Development Area. Thus, a UXO surveyor was commissioned by the Applicant to provide a toolbox talk and accompany personnel undertaking peat probing which involved groundbreaking. No UXO were discovered during the survey work which covered where proposed infrastructure is located. Additional UXO support is advisable pre-construction to ensure Health & Safety precautions are met.

13.5 SUMMARY

13.5.1 As noted above, a Radar Mitigation Scheme will need to be agreed with NERL to mitigate potential effects upon Lowther Hill Radar.

13.5.2 The Proposed Development is within the consultation zone for and likely to have some effect upon the Eskdalemuir Seismic Array. However, with the court ruling quashing the MOD's current policy approach and ongoing work undertaken by Scottish Government and others to establish a pragmatic solution, it is anticipated the Proposed Development can eventually be considered acceptable by the MOD.

13.5.3 The Proposed Development does not directly affect microwave fixed links and the potential effect on microwave fixed links is not significant. Pre-construction checks would be undertaken to ensure this still remains the case nearer the time of construction.

13.5.4 The potential effect of the Proposed Development is considered to be not significant with respect to other radio communication networks.

13.5.5 Five properties may potentially experience shadow flicker from the Proposed Development, 4 of which have financial interest with the Proposed Development. These properties have been assessed to be within a deemed acceptable threshold for shadow flicker. It is therefore concluded that the Proposed Development would not cause a significant effect upon amenity due to shadow flicker.

13.5.6 There are no direct adverse effects upon Public Rights of Way. Paths would be appropriately managed during construction for health and safety purposes. Furthermore, the Applicant will improve access in the area through provision of funding to upgrade the Southern Upland Way's path and signage.

13.5.7 Through embedded mitigation and construction best practice, there will be no significant adverse effect upon Scottish Water assets and the public water supply.

13.5.8 The Proposed Development has avoided any direct effects on underground assets. Pre-construction checks would be undertaken to ensure no new assets have been developed and that this still remains the case prior to construction.

13.5.9 The potential for presence of UXO has been mitigated through on-site survey. It should be considered pre-construction to ensure Health & Safety precautions are met.