Strategy and Policy Group
Windfarm Policy

Civil Aviation Authority

Malcolm Spaven
Director, Aviatica Ltd.
Reservoir House
Gladhouse
Midlothian
EH23 4TA

9 September 2023
Ref Windfarms/Craig Watch

Dear Malcolm,

Proposed Obstacle Lighting Scheme for Craig Watch Wind Farm, Moray

Reference: Aviatica Report No. 23/1086/RAM, June 2023

1. Thank you for the report at reference. The attached report provides a revision to the proposal for an obstacle lighting plan for the Craig Watch wind farm because of a reduction in the numbers of proposed turbines (removal of turbine 9). This impacts the reduced obstacle lighting scheme that the CAA agreed in our letter dated 28 May 2022. This document supersedes the 28 May 2022 agreement.

2. The proposed Craig Watch wind farm consists of 10 turbines. The turbines will have tip heights of 200 metres above ground level (AGL), which brings them within scope of the Air Navigation Order (ANO) Article 222.

3. We have considered the report carefully and take note of the intent to address concerns relating to the night-time visual impact of such aviation lighting while ensuring that the lighting installed on the turbines meets air safety requirements.

4. You have conducted an aviation study that considers the type of aviation operations who might be expected to fly in this area and set out the rationale for a reduced lighting scheme.

5. We note the local terrain aspects and additional mitigation provided by the provision of infra-red lighting for those operators who carry Night Vision Device capability.

6. As a result, the CAA agrees a variation to the lighting requirements specified in the ANO Article for the Craig Watch wind farm, under provisions given in the Air Navigation Order (ANO) Article 222 section 6, as per the following:

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• medium intensity steady red (2000 candela) lights on the nacelles of turbines T01, T02, T04, T07, T08 and T11;
• a second 2000 candela light on the nacelles of the above turbines to act as alternates in the event of a failure of the main light;
• the lights on these turbines to be capable of being dimmed to 10% of peak intensity when the lowest visibility as measured at suitable points around the wind farm by visibility measuring devices exceeds 5km;
• infra-red lights to MoD specification installed on the nacelles of turbines T01, T02, T03, T04, T05, T06, T07, T08, T10 and T11.

7. Intermediate level 32 candela lights are not required to be fitted on the turbine towers.

8. We note the proposed intent to install an aircraft detection lighting system (ADLS) to the Craig Watch wind farm and we would be pleased to receive any detailed proposal for its use.

9. Please let me know if you have any further queries.

Yours sincerely,

Andy Wells
Manager Rulemaking and Safety Publications

Continued (2 of 2 pages)

CRAIG WATCH WIND FARM, MORAY: REVISED PROPOSAL FOR REDUCED LIGHTING SCHEME

June 2023

Report No.23/1086/RAM

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EXECUTIVE SUMMARY

1 In 2022 Craig Watch Wind Farm Limited submitted a proposal to the CAA for a reduced lighting scheme on their proposed 11 turbine wind farm at Craig Watch, Moray. The reduced lighting scheme was approved by the CAA by letter dated 28 May 2022.

2 As a result of responses to the planning application from non-aviation consultees, Craig Watch Wind Farm Limited has revised the layout of the Proposed Development. The revised layout consists of the removal of Turbine 9. All other turbines remain in their original planned locations and the dimensions of the remaining ten turbines are unchanged from the 2022 proposal. The revised proposal will be set out in Supplementary Environmental Information (SEI) to be submitted to the Scottish Government Energy Consents Unit in July 2023.

3 Since Turbine 9 in the original proposal was one of the turbines to be fitted with 2000 candela lighting in the CAA-approved lighting scheme, it has been necessary to re-design the lighting scheme for the revised 10-turbine proposal.

4 The proposed revised lighting scheme would consist of:

- 2000 candela steady red lights and infra-red lights on the nacelles of Turbines 1, 2, 4, 7, 8 and 11;
- infra-red lights only on Turbines 3, 5, 6 and 10;
- no mid-tower 32 candela lighting;
- the 2000 candela lights will be programmed to switch on at 30 minutes after sunset and switch off at 30 minutes before sunrise;
- the 2000 candela lights will be dimmed to 10% of their peak intensity when a visibility sensor at the wind farm records the meteorological visibility as exceeding 5 km; and
- the potential for an Aircraft Detection Lighting System will be explored and will be subject to separate and additional consultation with the CAA.

1. Introduction

1.1 In 2022 Aviatica, on behalf of Craig Watch Wind Farm Limited, submitted a proposal (Report No.22/994/RAM/2) to the CAA for a reduced lighting scheme on their proposed 11 turbine wind farm at Craig Watch, approximately 8 km south east of Dufftown, Moray. The reduced lighting scheme was approved by the CAA by letter dated 28 May 2022.

1.2 As a result of responses to the planning application from non-aviation consultees, Craig Watch Wind Farm Limited has revised the layout of the Proposed Development. The revised layout consists of the removal of Turbine 9. All other turbines remain in their original planned locations and the dimensions of the turbines are unchanged from the 2022 proposal. The revised proposal will be set out in Supplementary Environmental Information (SEI) to be submitted to the Scottish Government Energy Consents Unit in July 2023.

1.3 Since Turbine 9 in the original proposal was one of the turbines to be fitted with 2000 candela lighting in the CAA-approved lighting scheme, it has been necessary to re-design the lighting scheme for the revised 10-turbine proposal. This document sets out the proposed re-designed lighting scheme.

1.4 The following sections of Report 22/994/RAM/2 remain valid for the consideration of the revised lighting scheme and should be read in conjunction with this document:

- Section 4: Regulatory basis for the proposed lighting scheme
- Section 5: Methodological approach to the study
- Section 6: The night low level air traffic environment around Craig Watch
- Section 7: Visibility of LED lights

1.5 The obstacle environment around Craig Watch (Section 3 of Report 22/994/RAM/2) has altered since 2022 and is set out in Section 2 below.

1.6 The design of the proposed revised lighting scheme is set out in Section 3 below. Figures 1 and 2 below show, respectively, the original CAA-approved lighting scheme and the current proposal for a revised lighting scheme.

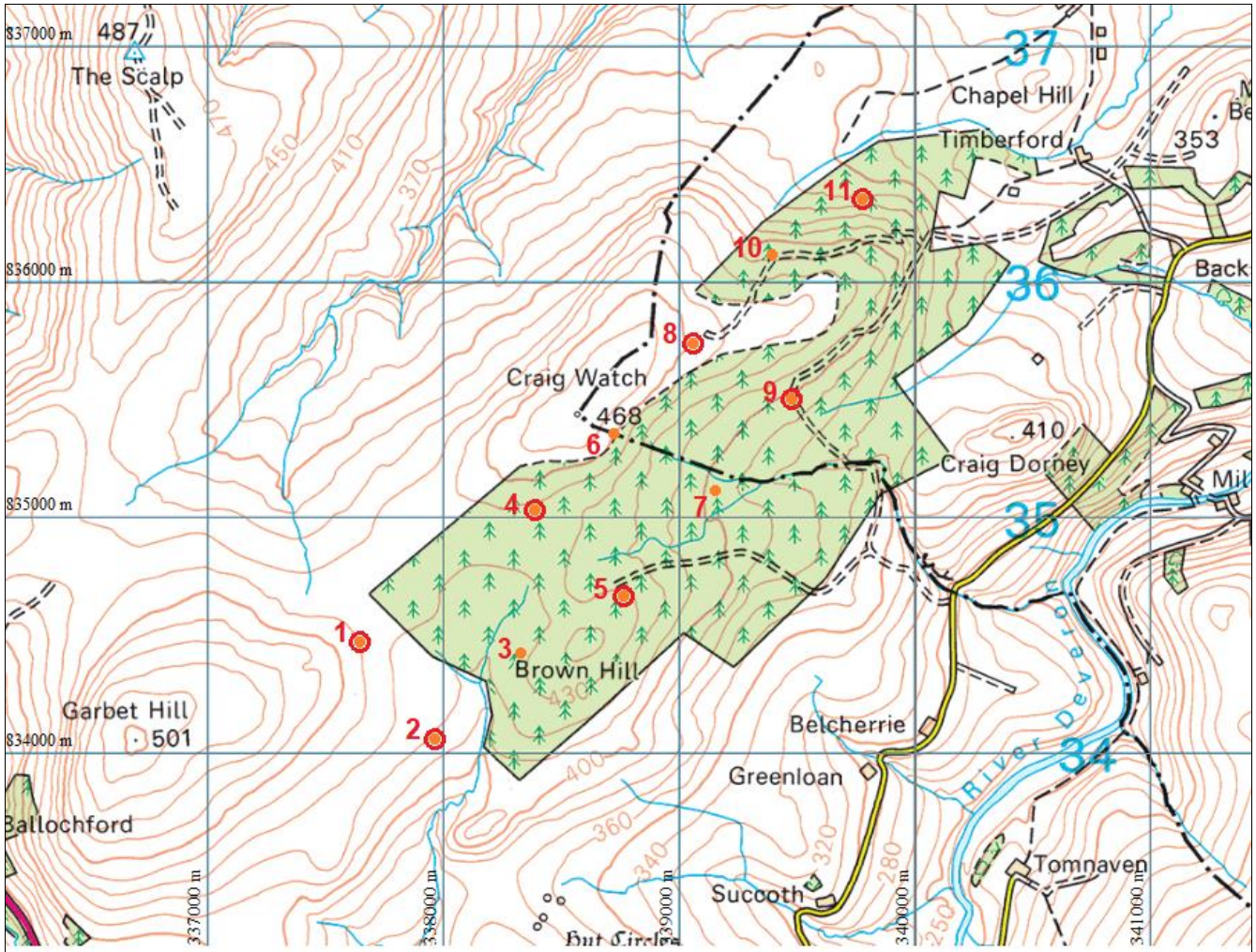

Figure 1: Craig Watch wind farm: 2022 layout and CAA-approved lighting scheme

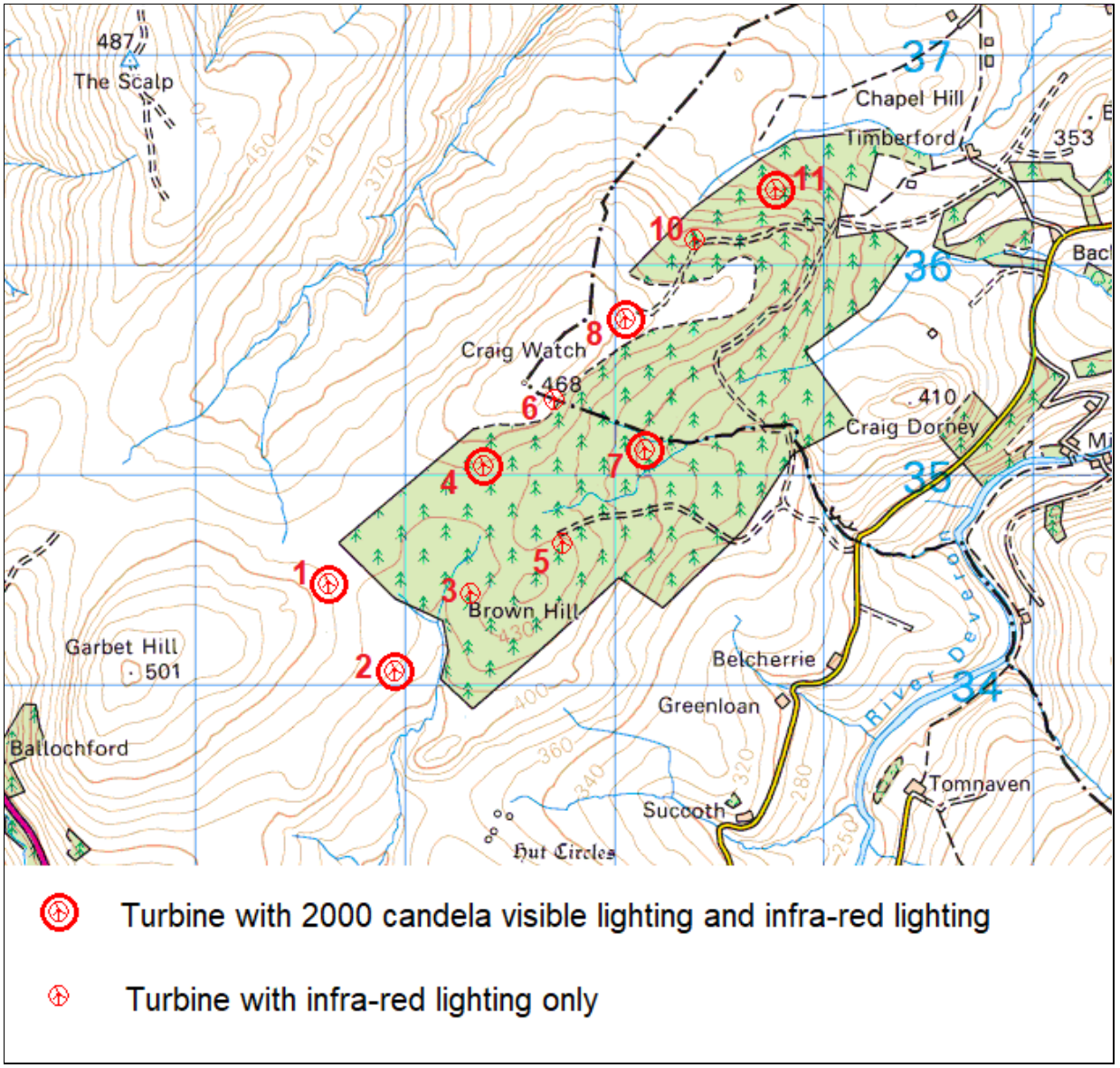

Figure 2: Craig Watch wind farm: 2023 layout and proposed revised lighting scheme

2. The obstacle environment around Craig Watch

2.1 The proposed Craig Watch development is located in an area containing numerous existing, consented and in-planning wind farms. The details of these are set out in Table 1.

2.2 In summary, there are nine existing, consented or proposed wind farms, totalling 168 turbines, within a 10 km radius of the Craig Watch proposed development. Of these:

- 150 (89%) have no visible spectrum lighting;
- 18 (11%) are proposed to be lit with 2000 cd nacelle-level lights in accordance with Article 222 of the Air Navigation Order.

2.3 The tip heights of existing and consented wind turbines within 10 km radius of the Craig Watch site range up to 2595 ft above mean sea level (amsl). The Craig Watch turbines would range from 1843 to 2138 ft amsl tip height.

2.4 In addition to the wind farm developments listed in Table 1, there is high ground with elevations greater than the highest blade tips of the Craig Watch development within 15 km radius of the site, to the west, south west and south of the wind farm site.

Table 1: Status of existing, consented and in-planning wind farms within 10km

Project	*No. of turbines*	*Tip height (m agl)*	*Max tip ht (ft amsl)*	*Operational status*	*Lighting status*
Craig Watch	10	200	2138	In planning	To be approved
Dorenell	59	126	2595	Operational	No lighting
Clashindarroch	18	110	1952	Operational	IR lighting on eight perimeter turbines only
Hill of Towie	21	100	1519	Operational	No lighting
Edintore	6	125	1384	Operational	IR lighting only
Cairnborrow	5	100	1260	Operational	IR lighting only
Hill of Towie II	16	125	1509	Consented	IR lighting only
Garbet	7	190	1910	Consented	2000cd lights on five turbines; IR lights on all turbines
Clashindarroch II	14	180	1952	In planning	2000cd + IR lighting on four cardinal turbines; IR lights on 3 additional perimeter turbines
Clashindarroch Extension	22	9 x 180 13 x 200	2253	In planning	2000cd lights on nine turbines; IR lights on 20 turbines.

3. Design of the lighting scheme

3.1 The proposed Craig Watch wind farm consists of 10 turbines with tip heights of 200 m above ground level.

3.2 The proposed lighting scheme is shown in Figure 1. Its main features are:

- six of the ten 200 m tip turbines – marking the corners and perimeter of the wind farm – will be lit with 2000 candela steady red lights and infra-red lights on the nacelle;
- all other turbines (four in total) will be lit with infra-red lights only.

Perimeter and corner lighting

3.3 In line with the recommendation in paragraph 6.2.4.3 (a) of ICAO Annex 14, it is proposed to fit all perimeter turbines in the Craig Watch wind farm with lights. The corner turbines of the wind farm – T1 and T2 at the south west end, and T11 at the north east end - will be marked with 2000 candela visible spectrum red lights and will also be fitted with MoD specification infra-red lights. A further three turbines – T4, T7 and T8– will also be fitted with both 2000 candela and infra-red lights. The remaining four turbines – T3, T5, T6 and T10 - will be fitted with infra-red lights only. This configuration will ensure that the whole of the wind farm will be delineated by visible spectrum lights and that every turbine in the wind farm will remain visible to aircrew operating on NVGs even when the visible spectrum lighting is not visible.

Highest turbines

3.4 ICAO Annex 14 paragraph 6.2.4.3(d) recommends that lights should be installed so that *"any wind turbines of significantly higher elevation are also identified wherever they are located".* In addition, paragraph 5.6(f) of the draft revised CAP 764 recommends that no proposed unlit turbines should be at angles of elevation greater than 10° from adjacent lit turbines. The highest turbine in the Craig Watch wind farm will be T6, halfway along the northern edge of the wind farm. This will not be lit with a 2000 candela light, but will be fitted with infra-red lighting. T6 will have turbines fitted with 2000 candela lighting to the south west (T4), south east (T7) and north east (T8). The elevation angles from each of those turbines to T6 are set out in Table 2.

Table 2: Elevation angles to T6 from adjacent lit turbines

Turbine no.	*Distance from T6 (m)*	*Height difference (m)*	*Elevation angle to T6*
4	465	13.7	1.7°
7	492	55.1	6.4°
8	513	4.4	0.5°

3.5 It can be seen that the elevation angles from all adjacent lit turbines to the unlit T6 are all less than 10°, thus meeting the provisions of paragraph 5.6(f) of the draft revised CAP 764.

3.6 Additionally, it is considered that, with a height difference of 4.4m between T8 and T6, T6 is not at a “significantly higher elevation” than the other turbines and that the provisions of ICAO Annex 14 paragraph 6.2.4.3(d) are met.

Mid-tower lighting

3.7 The CAA Policy Statement of June 2017 on lighting of turbines 150 m or more in height recommends that *“at least three (to provide 360 degree coverage) low-intensity Type B lights (32 candela) lights should be provided at an intermediate level of half the nacelle height.”* This reflects an ICAO recommendation in Annex 14 paragraph 6.2.4.3(e)(iii) for turbines between 150 m and 315 m tip height.

3.8 The purpose of the intermediate-level lights is understood to be to enable pilots to identify particular turbines that are greater than 150 m in height above ground level. However, during consultations with stakeholders on this and other proposed wind farm lighting schemes, the point has been made that because of their low intensity, 32 candela lights are of limited visibility to pilots especially when operating in low visibility conditions. In addition, as explained in Section 7 of Report 22/994/RAM/2, it is likely that LED lights will not be visible to aircrew wearing NVGs since modern LED red aviation obstacle lights operate in a narrow frequency spectrum which is outwith the range of frequencies detectable through NVGs. Consequently, Craig Watch Wind Farm Limited proposes not to fit intermediate-level 32 candela lights to the Craig Watch turbines, and seeks CAA permission for that deviation from the provisions of the 2017 Policy Statement and draft CAP 764.

Aircraft Detection Lighting System (ADLS)

3.9 In addition to the reduced lighting specification as set out above, Craig Watch Wind Farm Limited is exploring the potential for deploying an aircraft detection lighting system (ADLS) on the Craig Watch wind farm. This would activate the visible spectrum lighting on the wind farm when sensors detect an aircraft entering a specified volume of airspace around the wind farm. The specification of the ADLS will be subject to consultation with and approval by the CAA prior to the commencement of construction of the wind farm.

3.10 ADLSs are already in operational use at wind farms in the USA, Canada, Denmark, Sweden, France and Germany. A number of different aircraft detection technologies can be used in these systems. In the UK, the CAA has stated that it is developing a policy on ADLS. This is expected to be published in 2023. In addition, policy and guidance on ADLS will be addressed by the Scottish Government Aviation Lighting Working Group (AvLi) in 2023.

Summary of the proposed lighting scheme

3.11 The proposed revised Craig Watch lighting scheme is as follows:

- six of the ten turbines – Turbines 1, 2, 4, 7, 8 and 11 - will be lit with 2000 candela steady red lights and infra-red lights on the nacelle;
- a second 2000 candela light will be fitted to those same six turbines, to act as a back-up in the event of failure of the main light;
- all other turbines – Turbines 3, 5, 6 and 10 - will be lit with infra-red lights only;

- it is proposed not to fit mid-tower 32 candela lighting;
- the 2000 candela lights will be programmed to switch on at 30 minutes after sunset and switch off at 30 minutes before sunrise;
- the 2000 candela lights will be dimmed to 10% of their peak intensity when a visibility sensor at the wind farm records the meteorological visibility as exceeding 5 km; and
- the potential for an Aircraft Detection Lighting System will be explored and will be subject to separate and additional consultation with the CAA.

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APPENDIX 1

CRAIG WATCH WIND FARM CO-ORDINATES AND PROPOSED LIGHTING

Turbine no.	*Easting*	*Northing*	*Tip height (m)*	*Proposed lighting*
1	337646	834471	200	2000cd + IR
2	337964	834056	200	2000cd + IR
3	338322	834426	200	IR only
4	338385	835034	200	2000cd + IR
5	338763	834664	200	IR only
6	338723	835353	200	IR only
7	339154	835115	200	2000cd + IR
8	339062	835738	200	2000cd + IR
10	339393	836115	200	IR only
11	339779	836354	200	2000cd + IR

NB there is no Turbine 9 in the revised layout.