APPENDIX 2.2:

WIND FARMS WITHIN 20KM OF THE DEVELOPMENT

Inchamore Wind Farm

Appendix 2.2 – Wind Farms within 20 km of the Development

Wind Farm	Status	No. of Turbines	Approximate Distance to the Site Boundary	Direction from the Development
Barnastooka	Operational	14	7.50 km	South-West
Caherdowney	Operational	4	10.19 km	North-East
Carriganimmy Macroom (Bawnmore)	Operational	6	15.48 km	North-East
Cleanrath (11 consented, nine constructed and operational)	Operational	9	9.93 km	South-East
Clydaghroe, Clonkeen	Operational	4	6.05 km	North-East
Coolea	Permitted	1	3.17 km	South-West
Coolknoohil Inchee	Permitted	2	3.94 km	South-West
Coolknoohil Kilgarvan (Everwind)	Operational	11	4.40 km	South-West
Coomacheo	Operational	15	9.02 km	North-East
Coomagearlahy Kilgarvan	Operational	15	2.70 km	South-West
Cummeennabuddoge	Pre-Planning/ Concept Stage	17	4.72 km	North-East
Cummeennabuddoge, Clydaghroe, Cloonkeen	Operational	2	7.23 km	North-East
Curraglass	Permitted	7	14.97 km	South-West
Derragh	Operational	6	7.52 km	South
Drishane Millstreet (Curragh Mountain/Coomacheo 2)	Operational	8	10.47 km	North-East
Glanlee I (Midas)	Operational	6	4.87 km	South-West
Gneeves	Opertional	11	10.16 km	North-East
Gneeves Millstreet	Permitted	4	10.20 km	North-East
Gortnakilla, Clonkeen Killarney	Permitted	4	1.87 km	West
Gortyrahilly	Proposed/SID project pending decision from An Bord Pleanála	14	4.95 km	South
Grousemount	Operational	24	7.38 km	South-West
Inchee, Poulbatha & Foilgreana (Midas)	Operational	6	3.30 km	South-West
Inchincoosh Kilgarvan	Operational	6	4.51 km	West
Knocknamork	Permitted	7	4.42 km	North-East
Rosseightragh, Lettercannon, Kilgarvan	Operational	7	5.23 km	South-West
Shehy More	Operational	11	15.71 km	South
Sillahertane Kilgarvan	Operational	10	7.03 km	South-West

APPENDIX 2.3:

GRID CONNECTION DETAILS

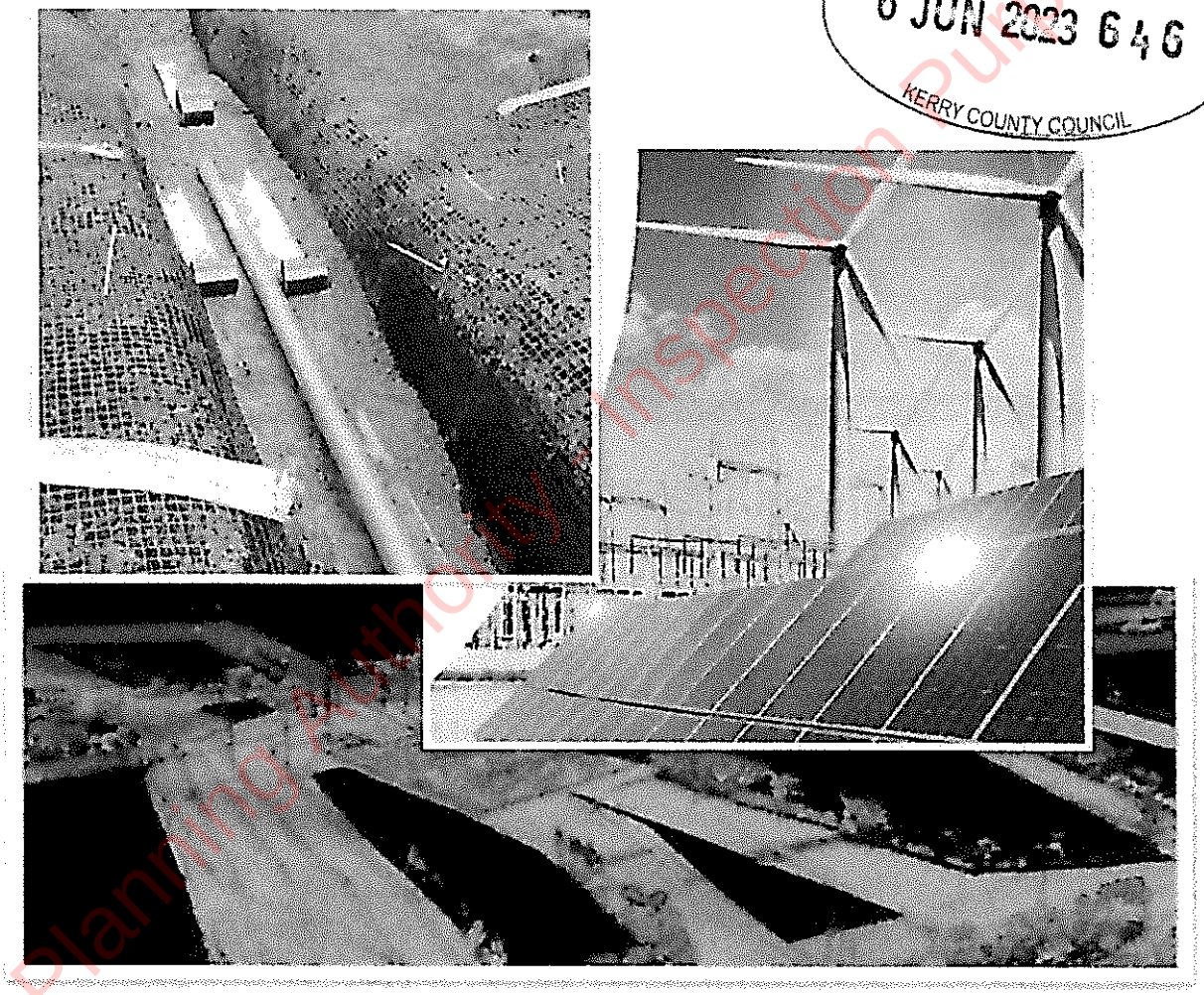
Inchamore WF - 38kV Grid Connection

Route Summary & Joint Bay Locations
(28.10.22)

Section From	Section To	Section Length	Bonding Arrangement	No. of Watercourses	Watercourses	No. of Culverts	No. of Service Crossings	Comments
Ballyvouskill SS	JB-01	1098.7	Bonded Both Ends			-	1	110kV Cable crossing and laid in parallel to Garrow UGC
JB-1	JB-2	1039.6	Bonded Both Ends			9		38kV laid in parallel to Garrow UGC
JB-2	JB-3	1102.2	Bonded Both Ends			7		38kV laid in parallel to Garrow UGC
JB-3	JB-4	1096.5	Bonded Both Ends			12		38kV laid in parallel to Garrow UGC
JB-4	JB-5	1031.6	Bonded Both Ends	1	Str. 1 - Valley	10	2	38kV laid in parallel to 20kV UGC, 20kV UG Cable Crossing, 1x HDD Crossing
JB-5	JB-6	1098.9	Bonded Both Ends			11	2	38kV laid in parallel to 20kV UGC, 20kV UG Cable Crossing, 38kV laid in parallel to 38kV UGC, 38kV UG Cable Crossing
JB-6	JB-7	1090.9	Bonded Both Ends			-		
JB-7	JB-8	1059.0	Bonded Both Ends			4		
JB-8	JB-9	1174.3	Bonded Both Ends	2	Str.2, Str.3	10		
JB-9	JB-10	1015.2	Bonded Both Ends			8		
JB-10	JB-11	1158.0	Bonded Both Ends			11		
JB-11	JB-12	1182.9	Bonded Both Ends			9		
JB-12	JB-13	1093.4	Bonded Both Ends			9	1	38kV UG Cable Crossing, 38kV laid in parallel to 38kV UGC
JB-13	JB-14	1163.3	Bonded Both Ends			3		38kV laid in parallel to 38kV UGC
JB-14	JB-15	576.6	Bonded Both Ends			2		38kV laid in parallel to 38kV UGC
JB-15	JB-16	1160.0	Bonded Both Ends			2		N22 HDD
JB-16	JB-17	1122.0	Bonded Both Ends			5		
JB-17	JB-18	1183.6	Bonded Both Ends			1		
JB-18	WF SS	292.0	Bonded Both Ends			-		
	Total:	18,348		3		113	6	

Outline Construction Methodology

Inchamore Wind Farm 38kV Grid Connection



Report Ref: 05934-R01-03

Client: Inchamore Wind DAC

Revision:	Author:	Checked:	Date:	Notes:
00	POS	DB	14.11.22	Issued for Planning
01	POS	DB	22.11.22	Issued for Planning
02	POS	DB	09.12.22	Correction to Typo Error
03	POS	DB	17.04.23	Revised as per Clients Comments

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Table of Figures

1.0 Introduction

The purpose of this document is to outline and explain the construction techniques and methodologies which will be implemented during construction of the Inchamore Wind Farm 38kV grid connection to the existing Ballyvouskil 220kV substation. The grid connection will consist entirely of underground cabling (UGC) with the majority of the UGC to be installed within internal forestry road networks.

The UGC works will consist of the installation of 4 No. ducts in an excavated trench to accommodate 3 No. power cables and 1 No. fibre communications cable to allow communications between the Inchamore Wind Farm Substation and Ballyvouskil 220kV substation.

This document is intended to be used as an aid to understand the methodologies to be employed during construction and should be read in conjunction with all other specialist reports which accompany the planning application. In addition, this document is in outline form only and will be revised and updated prior to the commencement of any construction activities, detailed Method Statements will be prepared in respect of each aspect of the development.

2.0 38kV Underground Cable Route

The UGC route is approximately 19.872km in length and traverse in an east to south easterly direction from the existing Ballyvouskil 220kV substation to the Inchamore Wind Farm substation location utilising public local road networks, existing access tracks and private forestry access tracks.

The cable location will take into consideration Cork County Council, Kerry County Council and all other relevant stakeholders' requirements. Installation of the cable will consider all environmental protection measures forming part of the planning application for the development at Inchamore wind farm and accompanying technical reports.

Figure 1 outlines the UGC route, with the total length of each road type detailed in Table 1.

Figure 1 - Grid Connection Route Layout Plan

Table 1 – Approximate UGC Route Location of Preliminary Design:	
Wind Farm Site/Forestry Roads	**ESB Access Track**
18.8km	1km

Table 1: Inchamore Wind Farm to Ballyvouskil 220kV Substation – UGC Route Location Summary

Table 2 separates the UGC route into a number of sections and describes the specific construction requirements of each individual section along with assessment of access routes to the work areas.

Table 2 - Summary of Grid Connection Design Route	
Section	**Description**
Section 1 UGC	**UGC from Ballyvouskil 220kV substation to N22 Road HDD Crossing (Chainage 17150m)** The underground cable route initially begins within the townland of Caherdowney, Co. Cork where from Ballyvouskil 220kV substation compound, the UGC departs the substation on the north western boundary, converging onto a permanent access track to be constructed as part of this development within agricultural lands and traverses on an upward trajectory for approximately 950m prior to entering into forested plantations propertied by Coillte. The UGC will establish a route for the majority within existing forestry access tracks and will traverse adjacent to existing ESB utility infrastructure that reside within these forestry tracks. The UGC remains within these tracks for the majority of the grid connection route, carrying for an approximate length of 15.7km whilst sporadically crossing between Cork county and Kerry county boundaries through denoted townlands Cummeenabuddogue, Clydaroe, Knocknagowen, Glashacormick across this plantation coverage. Subsequent to crossing through the forestry properties, the UGC will leave the forestry access track on the south westerly side within the townland of Cummeenavrick, Co. Kerry and converges onto first, a section of redundant regional roadway, adjacent to the N22 National carriageway prior to accessing consented third-party property (KY30186F). The UGC will traverse this parcel within a permanent access road to be constructed as part of this development. This access road entails a 4m wide track with load bearing capacity of 10 tonne to allow for Horizontal Directional Drilling (HDD) activities commence to drill beneath approximately 70m of the N22 carriageway with the remainder of the drill shot equating to approximately 580m. ***Features*** ***Section 1 contains 15 No. joint bays***. Joint bays will be located below ground and finished/reinstated as per Forestry Road Manual (Guidelines for the design, construction and management of forest road) and as per private landowner reinstatement requirements. Joint bays will have associated communication chambers which will have a surface access hatch which will match existing ground levels.

- Joint Bay 01 (JB-01) will be located within a permanent access track at ~~Chainage – 1100m~~
- Joint Bay 02 (JB-02) will be located south west of JB-01 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 2150m]*
- Joint Bay 03 (JB-03) will be located south west of JB-02 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 3250m]*
- Joint Bay 04 (JB-04) will be located south west of JB-03 positioning the joint bay within a widened verge to the existing forestry track *[Chainage – 4350m]*
- Joint Bay 05 (JB-05) will be located south west of JB-04 positioning the joint bay within a widened verge to the existing forestry track *[Chainage – 5400m]*
- Joint Bay 06 (JB-06) will be located north west of JB-05 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 6500m]*
- Joint Bay 07 (JB-07) will be located south west of JB-06 positioning the joint bay at receptor location for the HDD activities required to cross stream 1. *[Chainage – 7550m]*
- Joint Bay 08 (JB-08) will be located north west of JB-07 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 8650m]*
- Joint Bay 09 (JB-09) will be located north west of JB-08 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 9800m]*
- Joint Bay 10 (JB-10) will be located west of JB-09 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage –10800m]*
- Joint Bay 11 (JB-11) will be located west of JB-10 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 11950m]*
- Joint Bay 12 (JB-12) will be located west of JB-11 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 13150m]*
- Joint Bay 13 (JB-13) will be located south of JB-12 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 14250m]*
- Joint Bay 14 (JB-14) will be located north west of JB-13 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 15400m]*
- Joint Bay 15 (JB-15) will be located south west of JB-14, within a new permanent access road to be constructed to allow HDD activities on the eastern side of the N22 *[Chainage – 16000m]*
- Joint Bay 16 (JB-16) will be located south west of JB-15 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 17150m]*

Section 1 has 3 No. watercourse crossings:

- Stream 1 has been surveyed with the result of insufficient clearance existing within this structure. To cross this stream, it will be required to utilise a Horizontal Directional Drill within the existing forestry track to cross beneath with a satisfactory clearance to the waterway. *[Chainage 5200m]*
- Stream 2 has been surveyed with the result of insufficient clearance existing within this structure. To cross this culvert, it will be required to utilise a Horizontal Directional Drill within the existing forestry track to cross beneath with a satisfactory clearance to the waterway. *[Chainage 9200m]*
- Stream 3 has been surveyed with the result of insufficient clearance existing within this structure. To cross this culvert, it will be required to utilise a Horizontal Directional Drill within

	the existing forestry track to cross beneath with a satisfactory clearance to the waterway. *[Chainage 9750m]* ***Section 1 will require 6 No. service crossings:*** Existing ESBN infrastructure will be encountered and the crossing schedules will be prepared at detailed design to identify under or over methods to cross these existing buried services. ***Section 1 has 107 No. culvert crossings:*** See section 8 of this report for Culvert crossing methods and drawings 05934-DR-217-P1 & 05934-DR-218-P1 for further details.
Section 2 UGC	**N22 Road HDD Crossing to Inchamore Windfarm site location (Chainage 19850m)** The receptor pit from the drill shot will be located, again within Folio KY30186F on the opposite side of the N22 carriageway within the townland of Derryreag. From here the UGC route travels south within an existing forestry track through lands propertied by Coillte for approx. 1500m. The UGC will establish the remainder of the route within the designation of county Cork, traveling through the townland of Derreenaling and Inchamore, mainly southwest for a further approx. 1200m where the UGC route enters into the proposed onsite 38kV substation for Inchamore Wind Farm. ***Features*** ***Section 2 contains 2 No. joint bays***. Joint bays will be located below ground and finished/reinstated as per Forestry Road Manual (Guidelines for the design, construction and management of forest road), finished/reinstated to the required roads specification and reinstated to landowner preference where applicable. Joint bays will have associated communication chambers which will have a surface access hatch which will match existing ground levels. • Joint Bay 17 (JB-17) will be located south of JB-16 positioning the joint bay within a widened verge to the existing forestry track. *[Chainage – 18250m]* • Joint Bay 18 (JB-18) will be located south of JB-17, within consented third-party lands *[Chainage – 19400m]* ***Section 2 has 6 No. culvert crossings:*** See section 8 of this report for Culvert crossing methods and drawings 05934-DR-217-P1 & 05934-DR-218-P1 for further details.

3.0 Access Routes to Work Area

The majority of the underground cable route will be installed within existing forestry access track networks and therefore will be accessed via the existing road network. Where the cable route is located on private lands, contractor(s) will be required to utilise the local public road network in the vicinity of the work area and from there utilise private access tracks, where appropriate.

A detailed Traffic Management Plan has been prepared as part of the EIAR (Environmental Impact Assessment Report). Some work areas will require a road closure where it is not possible to safely implement a Stop/Go system. Where road closures are necessary, a suitable diversion will be implemented using appropriate signage, following consultation with Cork County Council

Careful and considered local consultation will be carried out, to minimise the amount of disturbance caused during works. Prior to the commencement of construction, the contractor will assess all access routes and determine any additional access requirements which will be incorporated as part of the method statement. All plant and equipment employed during the works (e.g. diggers, tracked machines, footwear etc.) will be inspected prior to arrival on site and on leaving site and cleaned where necessary to prevent the spread of invasive aquatic / riparian species.

4.0 Traffic Management

Traffic management and road signage will be in accordance with the Department of Transport: Traffic Signs Manual - Chapter 8: Temporary Traffic Measures and Signs for Road Works and in agreement with both Cork County Council and Kerry County Council. All work on public roads will be subject to the approval of a road opening license application by both Cork County Council and Kerry County Council. The contractor will submit the traffic management plan for inclusion as part of the road opening applications. Where road widths allow, the UGC installation works will allow for one side of the road to be open to traffic at all times by means of a 'Stop/Go' type traffic management system, where a minimum 2.5m roadway will be maintained at all times.

Where it is not possible to implement a 'Stop/Go' system a full road closure will be required. Temporary traffic signals will be implemented to allow road users safely pass through the works area by channelling them onto the open side of the road. Typically, the UGC will be installed in 150m sections, and no more than 100m will be excavated without the majority of the previous section being reinstated. Where the construction requires the crossing of a road, works on one carriageway will be completed before the second carriageway is opened, to maintain traffic flows.

All construction vehicles will be parked within the works area so as not to cause additional obstruction or inconvenience to road users or residents. The traffic signals will be in place prior to the works commencing and will remain in place until after the works are completed. The public road will be checked regularly and maintained free of mud and debris. Road sweeping will be carried out as appropriate to ensure construction traffic does not adversely affect the local road condition.

In the event of emergency; steel plates, which will be available on site, can be put in place across the excavation to allow traffic to flow on both sides of the road. All traffic management measures will comply with those outlined within the accompanying EIAR (Environmental Impact Assessment Report) and will be incorporated into a detailed Traffic Management Plan to be prepared, in consultation with both Cork County Council and Kerry County Council, prior to the commencement of UGC construction.

5.0 Road Opening Licence

The UG grid connection works will require a road opening licence under Section 254 of the Planning and Development Act 2000-2015 from both Cork County Council and Kerry County Council. A Traffic Management Plan (TMP) will be agreed with both Cork County Council and Kerry County Council prior to the commencement of the development. The TMP will outline the location of traffic management signage, together with the location of any necessary road closures and the routing of appropriate diversions. Where diversions are required, these will be agreed with both Cork County Council and Kerry County Council in advance of the preparation of the Traffic Management Plan (TMP).

6.0 UGC Construction Methodology

The UGC will consist of 3 No. 110mm diameter HDPE power cable ducts and 1 No. 110mm diameter HDPE communications duct to be installed in an excavated trench, typically 600mm wide by 1,220mm deep, with variations on this design to adapt to bridge crossings, service crossings and watercourse crossings, etc. The power cable ducts will accommodate 1 No. power cables per duct. The communications duct will accommodate a fibre cable to allow communications between the Inchamore Wind Farm substation and Ballyvouskil 220kV substation. The ducts will be installed, the trench reinstated in accordance with the Forestry Road Manual (Guidelines for the design, construction and management of forest road), private third-party landowners and both Cork, Kerry County Council specifications. Once all are satisfied, then the electrical cabling/fibre cable is pulled through the installed ducts in approximately 1000/1200m sections. Construction method statements and templates will be implemented to ensure that the UGC is installed in accordance with the correct requirements, materials, and specifications of ESBN and EirGrid.

6.1 Trenching Methodology

The following section outlines the methodology to be followed during trenching works:-

- The Contractor, and their appointed Site Manager, will prepare a targeted Method Statement concisely outlining the construction methodology and incorporating all mitigation and control measures included within the EIAR and as required by planning conditions where relevant;
- All existing underground services along the UGC route shall be confirmed prior to the commencement of construction works;
- At watercourse crossings, the contractor will be required to adhere to the environmental control measures outlined within the EIAR, the detailed Construction Environmental Management Plan (CEMP) and best practice construction methodologies;
- Where the cable route intersects with culverts, the culvert will remain in place (where possible) and the ducting will be installed either above or below the culvert to provide minimum separation distances in accordance with ESB and Irish Water specifications;
- Traffic management measures will be implemented in accordance with those included in the EIAR, and a detailed Traffic Management Plan will be prepared and agreed with both Cork, Kerry County Councils;
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height. Stockpiles will be located a minimum of 50m from surface water features and all stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW);
- Excavated material shall be employed to backfill the trench where appropriate and any surplus material will be transported to the on-site borrow pit;

- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;
- Where required, grass will be reinstated by either seeding or by replacing with grass turves;
- No more than a 100m section of trench will be opened at any one time. The second 100m will only be excavated once the majority of reinstatement has been completed on the first;
- The excavation, installation and reinstatement process will take on average of 1 no. day to complete a 100m section;
- Where the cable is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together;
- Following the installation of ducting, pulling the cable will take approximately 1 no. day between each joint bay, with the jointing of cables taking approximately 1 week per joint bay location.

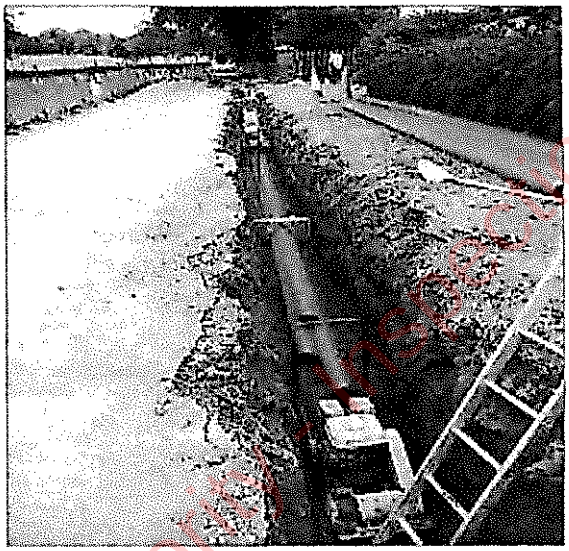


Figure 2 - Typical 38kV Underground Duct Installation

6.2 Ducting Installation Methodology

For the trenching and ducting works the following step by step methodology will apply:

1. Grade, smooth and trim trench floor when the required 1220mm depth and 600mm width have been obtained.
2. Place bedding layer of Cement Bound Granular Mixture B (CBGM B) material in accordance with the specification and compact it so that the compacted thickness is as per the drawings.
3. Lay the bottom row of ducts in trefoil formation as detailed on the design drawings. Use spacers as appropriate to establish horizontal duct spacing. Fit a secure cap / bung to the end of each duct run to prevent the ingress of dirt or water.
4. Carefully surround and cover ducts with CBGM B in accordance with the design drawings and specifications and thoroughly compact without damaging ducts.
5. Place cable protection strips on compacted CBGM B directly over the ducts.
6. Lay the top row of ducts onto the freshly compacted CBGM B including the cable protection strips above the bottom row of ducts. Place a secure cap at the end of each duct to prevent the ingress of dirt or water.

7. Carefully surround and cover ducts with CBGM B material in accordance with the drawings and thoroughly compact without damaging ducts.
8. Place red cable protection strip on top of compacted CBGM B over each set of ducts as shown on the drawings.
9. Place and thoroughly compact CBGM B material or Clause 804 backfill or soil backfill as specified and place warning tape at the depth shown on the drawings.
10. For concrete and asphalt/bitmac road sections, carry out immediate permanent reinstatement in accordance with the specification and to the approval of the local authority and/or private landowners, unless otherwise agreed with local authorities *(*Figure 3*)*.
11. For unsurfaced/grass sections, backfill with suitable excavated material to ground level leaving at least 100 mm topsoil or match existing level at the top to allow for seeding or replace turves as per the specification of the local authority or landowner *(*Figure 4*)*.
12. Clean and test the ducts in accordance with the specification by pulling through a brush and mandrel. Install 12 mm polypropylene draw rope in each duct and seal all ducts using robust duct end seals fitted with rope attachment eyes in preparation for cable installation at a later date. All the works should be witnessed by ESBN Clerk of Works (CoW) as required.

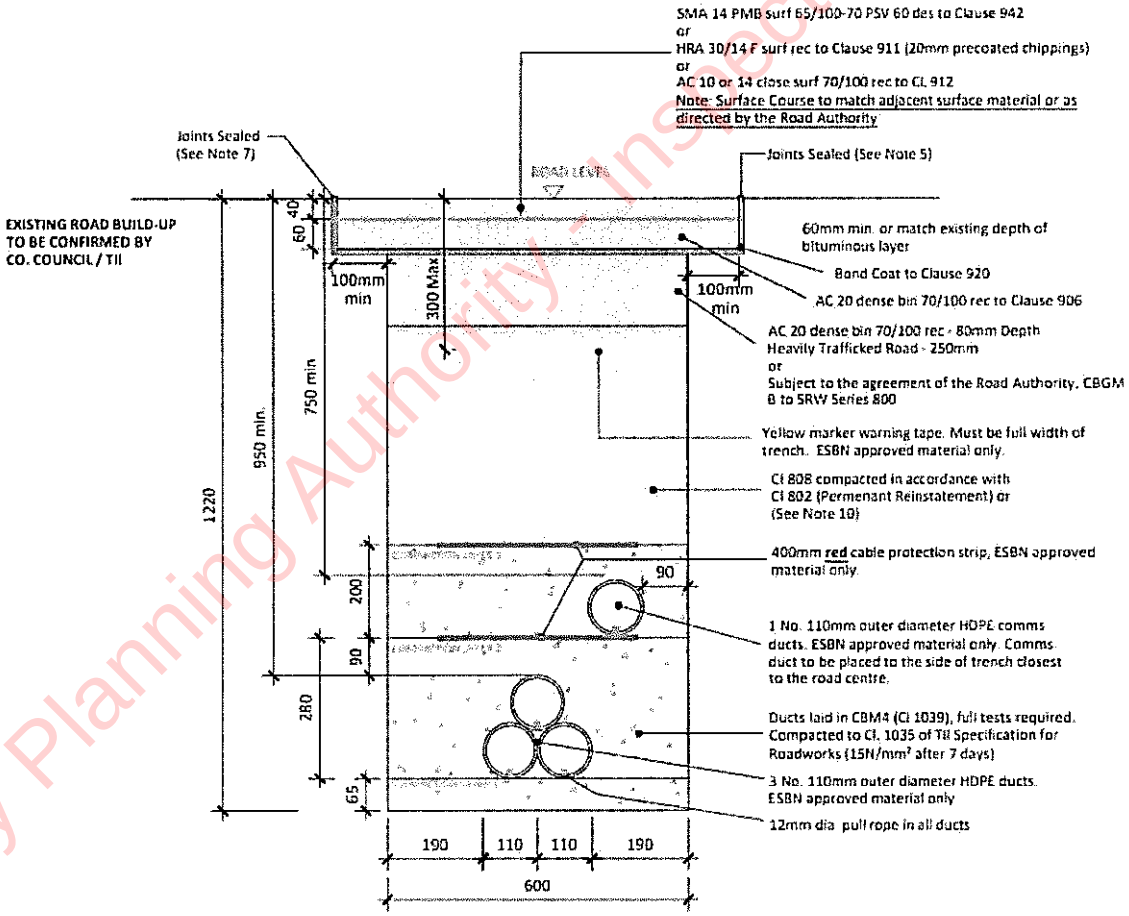


Figure 3 - Typical Trench in Roadway

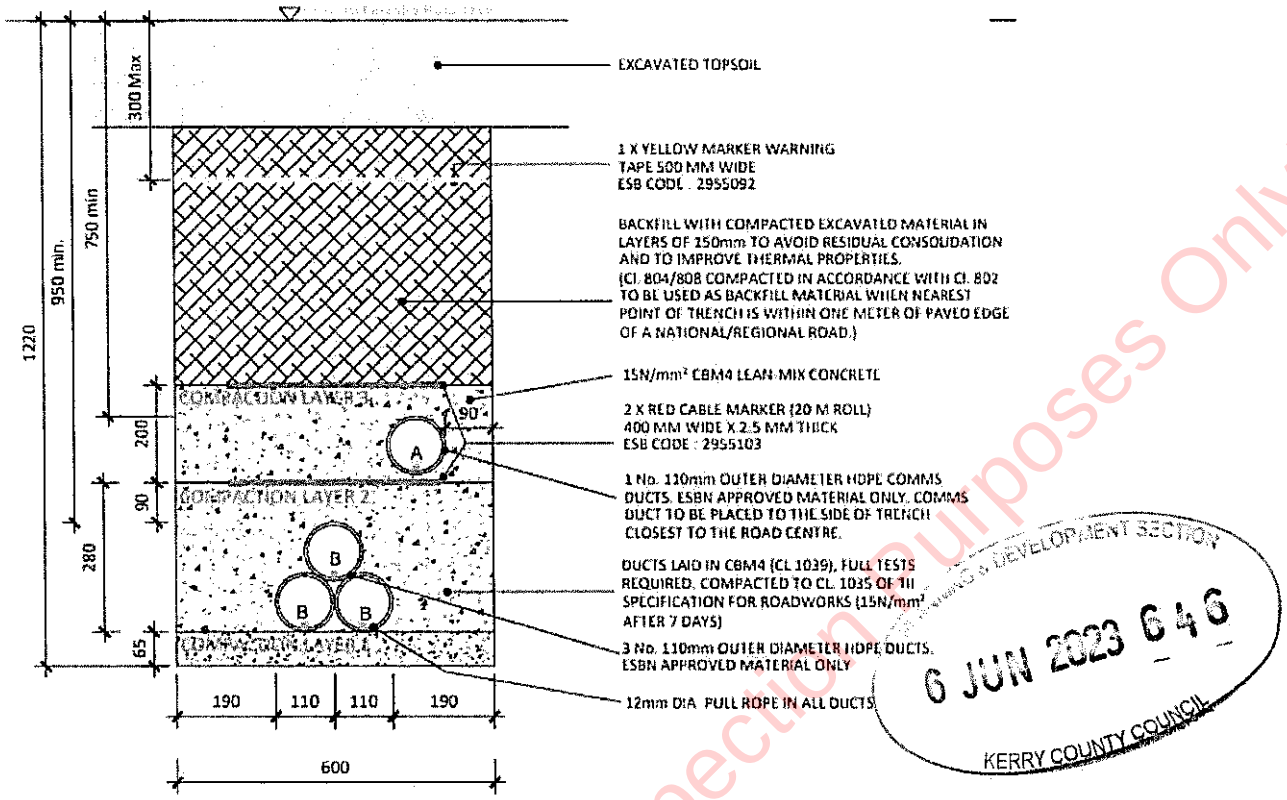


Figure 4 - Typical Trench in Forestry Road Section

6.2.1 UGC Installation on Public Road

Where the ducting is installed within public road carriages and where applicable the trench will be installed in the non-trafficked strip between the wheel marks on the road. The cable will be micro-sited based on the presence of exiting utilities and the nature of the road and the adjoining terrain. It is preferable to excavate a trench within the middle of the lane, or the middle of the roadway to reduce load on the cable.

6.2.2 UGC Installation on Tracks

The majority of the 38kV route is located within existing forestry access tracks. The location where the cable is laid will depend on several factors such as; width of track, bends along the track and crossings. Where the track needs to be widened, stone will be brought in to build up the area to the same level of the track. The excess material from the track will be used elsewhere on reinstatement works.

6.3 Marker posts

Surface cable markers will be placed along the route where cable depth is unavoidably shallow, due to constraints such as existing services, to indicate the precise location of the UGC. These markers will be metallic plates in accordance with ESBN and EirGrid standards.

Marker posts will be used on non-roadway routes to delineate the cable route and joint bay positions. Corrosion proof aluminium triangular danger sign, with 700mm base, and with centred lightning symbol, on engineering grade fluorescent yellow background shall be installed in adequately sized concrete foundations. Marker post shall also be placed in the event that burial depth is not to standard. Siting of marker posts to be dictated by ESBN as part of the detailed design process (Figure 5).

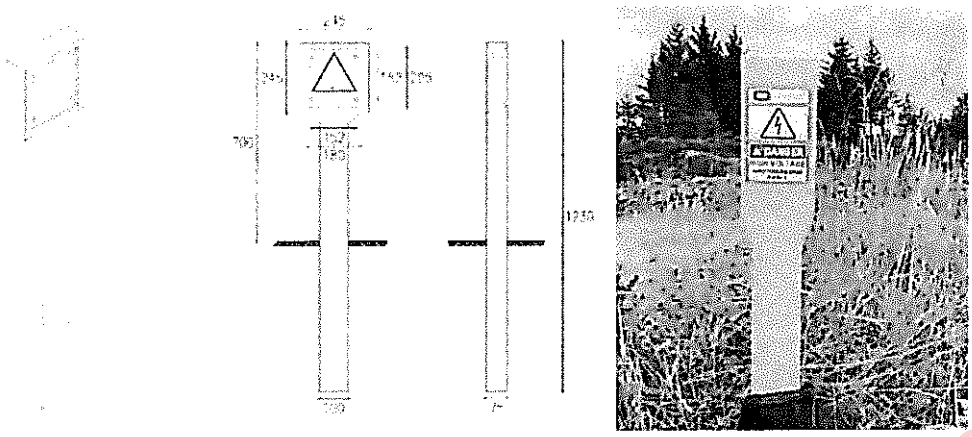


Figure 5 - Typical ESB Marker Posts Example

6.4 Managing Excess Material from Trench

All excavated material will be temporarily stored adjacent to the trench prior to re-use in the trench reinstatement (where applicable). Stockpiles will be restricted to less than 2m in height. Where excess material exists, it may be used in the reinstatement of the borrow pit as part of the Inchamore Wind Farm. Excavated tar from the public road network will be transported off site by an appropriately authorised waste collector and disposed of at an appropriately licenced waste facility.

6.5 Storage of Plant and Machinery

All plant, machinery and equipment will be stored on site within the UGC works area or within the temporary construction compounds to be located within the Inchamore Wind Farm. Oils and fuels will be stored in an appropriately bunded area within the temporary construction compounds.

6.6 Joint Bays and Associated Chambers

Joints Bays are to be installed approximately every 1000m - 1200m along the UGC route to facilitate the jointing of 2 No. lengths of UGC. Joint Bays are typically 4.5m x 2.03m x 1.475m pre-cast concrete structures installed below finished ground level. Joint Bays will be located in the non-wheel bearing strip of roadways, however given the narrow profile of local roads this may not always be possible.

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between Inchamore Wind Farm substation and the existing 220kV node at Ballyvouskil.

The precise siting of all Joint Bays and Communication Chambers is subject to approval by ESBN. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions.

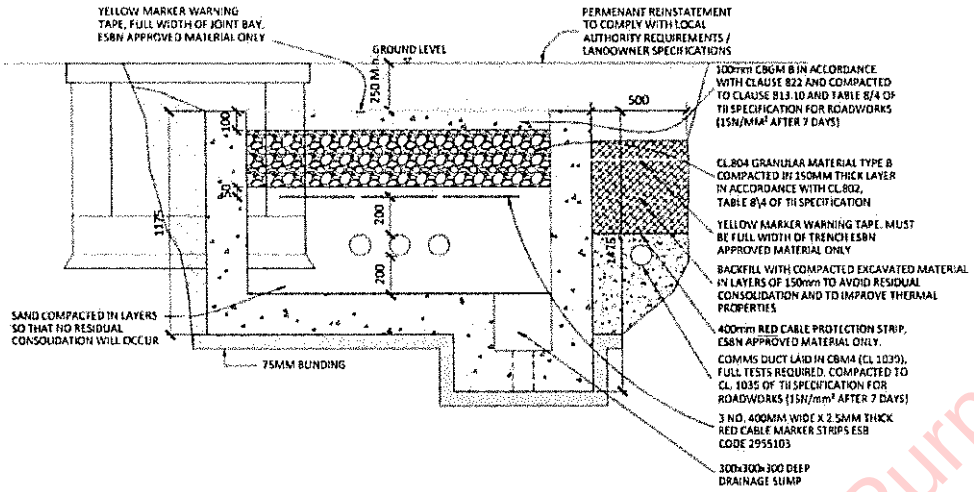


Figure 6 - Typical Section through Joint Bay

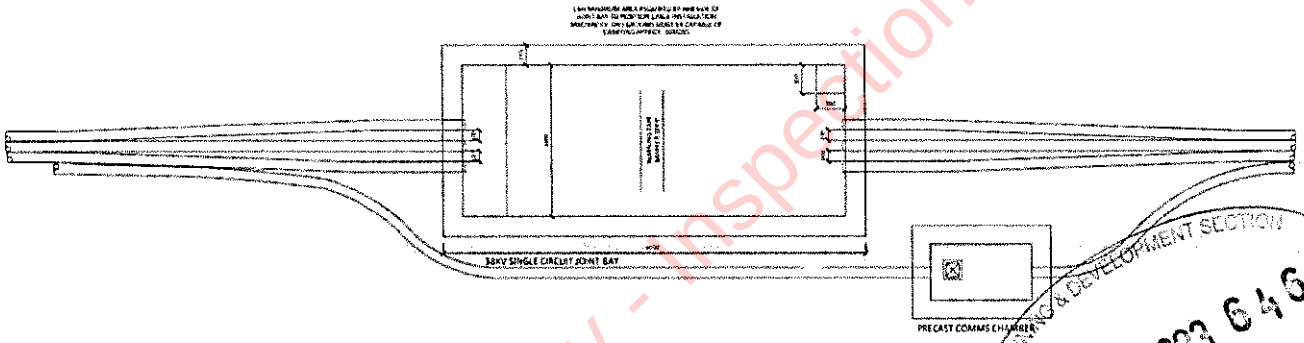


Figure 7 - 38kV Joint Bay Plan Layout

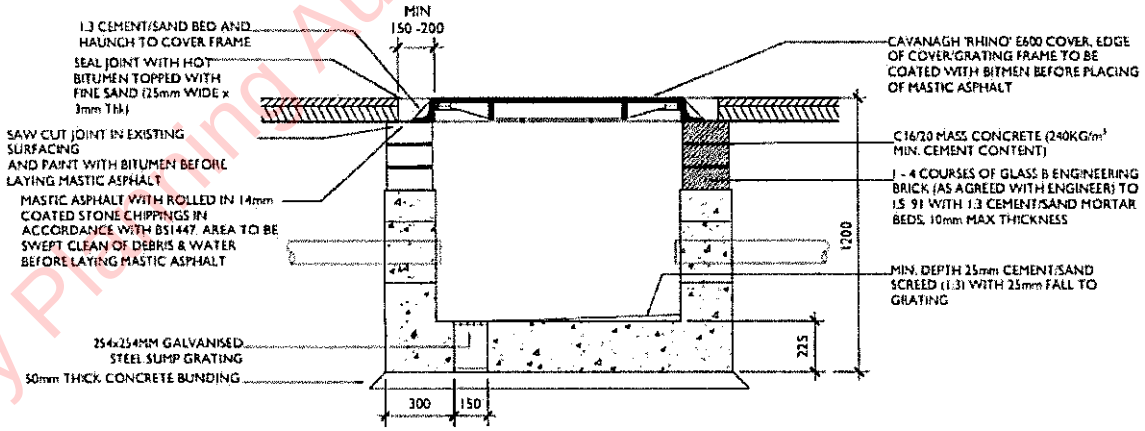


Figure 8 - Typical Section through Communications Chamber

6.7 Joint Bay Construction and Cable Installation

Before starting construction, the area around the edge of the joint bay which will be used by heavy vehicles will be surfaced with a terram cover (if required) and stone aggregate to minimise ground damage. Any roadside drains within the temporary works area will be culverted and check dams made from stone or sandbags covered with terram will be inserted upstream and downstream of these culverts to intercept any solids generated during the insertion or which wash out during the works. If the ground slopes from the working area toward a watercourse or if there is evidence of solids washing off the works area toward nearby watercourses or drains, a silt fence with straw bales, will be interposed between the works area and the watercourse.

All excavated material will be stored near the excavations and reused for reinstatement works. Any soil required for reinstatement that will be temporarily stockpiled on site will be placed at least 15m back from the nearest watercourse on level ground and will be ringed at the base by silt fencing and be regularly monitored by a designated competent person for signs of solids escape. In which case an additional line of silt fencing with straw bales will be added in line with the relevant environmental control measures.

If the joint bay needs to be dewatered, this will be pumped to a percolation area if the soil is not saturated, otherwise a settlement tank will be used to remove any solids from the dewatering process to comply with the environmental control measures.

The risk of concrete reaching surface waters is considered very low given that all concrete will be poured into the pit excavated for the joint bay so that spills will be contained. The basic requirement therefore is that all pouring operations be constantly supervised to prevent accidental spillages occurring outside the pit.

Temporary storage of cement bound sand (if required) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g. using sand-bags and geotextile sheeting or silt fencing to contain any solids in run-off.

Equipment:

- 2-3 General Operatives
- 1 Excavator Operator
- 360˚ tracked excavator (13 ton normally, 22 ton for rock breaker)
- 1 no. tracked dumper or tractor and trailer

Materials:

- Sand for pipe bedding
- Blinding Concrete where necessary
- Clause 804 Material
- 125mm diameter HDPE ducting
- Precast Chamber Units / Relevant construction materials for chambers

7.0 Relocation of Existing Services

In order to facilitate the installation of the underground cable, it may be necessary to relocate existing underground services within the curtilage of the road such as water mains, telecom networks or existing cables. In advance of any construction activity, the contractor will undertake detailed surveys and scans of the UGC route to confirm the presence or otherwise of any services. If found to be present, the relevant service provider will be consulted with in order to determine the requirement for specific excavation or relocation methods and to schedule a suitable time to carry out works.

8.0 Major Watercourse Crossings

The cable route will involve 3 No. waterbody crossings. Where the cable route intersects with existing watercourses, a detailed construction method statement will be prepared by the Contractor prior to the commencement of construction and is to be approved by the Local Authority and relevant environmental agencies.

Crossing existing culverts will be implemented using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert. The cable route will involve 3 No. culvert crossings locations which will require the mobilisation of HDD. The culvert crossing methods are detailed in Figure 9 and Figure 10 below with more detail seen in 05934-DR-217-P1 & 05934-DR-218-P1.

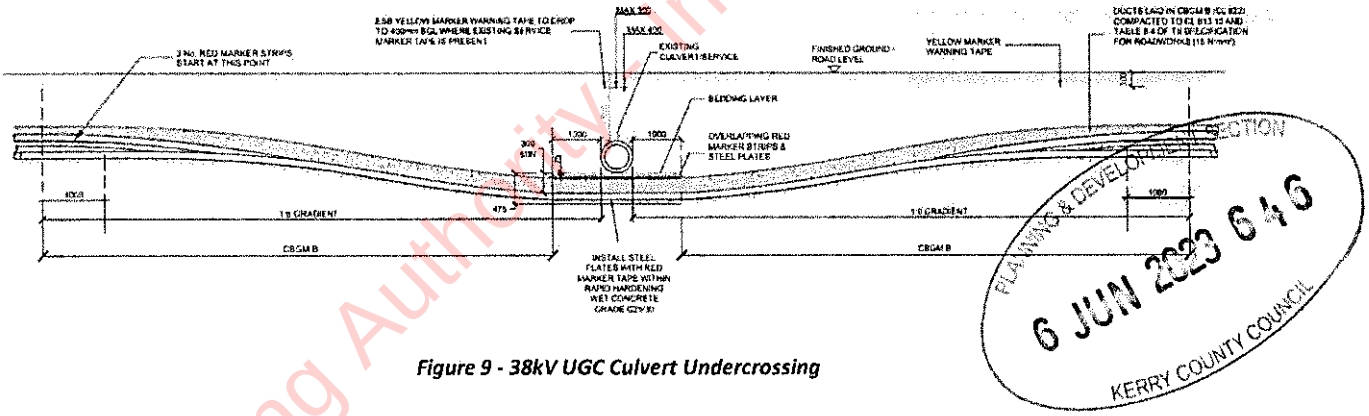


Figure 9 - 38kV UGC Culvert Undercrossing

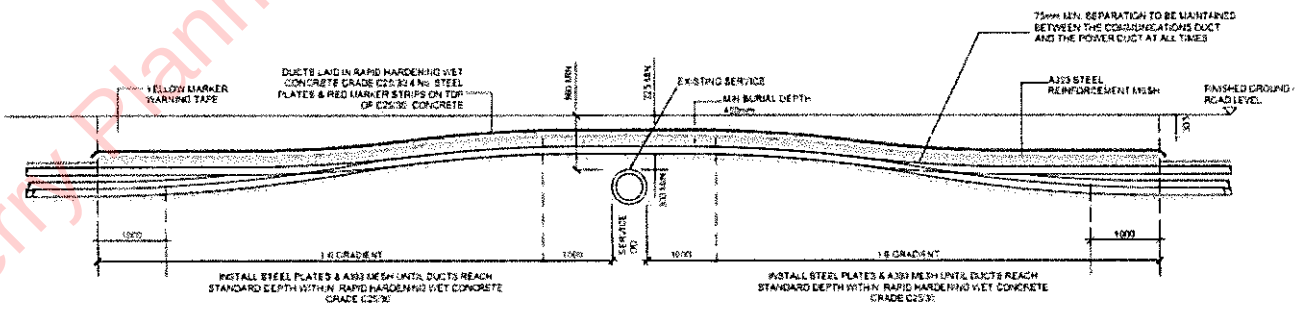


Figure 10 - 38kV UGC Culvert Overcrossing

Inland Fisheries Ireland have published guidelines relating to construction works along water bodies entitled 'Requirements for the Protection of Fisheries Habitats during Construction and Development Works at River Sites", and these guidelines will be adhered to during the construction of the development.

8.1 Stream 1 - Horizontal Directional Drilling

ITM Coordinates: 521705.04, 583153.2

Stream 1 is located approx. 174m east of JB05 crossing over a large stream within a valley. This steam flows in a northern direction. Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the forestry access track carriageway. The methodology for HDD is outlined in Section 9 below. Ref drawing 05934-DR-222.

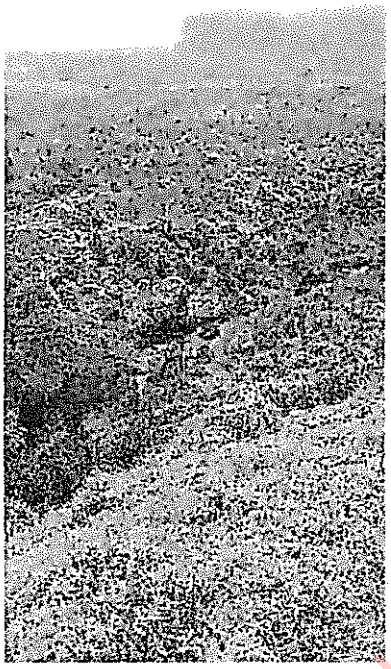


Figure 11 - Stream 1 Valley Crossing

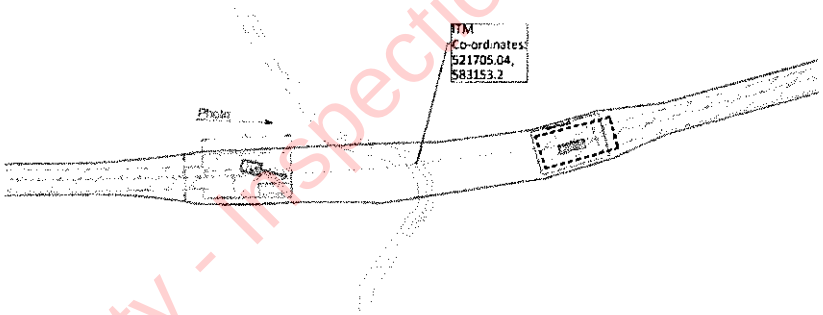


Figure 12 - Stream 1 Valley Crossing on OSI Background

8.2 Stream 2 (Culvert 56 & Culvert 57) - Horizontal Directional Drilling

ITM Coordinates: 518279.2, 583469.4

Stream 2 is located on a forestry access track approx. 580m east of JB09 crossing over a large Stream. This steam flows in a north direction and into the River Clydagh. This stream also flows into Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (Special Area of Conservation).

Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the forestry access track carriageway. The methodology for HDD is outlined in Section 9 below. Ref drawing 05934-DR-223.

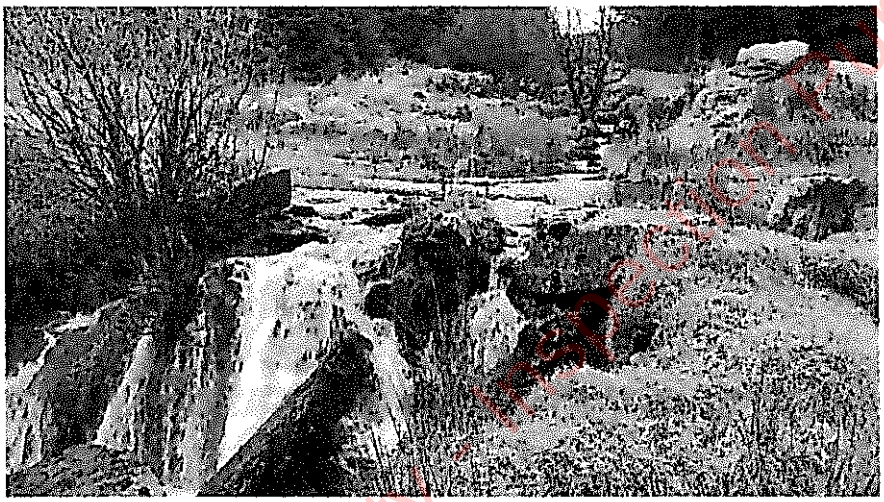


Figure 13 - Stream 2

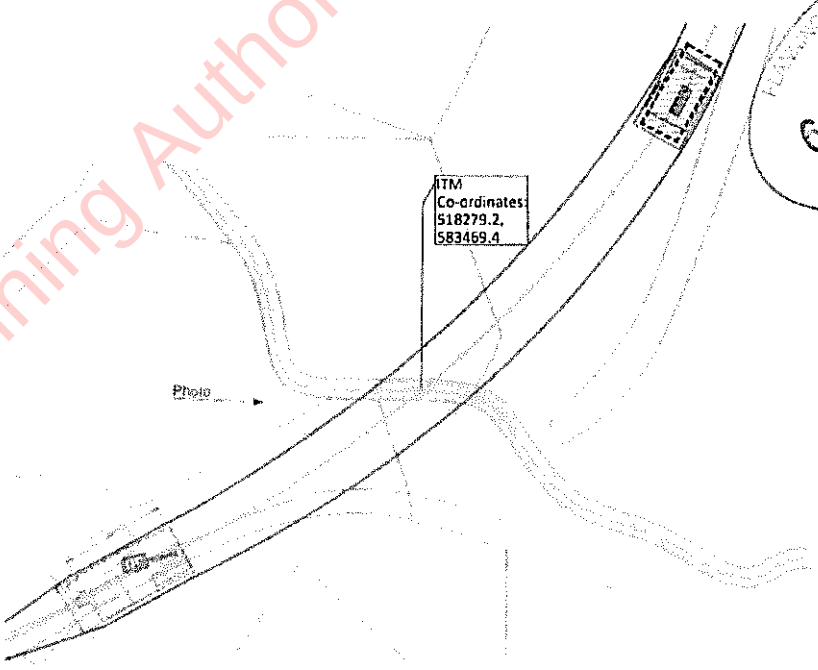


Figure 14 - Stream 2 within Forestry Road on OSI Background

8.3 Stream 3 (Culvert 59 to 63) - Horizontal Directional Drilling

ITM Coordinates: 517802.26, 583246.3

Stream 3 is located on a forestry access track approx. 44m east of JB09 crossing over a large Stream. This steam flows in a north direction and into the River Clydagh. This stream also flows into Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (Special Area of Conservation).

Horizontal directional drilling (HDD) will be implemented to bore approximately 1500mm beneath the waterway. This depth is based on locating a suitable clay/silt formation for HDD and the required depth may increase subject to geotechnical investigations. Drilling will take place from the forestry access track carriageway. The methodology for HDD is outlined in Section 9 below. Ref drawing 05934-DR-224.

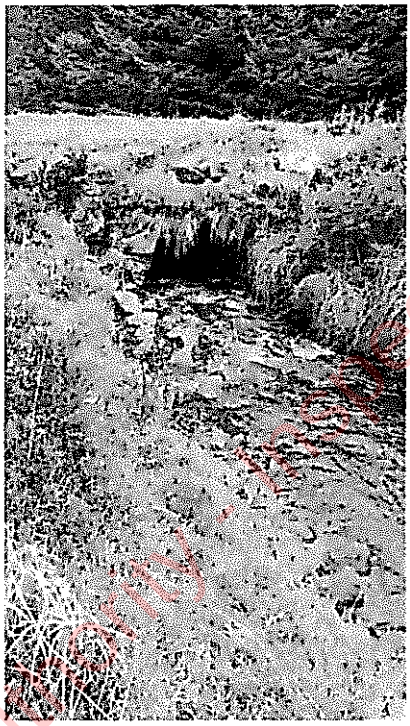


Figure 15 - Stream 3

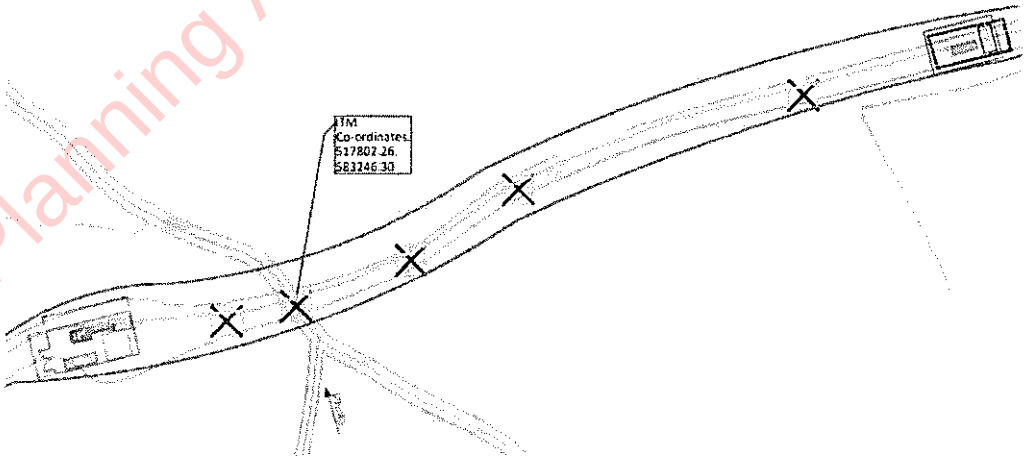


Figure 16 - Stream 3 within Forestry Road on OSI Background

9.0 Horizontal Direction Drilling (HDD)

Horizontal Direction Drilling (HDD) is a method of drilling under obstacles such as bridges, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible. The drilling methodology is as follows: -

1. A works area of circa. 40m^2 will be fenced on both sides of the river crossing,
2. The drilling rig and fluid handling units will be located on one side of the bridge and will be stored on double bunded 0.5mm PVC bunds which will contain any fluid spills and storm water run-off.
3. Entry and exit pits (1m x 1m x 2m) will be excavated using an excavator, the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.
4. A 1m x 1m x 2m steel box will be placed in each pit. This box will contain any drilling fluid returns from the borehole.
5. The drill bit will be set up by a surveyor, and the driller will push the drill string into the ground and will steer the bore path under the watercourse.
6. A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
7. The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit.
8. Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side.
9. Once all bore holes have been completed, a towing assembly will be set up on the drill and this will pull the ducting into the bore.
10. The steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.
11. The ducts will be cleaned and proven and their installed location surveyed.
12. The entry and exit pits will be reinstated to the specification of ESBN, EirGrid and Cork County Council.
13. A transition coupler will be installed at either side of the bridge/ following the horizontal directional drilling as per ESB and EirGrid requirements, this will join the HDD ducts to the standard ducts.

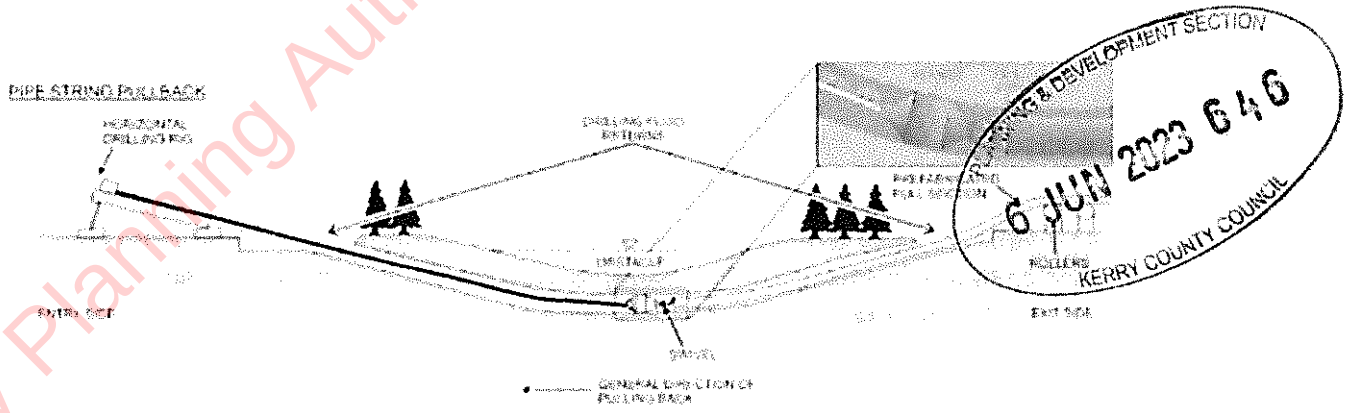


Figure 17 - Typical HDD Installation

10.0 Reinstatement of Private Land

Once all construction works are complete, the work areas will be reinstated with excavated soil and either seeded out with native species, allowed to vegetate naturally or reinstated with excavated grass turves and will be restored to their original condition. This work will be carried out in in consultation with the landowner and in line with any relevant measures outlined in the planning application, CEMP and planning conditions.

11.0 Best Practice Design and Construction & Environmental Management Methodology

Prior to commencement of construction works the contractor will draw up detailed Method Statements which will be informed by this Outline Construction Methodology, environmental protection measures included within the EIAR, measures within the CEMP, and the guidance documents and best practice measures listed below. This method statement will be adhered to by the contractors and will be overseen by the Project Manager, Environmental Manager and ECoW where relevant.

The following documents will contribute to the preparation of the method statements in addition to those measures below: -

- Inland Fisheries Ireland (2016) *Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters*. Inland Fisheries Ireland, *Dublin,*
- *National Roads Authority (2008) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*. National Roads Authority, Dublin;
- E. Murnane, A. Heap and A. Swain. (2006) *Control of water pollution from linear construction projects.* Technical guidance (C648). CIRIA;
- E. Murnane et al., (2006) *Control of water pollution from linear construction projects*. Site guide (C649). CIRIA.
- Murphy, D. (2004) Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin;
- H. Masters-Williams et al (2001) *Control of water pollution from construction sites. Guidance for consultants and contractors* (C532);
- Enterprise Ireland (unknown). *Best Practice Guide (BPGCS005) Oil storage guidelines;*
- Law, C. and D'Aleo, S. (2016) *Environmental good practice on site pocket book*. (C762) 4th edition. CIRIA;
- CIRIA *Environmental Good Practice on Site (fourth edition) (C741) 2015*.

The works will be carried out by employing accepted good work practices during construction, and environmental management measures such as those discussed below. Please note that the following measures will be supplemented by further specific environmental protection measures that will be included in method statements prepared for specific tasks during the works and will form part of the detailed CEMP.

- All materials shall be stored at the temporary compound within the Inchamore Wind Farm site and transported to the works zone immediately prior to construction;
- Where drains and watercourses are crossed with underground cables, the release of sediment will be prevented through the implementation of best practice construction methodologies.
- Weather conditions will be considered when planning construction activities to minimise risk of run off from site;
- Provision of 50m exclusion zones and barriers (silt fences) between any excavated material and any surface water features to prevent sediment washing into the receiving water environment;

- If dewatering is required as part of the works e.g. in trenches for underground cabling or in wet areas, water must be treated prior to discharge;
- The contractor shall ensure that silt fences are regularly inspected and maintained during the construction phase;
- If very wet ground must be accessed during the construction process bog mats/aluminium panel tracks will be used to enable access to these areas by machinery. However, works will be scheduled to minimise access requirements during winter months;
- The contractor shall ensure that all personnel working on site are trained in pollution incident control response. A regular review of weather forecasts of heavy rainfall is required, with the Contractor required to prepare a contingency plan for before and after such events;
- The contractor will carry out visual examinations of local watercourses from the works during the construction phase to ensure that sediment is not above baseline conditions. In the unlikely event of water quality concerns, the Environmental Manager and ECoW will be consulted;
- Excavations will be left open for minimal periods to avoid acting as a conduit for surface water flows.
- Only emergency breakdown maintenance will be carried out on site. Emergency procedures and spillage kits will be available and construction staff will be familiar with emergency procedures.
- Appropriate containment facilities will be provided to ensure that any spills from vehicles are contained and removed off site. Adequate stocks of absorbent materials, such as sand or commercially available spill kits shall be available;
- Concrete or potential concrete contaminated water run-off will not be allowed to enter any watercourses. Any pouring of concrete (delivered to site ready mixed) will only be carried out in dry weather. Washout of concrete trucks shall be strictly confined to a designated and controlled wash-out area within the Inchamore Wind Farm site; remote from watercourses, drainage channels and other surface water features;
- Entry by plant equipment, machinery, vehicles and construction personnel into watercourses or wet drainage ditches shall not be permitted. All routes used for construction traffic shall be protected against migration of soil or waste water into watercourses;
- Cabins, containers, workshops, plant, materials storage and storage tanks shall not be located near any surface water channels and will be located beyond the 50m hydrological buffer at all times.

12.0 Implementation of Environmental Protection Measures

All environmental protection measures contained within the EIAR (Environmental Impact Area Report) and NIS (Natura Impact Statement) which accompanies the planning application will be incorporated into the final CEMP (Construction Environmental Management Plan) and construction method statements prior to the commencement of development and will be implemented in full during the construction phase. The proposed UGC grid route does not form part of the wind farm planning application but is being assessed as part of the EIAR and NIS. The Project Manager and Site Manager will be responsible for the implementation of measures following consultation with the Environmental Manager and ECoW where necessary.

13.0 Invasive Species Best Practice Measures

Invasive species can be introduced into a location by contaminated plant, machinery, and equipment which were previously used in locations that contained invasive species. Good site organisation and hygiene management shall be maintained always on-site, and best practice measures will be implemented, as follows:

- The contractor will prepare an Invasive Species Action Plan to be implemented during construction, and all personnel will be made aware of the requirements contained within;
- Plant and machinery will be inspected upon arrival and departure from the site and cleaned/washed as necessary to prevent the spread of invasive aquatic/ riparian species such as Japanese knotweed *Fallopia japonica* and Himalayan Balsam *Impatiens glandulifera*. A sign off sheet will be maintained by the contractor to confirm the implementation of measures;
- Site hygiene signage will be erected in relation to the management of non-native invasive material.

14.0 Waste Management

All waste products (general waste, plastic, timber, etc.) arising during the construction phase will be managed and disposed of in accordance with the provisions of the Waste Management Act 1996 and associated amendments and regulations, and a Waste Management Plan will be prepared by the contractor before the commencement of construction. All waste material will be disposed of at a fully licensed facility.

15.0 Archaeology

The following are the mitigation measures which will be carried out during construction where required;

- Any specific mitigation measures outlined in the Cultural Heritage Report will be adopted.
- If required a project archaeologist will be appointed to oversee the project.
- Demarcation of protective buffer zones around cultural heritage sites where there is a potential for disturbance during the construction phase and inclusion of the same in site induction.

TECHNICAL NOTE 01

Project:	Inchamore WF – 38kV Grid Connection	Ref:	rev-00
Section:	Cable Rating Check	Job No:	05-934
		Date:	11.11.22
Made By:	POS	Checked By: DB	Sheet No: 1 of 9

Instruction

Technical Lead:	Ruairi Geary - TLI Group
Date of Writing:	07.11.2022
Scope of Note:	Review of the 38kV grid connection cable loading based on the proposed MEC for the project.
Documents & Data Issued for Review:	n/a

Overview

TLI Group (the Consultant) were engaged by Future Energy Ireland ("the Client") on the development of Inchamore Windfarm in counties Cork and Kerry. The Consultant was engaged to assist the Client in selecting and preparing a planning application for the 38kV grid connection for Inchamore Windfarm. The Client is currently working on the development of the windfarm.

The proposed grid connection will be a 38kV UGC from the existing Ballyvouskil 220kV Substation to a new 38kV substation serving Inchamore Windfarm which will consist of an approximate grid connection length of 19.3km. This cable rating study was completed to assess the suitability of the proposed cable size and cable trench designs for the 38kV UGC grid connection circuit.

The cable ratings which have been completed as part of this study include:

- Standard Trefoil Trench Design
- Flat Formation Trench Design
- HDD Crossings – Direct Buried Trefoil Formation (Depth 5000mm)
- Parallel Trench Design

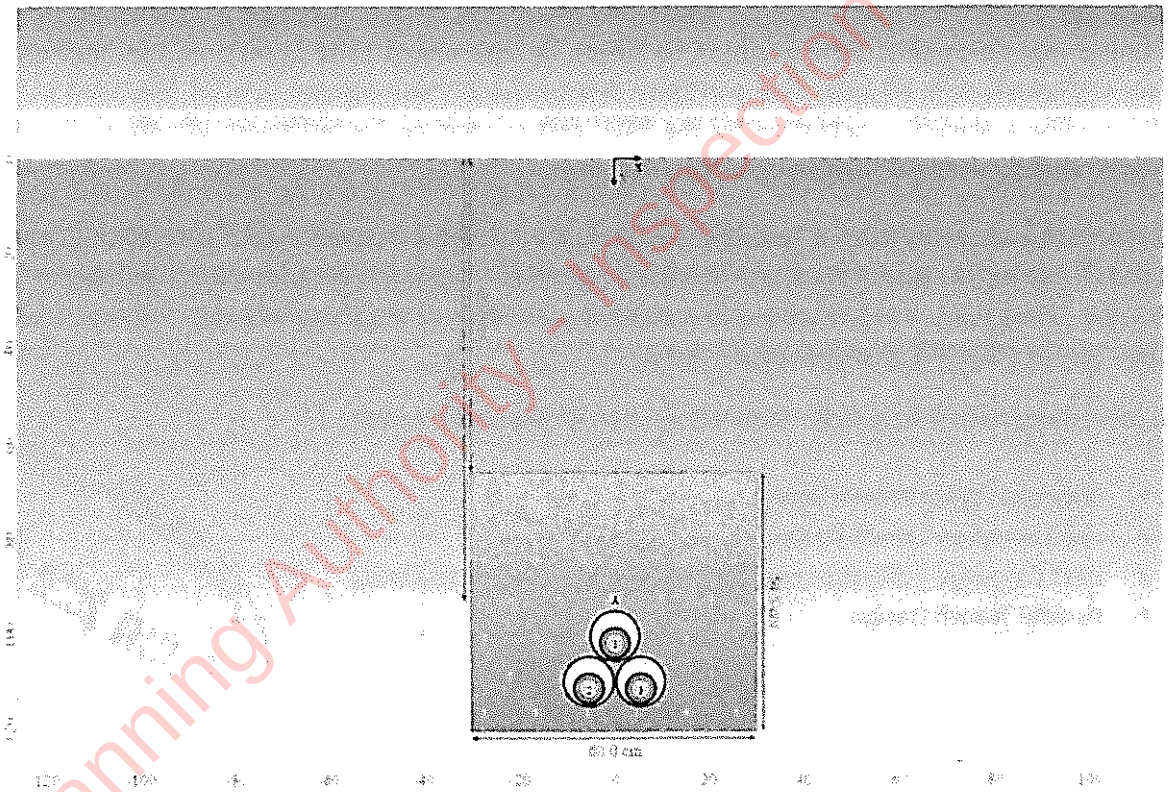
Table 1 - Cable Study General Parameters

Cable Study Parameters	
Cable Size:	1000mm^2 Al Cable
Nominal Voltage:	38kV assumed *(Range 30kV to 52kV)*
Power:	Required 39.6 MW
Power Factor:	0.95 assumed *(Range 0.85 lag to 0.93 lead)*
Avg. Cable Section Length:	1000/1200m *(trefoil), 100m (flat)*
Cable Trench Design:	See Appendix A
Ambient Temp (Soil)	20°C *(Summer rating)*
Soil Thermal Resistivity	1.2 K·m/W *(Summer rating)*
Backfill Thermal Resistivity	1 K·m/W *(Summer rating)*
Cable Screen Bonding:	Bonded Both Ends
Power Duct Size:	110mm

Cable Study Analysis

1000mm² Al Cable - 38kV Standard Trefoil Trench (Depth 950mm) Design:

A cable rating study was completed for a **SolidAl 1000mm² AL XLPE (38kV) UGC** over a distance of 1km using the **standard trefoil trench design in 110mm ducts** as detailed in Appendix A. Using this arrangement, the circuit is capable of carrying a maximum full load current of **758.4A** without exceeding the cables max insulative property of 90°C. Therefore, 1000mm² Al XLPE (38kV) UGC when installed using the standard trefoil trench design is capable of achieving the required maximum full load (39.6 MW).



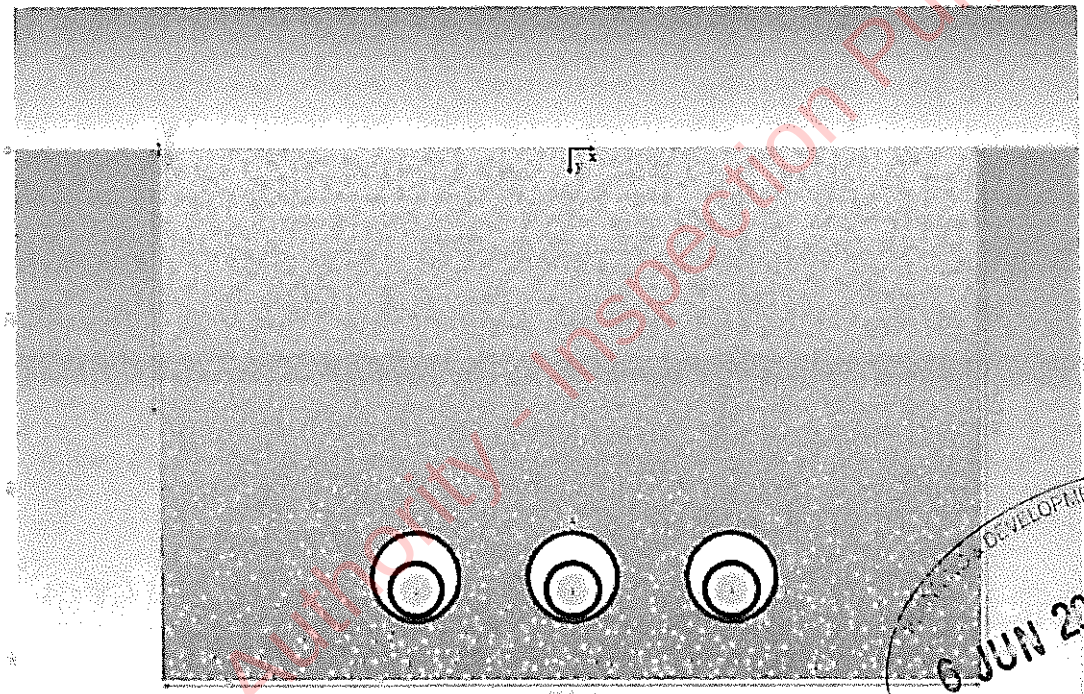
Following systems are active in the arrangement:

System	Object	Current I_c [A]	max Temp. θ_c | θ_e (θ_{de}) [°C]	Losses W_{sys} [W/m]
System A	SolidAl 1000mm2 Al XLPE (38kV)	758.4	90.0 | 82.4 (69.8)	87.7

Figure 1 - Cable Rating Model, Standard Trench Design, 1000mm.sq Al

1000mm² Al Cable - 38kV Flat Formation Trench (Depth 450mm) Design:

A cable rating study was completed for a **SolidAl 1000mm² AL XLPE (38kV)** over a distance of 100m using the **Flat Formation Trench design in 110mm ducts** as detailed in Appendix B. Using this arrangement, the circuit is capable of carrying a maximum full load current of **778A** without exceeding the cables max insulative property of 90°C. Therefore, 1000mm² Al XLPE (38kV) UGC when installed using the standard trefoil trench design is capable of achieving the required maximum full load (39.6 MW).



Following systems are active in the arrangement:

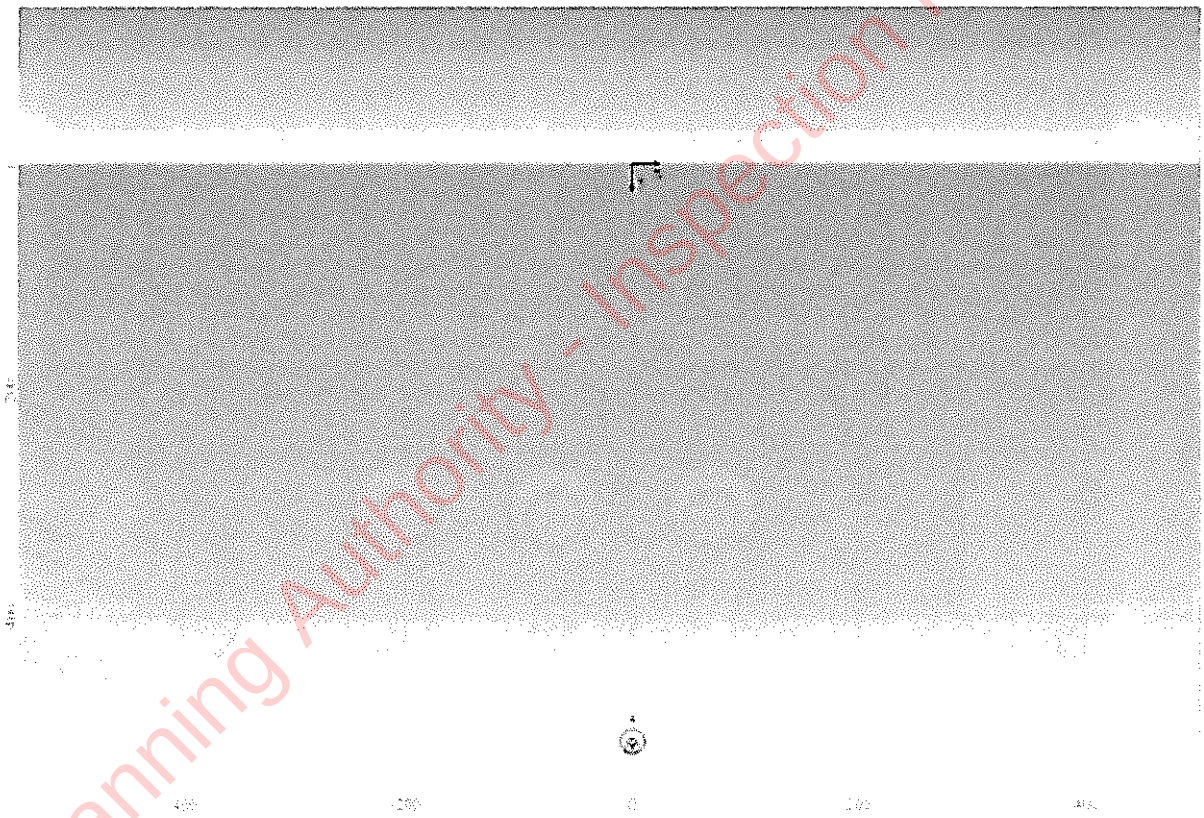
System	Object	Current I_c [A]	max Temp. θ_c | θ_a (θ_{da}) [°C]	Losses W_{sys} [W/m]
System A	SolidAl 1000mm2 Al XLPE (38kV)	778.0	90.0 | 81.3 (61.2)	120.0

Figure 2: Cable Study Results – 38kV 1000mm.sq Al Flat Formation (450mm Depth)

Horizontal Directional Drill - Trefoil Formation (Depth 5000mm):

A cable rating study was completed for a **SolidAl 1000mm² AL XLPE (38kV)** over a distance of 200m utilising a HDD in a trefoil formation, at a **depth of 5000m**. It should be noted that 180mm or 225mm ducts (SDR = 11) will be utilised for HDD crossings.

Using this arrangement, the circuit is capable of carrying a maximum full load current of **692.2A** without exceeding the cables max insulative property of 90°C. Therefore, 1000mm² Al XLPE (38kV) UGC when installed using this HDD trench design is capable of achieving the required maximum full load (39.6 MW).



Following systems are active in the arrangement:

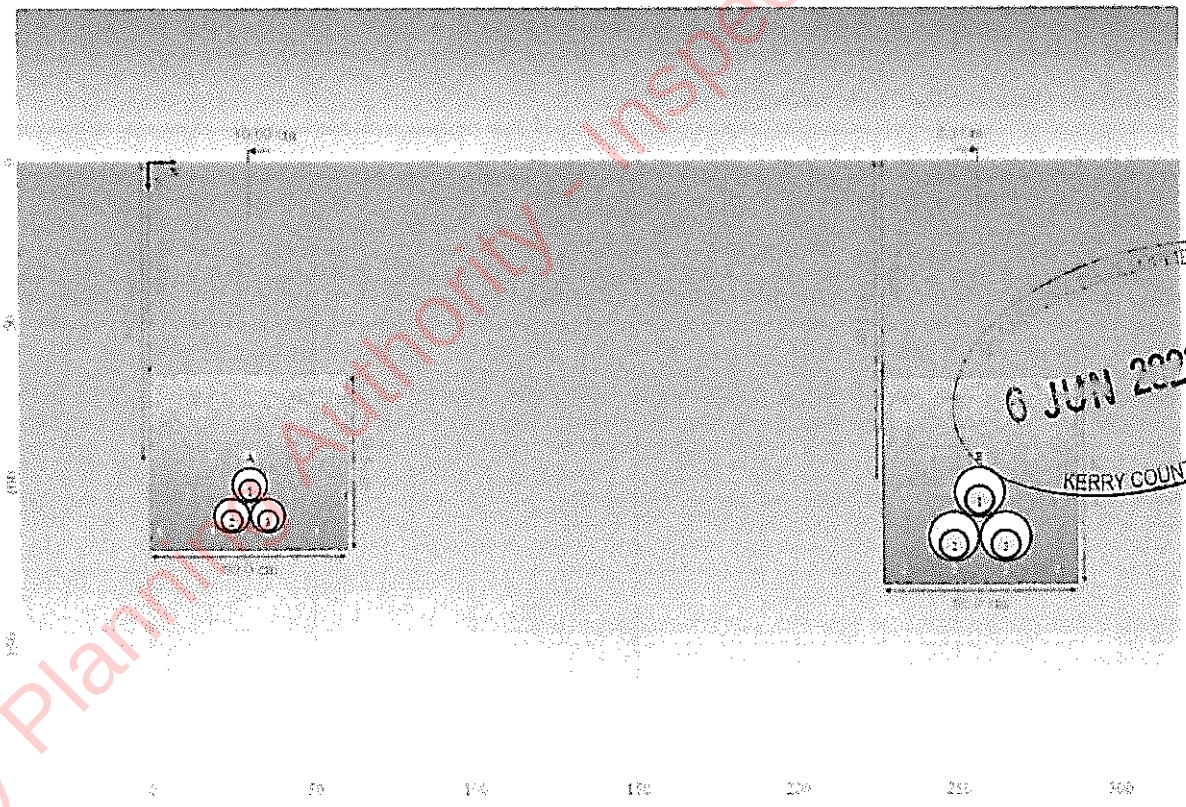
System	Object	Current I_c [A]	max Temp. θ_c | θ_e (θ_{de}) [°C]	Losses W_{sys} [W/m]
System A	SolidAl 1000mm2 Al XLPE (38kV)	1x 692.2	90.0 | 83.7 (67.0)	65.5

Figure 3: Cable Study Results – 38kV 1000mm.sq Al HDD Formation (5000mm Depth)

Inchamore WF 38kV Trefoil parallel run Ballyvouskill – Garrow 110kV Trefoil Formation (Separation 2000mm duct to duct) Design:

A cable rating study was completed for the parallel run of an existing **1000mm² Cu XLPE (110kV) UGC** in operation to conduct flow between Garrow GIS to Ballyvouskil Node ***(System A).*** Running parallel with ***(System B – Ballyvouskil to Inchamore WF 38kV UGC)*** over a distance of 1000m whilst implementing a trefoil formation trench arrangement with a separation of 2000mm between duct to edge of duct trenches and supplying a load without compromising the insulative properties of the selected cable.

The consultant believes that the use of **1000mm² AL XLPE (38kV)** should be sufficient to be installed at 38kV - 110kV parallel intervals to achieve the 178MVA rating for 110kV UGC and the desired MEC of Inchamore WF (39.6MW). As seen below in Figure 5, System B (Inchamore to Ballyvouskil) will conduct in excess of full load carrying capacity.



Following systems are active in the arrangement:

System	Object	Current I_c [A]	max Temp. θ_c | θ_e (θ_{de}) [°C]	Losses W_{sys} [W/m]
System A	SolidAl 1000mm2 Al XLPE (38kV)	731.8	90.0 | 83.0 (71.2)	81.6
System B	NKT 1600mm2 Al XLPE (110kV)	935.0	82.9 | 74.1 (65.2)	77.6

Figure 4: Cable Study Results – 38kV 1000mm.sq Al trefoil formation parallel 110kV 1000mm.sp Cu trefoil formation

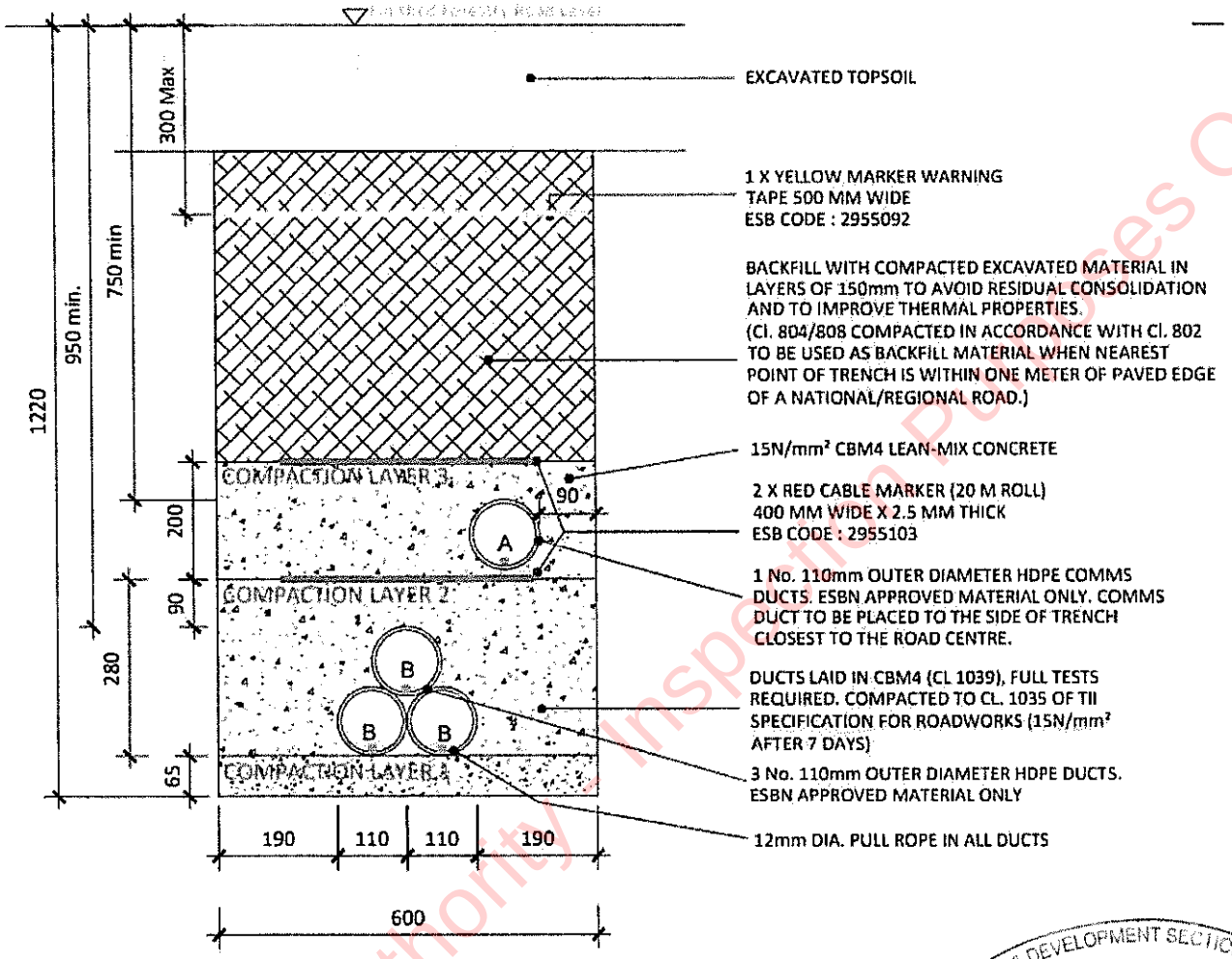
Cable Study Results Summary

The Cable Rating Study Checks completed have indicated that it should be possible to carry the maximum export capacity of the cable at ***39.6MW*** on a standard 38kV single circuit **1000mm² Al cable** for the majority of the grid connection without exceeding the proposed recommended maximum conductor temperature of 90°C when using the proposed trench designs with the exception of the existing cable crossing intervals and HDDs at a depth greater than 5000mm.

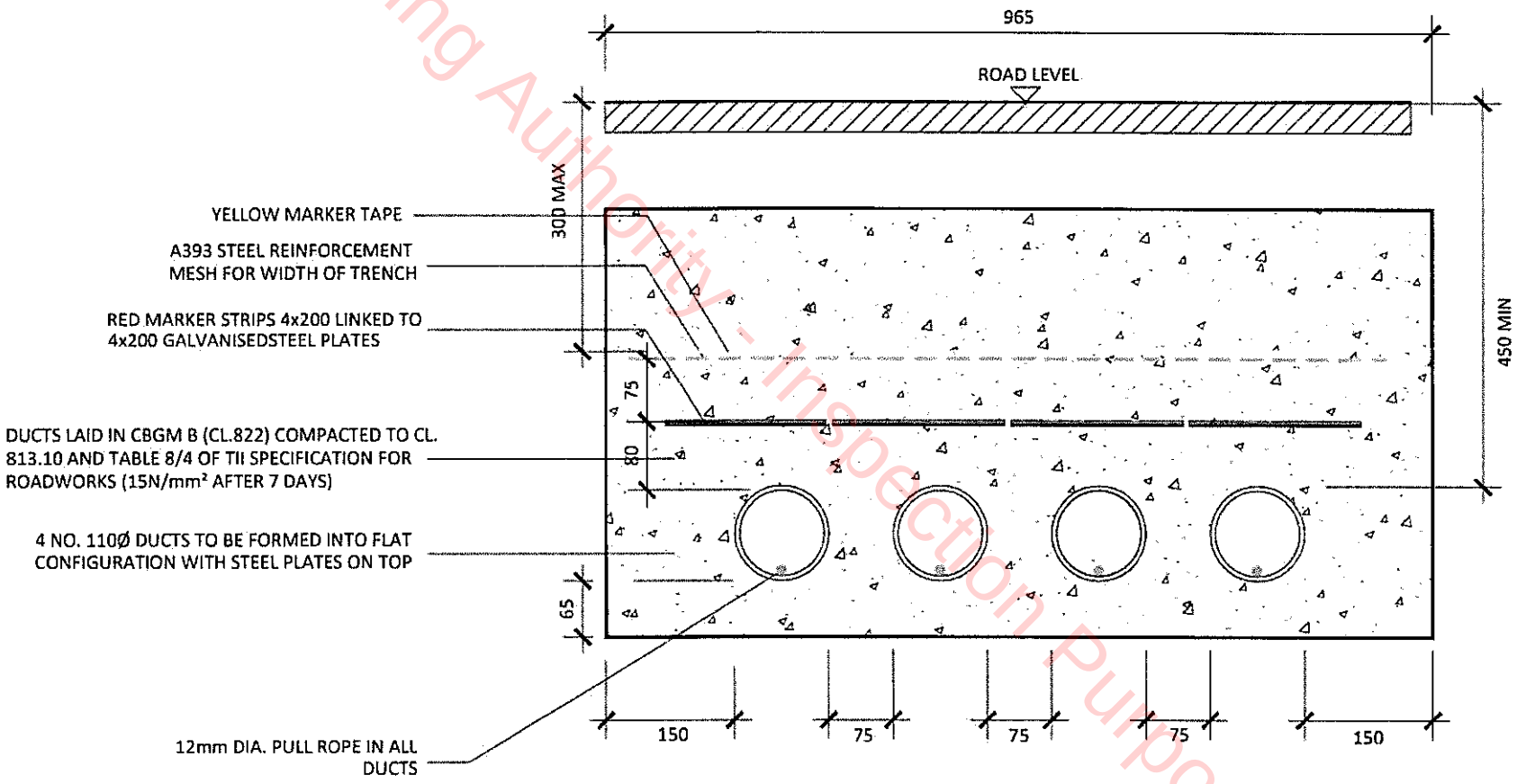
It should be noted that any crossings or parallel runs with other underground cable MV/HV circuits or other services may result in a derating of the Inchamore Grid Connection Cable. This derating effect will further decrease the available loading capacity of the cable. Two further existing service routes, both a 38kV UGC circuit and a 20kV cable route exist within forestry access tracks west of Garrow GIS substation but a derating study hasn't been concluded on these circuit owing to minimal circuit rating information.

All results at this stage are indicative only, further analysis will be required at the detailed design phase in order to accurately calculate the final loading on the cables.

Appendix A – Standard 38kV Trench Trefoil Design (110mm Ducts)



Appendix B – Flat Formation 38kV Trench Design (110mm Ducts – 450mm Depth)



APPENDIX 2.4:

LIST OF PROJECTS FOR CUMULATIVE ASSESSMENT

Proposed Inchamore Wind Farm, Co. Cork.

Schedule of Developments in the vicinity of the Development

Cork County Council

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
174167	A solar photovoltaic panel array consisting of up to 37,800 m2 of solar panels on ground mounted steel frames, 2 no. electricity control cabins, underground cables & ducts, inverter units, hardstanding area, boundary security fence, CCTV, all associated site works and services.	01-11-17	3.91 km from centre of Site	Large Scale Development
215127	The erection of a temporary 100m high lattice type meteorological mast for a period of 5 years. The structure will be fixed to ground anchors by stay wires and will include instruments for measuring local climate conditions and all ancillary works.	31-08-21	0.49 km from centre of Site	Large Scale Development
224724	The development will consist of a soil recovery facility for greenfield soil and stones with smaller quantities of concrete, bricks, tiles, and ceramics (the concrete, bricks, tiles, and ceramics will be used for internal road building). The proposed development will involve the remediation by infilling of existing agricultural land which was historically excavated in the past. The site comprises 1.58 hectares, of which 1.09ha will be fill area. The proposed development incorporates improving the existing site entrance, and all ancillary works associated with the development.	24-01-23	1.86 km from centre of Site	
217318	Erecting a 30m high latticework telecommunications structure together with antennas, dishes and associated telecommunications equipment enclosed by security fencing and all associated site works with an extension to the existing access track.	15-02-22	1.5 km from centre of Site	Large Scale Development
224455	Permission for new two storey dwelling with attached garage, sewerage system, site entrance and all associated works.	25-04-22	2.82 km from centre of Site	
196555	Reclamation of land for agricultural use by filling low lying area with imported fill.	16-04-20	3.59 km from centre of Site	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
166754	To alter condition no. 2 of previous planning ref 15/5991 from "the maximum number of loads delivered to the site each day shall be 4 loads" to a maximum of 11 loads per day.	22-12-16	3.61 km from centre of Site	
155991	Reclamation of land for agricultural use by filling low lying area with imported fill.	17-02-16	3.54 km from centre of Site	
146165	Dwellinghouse, garage and septic tank, extension of duration to permission granted under Planning Ref. no. 09/4190	of duration by CCC (	3.44 km from centre of Site	
165208	Permission for construction of a single storey extension with attached lean-to structure for domestic storage to rear, and porch extension to side of dwellinghouse, and Permission for retention of minor alterations to elevations (changes to doors and windows from that permitted under Planning Reg. No. 01/5772 to include: a door in place of the permitted window on rear eastern elevation, omission of window on rear elevation, inclusion of bathroom window on eastern elevation, and 1 no. larger window in place of 2 no. permitted smaller windows on western elevation. (Cead do sineadh aon stoir ar teach, le claonseantain ceangailte leis le haghaidh storala tis ar chuil, agus sineadh poirse ar taobh an ti, agus cead coinneala le haghaidh athruithe beaga ar na ingearchlonna (athruithe ar doirse agus fuinneoga o na cinn a bhi ceadaithe faoi Tag Pleanala Uimh 01/5772, a n-airitear doras in ionad an fhuinneog ceadaithe ar ingearchlo thoir cuil, fuinneog a fhagail ar lar on ingearchlo cuil, fuinneog folctha sa bhreis ar an ingearchlo thoir, agus 1 fuinneog mor in ionad 2 fuinneoga nios lu ar an ingearchlo thiar)	11-05-17	1.27 km from centre of Site	
216559	Permission for the retention of existing as built residential unit.	12-01-22	3.21 km from centre of Site	
164268	Change of use of silage shed to cubicle house, construct a slatted house, silage base, and associated site works.	05-04-16	2.61 km from centre of Site	
204959	(A) Demolition of existing calf house (B) Construction of milking parlour, handling facilities, waiting yard and associated slatted tank (C) Erection of meal bin (D) Construction of calf house and all associated siteworks.	11-08-20	2.61 km from centre of Site	
214587	The construction of a new dwelling house, domestic garage and associated site works.	30-04-21	2.49 km from centre of Site	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
186505	Construction of a dwellinghouse, the change of use of an existing semi-derelict dwellinghouse to domestic store, a new wastewater treatment system with tertiary filter, enhanced site landscaping, vehicular access via an existing site entrance and all ancillary infrastructure and associated site development works above and below ground level at a site of approximately 1.346 ha.	13-11-18	2.91 km from centre of Site	
184273	Construction of a dwelling and detached domestic garage and carrying out of all associated site works, including the installation of a treatment unit and soil polishing filter.	27-03-18	2.95 km from centre of Site	
156009	Construction of a dwellinghouse, domestic garage and associated site woks.	19-01-16	3.46 km from centre of Site	
145105	Dwelling, domestic garage and proprietary treatment unit.	21-07-14	3.72 km from centre of Site	
196056	Chun "Slatted House" a thógáil comh maith le hoibreacha laithreáin a bhaineann leis. / To construct a new "Slatted House" and associated site works.	11-11-19	3.79 km from centre of Site	
225591	Chun suíomh athbhreithnithe an "Slatted House" nua a choinneáil, comh maith le hoibreacha laithreáin a bhaineann leis, a fuar chead pleanála uimhir 19/06056 roimhe. / Permission for retention of revised location of new slatted house and associated site works previously granted planning permission number 19/06056.	11-11-19	3.81 km from centre of Site	
185390	The construction of a two storey dwelling, garage, wastewater treatment system and ancillary site works.	22-08-18	3.69 km from centre of Site	
146835	Change of use of disused school building to dwellinghouse and installation of domestic waste water treatment unit and associated site works.	26-02-15	3.37 km from centre of Site	
216559	Permission for the retention of existing as built residential unit.	03-12-21	3.19 km from centre of Site	
216769	Permission to raise the level of permitted Astro turf playing pitch along with perimeter fencing and entrance gates together with all other ancillary site works to that permitted under planning reference number 20/6706.	03-12-21	4.23 km from centre of Site	
116580	Construction of a single storey extension to existing primary school and associated works, relocation of the existing portacabin classroom and retention of the existing portacabin classroom.	09-02-12	4.18 km from centre of Site	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
206706	Cead pleanála iomlán a lorg chun páirc astro-turf a thógaint, chomh maith le claí fan imeall na páirce agus geataí iontrála, mar aon leis na hoibreacha suímh foghabhálacha. - Seek full planning permission for the construction of an astro-turf park, as well as a field edge fence and entrance gates, together with ancillary site works.	04-02-21	4.17 km from centre of Site	
205603	Cead pleanála iomlán le haghaidh athrú agus sineadh a chur ar an scoil. Is seo a leanas a bheidh ann: an seomra réamhdhéanta atá ann a chur i suíomh difriúil. Gnáth sheomra ranga seomra oideachas speisialta, díolcheantar agus clós spraoi clúdaithe, a bheidh ceangailte leis an sineadh nua, a thógail chomh maith le fosheirbhisí eile. (Full planning permission for alterations, and construction of extension to the school. - This will be as follows: relocation of the existing prefabricated room. Normal classroom, Special education room, circulation area and covered playground, attached to the new extension, along with other ancillary services)	13-10-20	4.22 km from centre of Site	
194972	Renewable energy development consisting of the provision of a 7 turbine wind farm, solar photovoltaic array, electricity substation, battery storage compound and all associated works consisting of the following, i. Up to 7 wind turbines with an overall blade tip height of up to 150 metres and all associated foundations and hard-standing areas; ii. Up to 70,000sq.m solar photovoltaic array, with up to 17 associated inverters and 2 no. control cabins; iii. 1 no. borrow pit, iv. 1 No. permanent meteorological mast with a maximum height of up to 100 meters; v. Upgrade of existing and provision of new site access roads, vi. 1 no. 38kV electrical substation with 1 no. control building with welfare facilities, associated electrical plant and equipment security fencing and waste water holding tank; vii battery storage compound accommodating 4 no. battery storage containers, security fencing, and associated electrical plant and equipment, viii. Forestry felling ix. 1 no. temporary construction compound, x. Site drainage xi. All associated internal underground cabling; xii. 38kV underground grid connection cabling; xiii. All associated site development and ancillary works. The proposed development will have an operational life of 30 years from the date of commissioning of the development and the application seeks a ten year planning permission. An Environmental Impact Assessment Report (EIAR) and a Natura Impact Statement (NIS) have been prepared in respect of the proposed development.	18-11-19	5.25 from centre of Site	Large Scale Development

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
234455	Alterations to the dimensions of the 7 no. wind turbines permitted as part of the Knocknamork Renewable Energy development (planning reference 19/4972). The proposed development includes the provision of 7 no. wind turbines with an overall ground to blade tip height of 175m (an increase of 25m, from 150m), a rotor blade length of 75m and a hub height of 100m, and all associated site development and ancillary works, an operational period and planning permission duration to align with the existing permission (planning reference no. 19/4972) is sought. An Environmental Impact Assessment Report (EIAR) and Natura Impact Statement (NIS) have been prepared in respect of the proposed development and accompany this application	08-05-23	5.23 km from centre of Site	Large Scale Development
195250	To construct a two-storey dwelling with domestic waste water treatment system and percolation area, a detached garden store, new site entrance onto existing private road with walls and piers and all associated site works	11-07-19	4.9 km from centre of Site	
185008	"Slatted House" nua a thógáil comh maith le hoibreacha laithreáin a bhaineann leis. (Construction of slatted house along with associated site works	13-06-18	5.0 km from centre of Site	
234370	The importation of soil and stone for the raising of an agricultural field in order to improve the agricultural output of the field, the construction of a new temporary entrance and a new temporary haul road for the duration of the land improvement works. The entrance will be closed and the haul road removed once works are complete. Extension of Duration to Permission granted under Planning Ref. No. 17/5212 & PL04.249314	25-04-23	4.7 km from centre of Site	
234358	Construction of grass mounds, erection of sculptures and all associated works	25-04-23	0.04 km from TDR	
205840	Renovations and alterations to existing community centre building, including installation of 22no. 275W 60 cell roof mounted P.V. panels and ancillary site works.	05-10-20	0.01 km from TDR	
214439	Construction of a two-storey mixed-use development, namely; ground floor retail premises, and first floor residential (2no. apartments), along with associated site works.	16-04-21	0.01 km from TDR	
225444	Permission for the construction of a grass mound and erection of a commemorative sculpture and all associated works.	15-08-22	0.01 km from TDR	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
194640	A residential development of 30 no. dwellings and all ancillary site development works. The proposed development consists of 29 no. two-storey townhouses comprising of 4 no. 2 bedroom dwellings and 25 no. 3 bedroom dwellings and 1 no. 2 bedroom bungalow. Vehicular and pedestrian access to the proposed development will be via a new entrance off Warren's Court and makes provision for the upgrade of the existing access road, the provision of a public footpath, public lighting and upgrades to the junction with the N28.	10-07-19	Roadside from TDR	
224577	Removal of external inclined conveyer system to warehouse as permitted under Cork County planning Ref. 06/13900 and replacement with vertical elevator and associated pit and a horizontal enclosed conveyor with supporting bridge structure and all associated site works.	11-07-22	0.05km from TDR	
205207	The construction of a 1 storey water treatment & electrical building and a 2 storey electrical room extension to the existing finished goods building at the production facility. The site currently operates under an Industrial Emissions (IE) license (P0013-04) under part IV of the Environmental Protection Agency Act 1992 (as amended for the Protection of the Environment Act, 2003). The new development is on a site to which the Chemical Act (Control of Major Accident Hazards Involving Dangerous Substances) regulations 2015 (S.I. 209 of 2015) applies.	31-07-20	0.01 km from TDR	
184414	Construction of a sub-station at production facility. The proposed development is covered by an existing Industrial Emissions Licence No. P0013-04. The development refers to a modification to an establishment to which the Major Accident directive applies.	27-03-18	0.01 km from TDR	
186595	The construction of a ground floor extension to the rear of the existing Engineering Building and a one storey electrical building to the north west of the existing Engineering Building at their production facility. The proposed development is covered by an existing Industrial Emissions Licence No. P0013-04. The development refers to a modification to an establishment to which the Major Accident Directive applies.	19-11-18	0.01 km from TDR	
206995	Works involving the replacement of approximately 80m of existing 2.4m high chainlink fence and associated gates with new 2.4m high green palisade security fencing/gates and all associated works at an existing Above Ground Natural Gas Installation.	17-02-21	0.05 km from TDR	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
224629	The construction of a two storey value added seafood factory building with R&D and ancillary office accommodation to the first floor, complete with the following (i) signage (ii) car, cycle and motorcycle parking; (iii) internal access roadways, yard area with dock levellers, w.c. and shower facilities, back-up generators, and bunded fuel tanks (iv) fire water storage tank and associated pumps; (v) substation; (vi) security gates and fencing (vii) 1 no. access to the estate road; (viii) underground storm water attenuation, and all associated site development and landscaping works.	05-08-22	0.01 km from TDR	
216106	Decommission existing septic tank system and install a new treatment plant and soil polishing filter in its place to serve existing dwellinghouse (as currently being extended under Planning Ref. 20/4005).	02-09-21	0.03 km from TDR	
204005	Alterations and extensions to an existing dwelling, decommissioning of an existing septic tank, a new connection to the mains foul sewer on the public road and all other associated site works. Permission is further sought for retention of an existing temporary habitable structure (mobile home) on the site which is to be used by the applicant during the course of the proposed works and is to be removed on completion of same.	11-02-20	0.03 km from TDR	
215418	The construction of a temporary 290-space car park, with associated bus turning and set-down area, and site lighting. The car park will operate for a period of up to 24 months.	16-07-21	0.03 km from TDR	
196166	Change of use of existing creche/montessori to a proposed dwellinghouse with no external alterations.	02-12-19	0.03 km from TDR	
216509	Alterations, including partial demolition, and new extension to dwelling incorporating a granny flat, demolition of existing shed and associated site works.	16-03-22	0.04 km from TDR	
185229	Permission for the retention of i) a single storey extension to the front, ii) elevational changes, iii) the conversion of a garage and store to habitable rooms and iv) for permission for the installation of a proprietary treatment unit and soil polishing filter, at the existing residential care unit.	02-07-18	0.01 km from TDR	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
195428	Permission to install a fire escape window in existing loft space to accommodate a habitable room (complete with louvres to prevent overlooking), two proposed rooflights and all associated works. Retention is also sought for minor alterations to elevations and rooflights and minor alterations to internal layout to that granted under planning permission reference 15/04795 relating to existing split-level dwelling house.	22-07-19	0.01 km from TDR	
194301	Modifications and elevational changes to an existing retail unit (Protected Structure). The proposed development includes the partial demolition and reconstruction of the north-western corner of the building to improve vehicular and pedestrian access within the Mills complex; the closure of an existing pedestrian entrance on northern elevation and relocation of existing signage on the northern elevation; the provision of a revised entrance and new ancillary signage on the western elevation; a new fire escape on the eastern elevation and all ancillary development including the demolition of a ESB substation.	28-05-19	0.01 km from TDR	
194036	A part single-storey, part two-storey building (c. 4,378m2 in area) with ancillary workshop and offices. The building is to be constructed in two phases, with Phase 1 comprising part single-storey, part two-storey building (c. 1,929m2) to be used for the hire and sale of plant and/ or machinery and/or tools; and Phase 2 comprising a single-storey building to be used as a warehouse (c.2449m2). The proposed development also includes an external yard for the storage of plant/machinery; palisade fence/wall to boundaries; signage, including stand-alone totem sign; car parking; replacement new access from Blackash Road; and all associated site development, drainage and landscaping works. A Natura Impact Statement (NIS) will be submitted to the Planning Authority with the application.	30-07-19	0.01 km from TDR	
184243	The development will comprise of one no. light industrial/warehouse building (5459 sqm) (capable of subdivision upto three no. units) including ancillary office space, car parking, 10m high site signage substation and associated site works. The proposed building will be capable of accommodating warehousing/distribution (logistics)/light industrial.	24-05-18	0.01 km from TDR	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
186402	Construction of 10 no. dwellinghouses and all associated ancillary development works including car parking, access, landscaping and amenity areas (the proposed development will replace 21 no. apartments previously permitted under Planning Reg. No. 00/3131 and An Bord Pleanala Ref. PL04.130788) Extension Of Duration of Permission granted under planning 13/4773.	26-10-18	0.05 km from TDR	
225656	Intend to apply for 10 year planning permission. Underground electricity grid connection cabling, substation and ancillary site works. The development will comprise (1) a grid connection consisting of medium voltage cables and ducting in a excavated trench with a total length of c.1194 meters which will be installed on private land and public roads (L-2216 & L-22161); (2) control/switching substation consisting of either (i) single storey block building or (ii) 2 no. modular units; (3) cable beam over grange hill stream; (4) provision of ring main unit (RMU); (5) and all associated site development and reinstatement works. The proposed development includes minor revisions to the approved layout of the solar farm previously permitted under Cork County Council planning reference 18/5760 comprising omission of substation and satellite mast, and provision of the above referenced RMU, and the addition of a cable beam and underground cabling. The purpose of the proposed development is to connect the permitted solar farm under reference 18/5760 to the national grid at the existing Ballincollig 38Kv substation.	10-11-22	0.01 km from TDR	
224769	Demolition of existing dwelling, construction of two storey dwelling, sewerage system, upgrade to site entrance and all associated works (change of design to previously permitted under Planning Ref. 19/6060)	15-11-22	0.03 km from TDR	
196060	Demolition of existing dwelling, construction of new dormer type dwelling, domestic garage, waste water treatment and percolation system, relocation of site entrance and all associated site works.	10-10-19	0.03 km from TDR	
206720	Permission for 9 no. residential serviced sites and all ancillary site development works including access roads, footpaths, parking, drainage, landscaping and amenity areas.	05-02-21	0.03 km from TDR	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
214669	The proposed development will consist of the lateral extension of the Classis South Quarry (planning references 03/4253, PL04.205925 and 14/4728) for the extraction of sand and gravel (aggregate) within a ca. 15.049 ha application area. The extraction area will extend to ca. 8 ha and to a maximum depth of 13 mOD (ca. 8.6 metres below the winter water table). The aggregate will be transported by a proposed on-site temporary conveyor to the existing, authorised fixed conveyor (permission 19/4530). An initial construction phase of up to 12 weeks will include the stripping of topsoil, installation of on-site temporary welfare facilities (port-a-loo ca. 6m2 by 2.3m), two concrete parking plinths (ca. 56m2 and 36m2), concrete refuelling plinth (ca.80m2) and associated interceptor and drainage, and installation of an access road to connect the existing Classis South Quarry to the proposed extension ca.101 m long by ca. 5 m wide incorporating a culvert (ca. 4 m in height), installation of screening embankments to a height of 3.1 m, installation of fencing and all associated site works. The operational phase of up to 7 years duration will include extraction and then transport of aggregate via conveyor. The proposed development will include a rehabilitation phase of up to 2 years duration to form a water body, united with the existing Classis South Quarry water body. An Environmental Impact Assessment report and Natura Impact Statement will be submitted with the planning application.	14-12-21	0.01 km from TDR	Appealed
194530	The continuance of use of an existing conveyor system to facilitate continued transport of sand and gravel to the nearby processing plant and culvert under the N22 roadway in the townland of Knockanemore	18-04-19	across TDR	
226417	The development will consist of: a readymixed concrete plant (comprising a feed ramp, 5 no. bins, a batch conveyor, a mixer house and 2 no. cement silos) with associated concrete reclaimer unit, electricity supply and switch room building (47sqm), lab/store building (14sqm), bunded fuel tanks, hard and soft landscaping and all other site excavation, infrastructural and site development work above and below ground. The proposed development will operate from 07.00hrs to 18.30hrs Monday to Friday inclusive and from 08.00hrs to 16.00hrs on Saturdays inclusive (no operation on Sundays, Bank and Public holidays). Permission is also being sought for occasional out of hours operation, up to a maximum of 40 no. occasions per year (excluding Sundays, Bank and Public holidays), outside of normal operating hours. There is no changes proposed to the permitted pit operating hours.		0.04 km from TDR	NEW APPLICATION

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
194385	(1) The construction of single storey extensions to the west and south of an existing dwelling, alterations to existing elevations, modifications to the existing internal layout and all associated site works (2) The retention of a sunroom at ground floor level and an attic conversion to bedroom accommodation including a dormer extension with window to south and first floor windows on east and west elevations of existing dwelling (3) The retention of a domestic garage.	15-04-19	0.05 km from TDR	
185155	Development consists of restoration of part (c. 6.7 ha) of existing quarry (QR19 06/11798 & PL04.225332) by importation of up to 300,000 tonnes per annum of inert soil and stones and river dredging spoil (EWC 17-05-04 and 17-05-06).The proposed soil recovery facility will utilise the permitted quarry infrastructure including internal roads, site office, welfare facilities and other ancillaries to complete the works. Access to the site will be from the permitted main entrance on the N22 National Primary Road. A wheel wash and weighbridge will be provided as part of the proposed development and the existing workshop will be utilised as a quarantine area. A hard-stand with drainage to oil interceptor will also be provided as a designated refuelling area. The total application area including the site infrastructure covers 7.9 ha of lands. The development will be subject to the requirements of the waste management licence. An Environmental Impact Assessment Report (EIAR) will be submitted to the Planning Authority with the application.	22-11-18	0.01 km from TDR	
216282	New two storey dwelling with additional attic accommodation, domestic garage, sewerage system, and all associated works – house previously permitted as part of master planning reference 16/07237 with site boundary works previously completed.	07-10-21	0.01 km from TDR	
224953	(a)sub-division of ground floor of dwelling to use as two separate (2 bed and 3 bed) apartment units (b) single storey side annex for storage/toilet/utility use. (c) new rear boundary wall and (d) general modifications to window/door opes.	27-10-22	0.02 km from TDR	
226258	Permission for construction of dwelling (change of layout and design from that previously granted under pl.reg.21/6639), propriety waste water treatment system and all associated site works at Rosemount House (a protected structure - RPS Reg. No. 00553)	19-01-23	0.01 km from TDR	

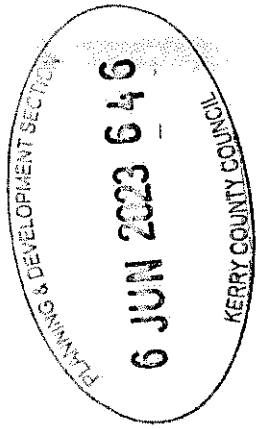
Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
226316	(1) the construction of a ground floor extension, (2) The conversion of the attached garage to utility/ ancillary space, (3) The replacement of an existing mono-pitch roof with a flat roof, (4) alterations to fenestration and (5) all associated site works to existing dwelling.	07-12-22	0.01 km from TDR	
184885	Retain rear extensions, domestic garage and dwelling as constructed (change of layout and design from that permitted under Planning Reg. No. S/98/1422) and permission to construct extension to rear of dwelling and all associated site works.	10-12-18	0.01 km from TDR	
196279	Retention for alterations to existing cottage including partial removal of roof tiles and removal of windows, guttering and chimney to cottage, partial removal of roadside boundary wall and widening of site entrance and excavation/alteration of existing ground levels and removal of topsoil and permission to remove remainder of out-building and construct new two storey extension to rear of existing single storey cottage, completion of roof and facade alterations to existing cottage, new domestic garage, new sewerage treatment system to replace existing system, completion of works to existing roadside boundary wall and all associated works.	09-12-19	0.02 km from TDR	
225306	4 no. residential serviced sites, construction of 2 no. new shared entrances, roadside boundary walls, 4 no. individual wastewater treatment systems and all other ancillary site works.	11-01-23	0.02 km from TDR	
225426	Permission for the construction of dwellinghouse and domestic garage, new shared entrance, wastewater treatment system, 2.4 meter high noise mitigation fencing to roadside boundary together with all other ancillary site works.	11-08-22	Roadside from TDR	
195391	Upgrading and relocation of existing septic tank serving dwellinghouse to proprietary treatment system.	17-07-19	0.01 km from TDR	
195652	Construction of dwellinghouse and domestic garage and all associated site works. Extension of Duration of Permission granted under Planning Reference: 14/5284.	14-08-19	0.01 km from TDR	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
216900	Works to existing single storey dwelling, 1) demolition of existing side extension, 2) construction of new 1 1/2 storey extension to side of existing dwelling, 3) internal and external alterations to existing dwelling, 4) new sewerage system to replace existing septic tank, 5) re-located site entrance, 6) demolition of 2 no. existing out-buildings/sheds, 7) construction of new domestic garage with loft storage and 8) all associated works.	17-12-21	0.01 km from TDR	
224173	The change of use of a site from temporary soil storage area / construction compound to that of permanently improved agricultural grassland.	28-03-22	0.02 km from TDR	
206736	The change of use from temporary soil storage area/ agricultural field to a permanent environmental berm.	02-02-21	0.02 km from TDR	
217049	The change of use of a site from temporary soil storage area / bedrock processing compound to that of permanently improved agricultural grassland.	16-05-22	0.02 km from TDR	
215453	The construction of new milking parlour and meal bin along with the construction of new agricultural cubicle house and scraping areas which will be attached to existing agricultural units together with all other ancillary siteworks.	27-08-21	0.01 km from TDR	
184581	Construction of new agricultural slatted unit which will be partly attached to existing agricultural building together with all other ancillary site works	30-05-18	0.01 km from TDR	
224994	Demolition of existing dwellinghouse, construction of new dwellinghouse and garage in lieu thereof, new entrance, wastewater treatment system, together with all other ancillary site works.	11-10-22	0.01 km from TDR	
206977	The importation of soil & stone for the raising of an agricultural field in order to improve the agricultural output of the field.	13-08-21	0.02 km from TDR	
234415	Change of use of a site from temporary soil storage area/compound to that of permanently improved agricultural grassland.		0.02 km from TDR	NEW APPLICATION
216547	Construction of a one and a halfstorey dwelling, domestic garage, sewerage system, site entrance and all associated works.	05-11-21	0.02 km from TDR	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
184182	A battery energy storage facility which will comprise of rechargeable battery units contained within up to 39 No. 40 foot containers on site and the associated development of unit substations, a 110 kV substation, security fencing, security cameras, lightning mast, new site roads and the upgrading of the existing vehicular access. The facility will connect into the adjoining Ballyvouskill ESB substation via underground cable. All associated site development, landscaping and boundary treatment works above and below ground.	30-11-18	0.01 km from GCR	
205281	Proposed modifications to the previously permitted development (planning ref: 18/06438 granted on 7th March 2019).The proposed modifications will comprise the additional construction of one (1) harmonic filter, one (1) HV circuit breaker (including CT and VT), one (1) MV disconnector and earth switch, two (2) cable sealing ends, three (3) additional lightning masts (approximately 25m high) and additional lamppost lightning. It further includes a retaining wall (approximately 2.5m high), asphalt (non-permeable) surfacing, additional permanent access road, additional fencing to match existing 2.6m high palisade, additional permanent access gate and all other ancillary site development works. The development will remain an extension to the existing substation and this extension will have an overall site area (within the planning application boundary) of 0.73ha. Access will continue to be provided via a L5226 and the R582.	17-08-20	0.01 km from GCR	
186438	The proposed development will comprise the construction of one (1) no. ± 100 Mvar STATCOM transformer, one (1) no. auxiliary transformer, three (3) no. reactors, one (1) no. outdoor cooling bank, control and valve building (268m²), underground connection to existing ESB substation. It further includes security fencing, security gate, four (4) no. 25m high lightning masts, permeable surfacing, and an internal access road. There will also be the construction of one (1) no. temporary contractors' compound. The development is an extension to the existing substation and the overall site area (within the planning application boundary) is 0.73ha. Access is provided via a local road (L5226) onto the R582.	28-01-19	0.01 km from GCR	

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
185686	Construction of a battery storage compound including 2 no. battery storage buildings with associated plant and equipment, an ancillary 110kV electricity substation with 2 no. control buildings, associated electrical plant & equipment and fencing, underground electricity cabling, surface water drainage, site entrance and access track, security fencing and all ancillary site works.	10-01-19	0.05 km from GCR	
Kerry County Council				
21636	(1) CONSTRUCT A TWO STOREY DWELLING WITH SEPTIC TANK AND PERCOLATION AREA (2) DECOMMISSION EXISTING SEPTIC TANK AND PERCOLATION AREA (3) ANCILLARY SITE WORKS ASSOCIATED WITH (1) AND (2) (4) CONVERT EXISTING COTTAGE TO DOMESTIC STORE/GARAGE ANCILLARY TO THE PROPOSED DWELLING ON OUR SITE	44463	4.1 km from centre of Site	
22816	(I) UNDERGROUND ELECTRICAL CABLING (33KV), (II) UPGRADE OF ACCESS JUNCTIONS; (III) ACCESS ROADS (NEW AND UPGRADE OF EXISTING); (IV) TEMPORARY ACCESS ROAD; (V) BORROW PIT; (VI) SITE DRAINAGE; (VII) FORESTRY FELLING; AND (VIII) ALL ASSOCIATED SITE DEVELOPMENT ANCILLARY WORKS AND APPARATUS. THE DEVELOPMENT SUBJECT TO THIS APPLICATION FORMS OF GRID CONNECTION AND ACCESS ARRANGEMENTS WHICH WILL FACILITATE THE PERMITTED KNOCKNAMORK RENEWABLE ENERGY DEVELOPMENT, CORK COUNTY COUNCIL REF. NO. 19/4972. CONCURRENT PLANNING APPLICATIONS IN RELATION TO THE OVERALL GRID CONNECTION AND ACCESS ARRANGEMENTS WILL ALSO BE LODGED TO CORK COUNTY COUNCIL AND AN BORD PLEANÁLA. AN OPERATIONAL PERIOD AND EXTENDED PLANNING PERMISSION DURATION TO ALIGN WITH THE PERMITTED KNOCKNAMORK RENEWABLE ENERGY DEVELOPMNET, CORK COUNTY COUNCIL REF. NO. 19/4972 IS SOUGHT. AN ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) AND NATURA IMPACT STATEMENT (NIS) HAVE BEEN PREPARED IN RESPECT OF THE PROPOSED DEVELOPMENT AND ACCOMPANIES THIS APPLICATION.	FURTHER INFORMATION - Decision due 24/05/2023	2.93 km from centre of Site and along GCR	Large Scale Development

Planning Ref. No.	Description	Final Grant	Distance (TDR = Turbine Delivery Route) (GCR = Grid Connection Route)	Notes
1876	(A) INSTALL A WASTE WATER TREATMENT SYSTEM TO REPLACE SEPTIC TANK SERVING EXISTING DWELLING HOUSE (B) PERMISSION FOR CHANGE USE OF EXISTING DETACHED OUTBUILDING TO INDEPENDANT HABITABLE DWELLING UNIT/STUDIO INCLUDING REPLACEMENT OF ROOF INCLUDING NEW ROOF LIGHTS, INSTALLATION OF ROOF MOUNTED SOLAR PANELS AND INSTALLATION OF INDEPENDENT WASTEWATER TREATMENT SYSTEM.(C) RETAIN EXISTING DWELLING AND ALL ANCILLARY SITE WORKS WITHIN REVISED SITE BOUNDARIES INCLUDING SUBDIVISION TO PROVIDE SEPARATE SITE FOR SECONDARY DWELLING .	27-06-18	3.76 km from centre of Site	
201263	CONSTRUCT A 100M HIGH TEMPORARY GUYED LATTICE METEROLOGICAL MAST (MET MAST) WHICH WILL BE IN PLACE FOR 5 YEARS. THE STRUCTURE WILL BE FIXED TO GROUND ANCHORS BY GUY WIRES AND WILL INCLUDE INSTRUMENTS FOR MEARSURING LOCAL CLIMATE CONDITIONS AND ALL ANCILLARY WORKS	24-02-21	0.02 km from GCR	
20519	CONSTRUCT AN AGRICULTURAL SHED WITH ASSOCIATED YARDS AND WALLS	06-11-20	4.14 km from centre of Site	



APPENDIX 2.5:

CONSIDERATION OF AFFORESTATION

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE
& PLANNING

Appendix 2.5

Consideration of Afforestation

Consideration of Afforestation

Statutory Overview

The United Nations Framework Convention on Climate Change, the Kyoto Protocol, the Paris Agreement and the recent Glasgow Climate Pact have as their ultimate objective the stabilisation of greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous human interference with the climate system, in a time frame which allows ecosystems to adapt naturally and enables sustainable development.

The Forest Service of the Department of Agriculture, Food & the Marine is Ireland's national forest authority. It is responsible for national forest policy, the promotion of private forestry, the administration of the forest consent system and forestry support schemes, forest health and protection, the control of felling, and the promotion of research in forestry and forest products.

The strategic goal of Ireland's forest policy is: "To develop an internationally competitive and sustainable forest sector that provides a full range of economic, environmental and social benefits to society and which accords with the Forest Europe definition of sustainable forest management."[1] Benefits accruing from this policy are an increase in the sustainable production of forest biomass for use in domestic markets and for renewable energy production, and an increase in levels of carbon sequestration contributing towards climate change mitigation.

The level of forest cover in Ireland is at 11% which is well below the European average of 38%. National forest policy has a goal of increasing Ireland's forest cover to 18% of total land area. Further policies underpinning this goal are a national afforestation programme of at least 8,000 hectares per annum and a requirement to replant areas following final harvesting of tree crops ("clearfelling")[2]. Where areas are being permanently clearfelled arising from a change in land use (for example, during wind farm construction), forest policy dictates that these must be replaced by afforestation of an alternative site on a hectare-per-hectare basis anywhere in the State (see Section 5.3 of the Forest Service Felling and Reforestation Policy[3] as shown in Appendix 1 - note only Infrastructure or Construction felling proposed for this project).

Areas of forestry proposed to be permanently clearfelled for this wind farm are located in upland, marginal land locations. Some of these areas are of low forest productivity due to the nature of the environment and will be replaced by alternative afforestation which will be of higher forest productivity, corresponding to the latest afforestation guidelines, thus providing increased carbon sequestration.

The clearfelling of trees in the State requires a felling licence. The legislative provisions governing such licences are set out in the Forestry Act 2014 (as amended) and the Forestry Regulations 2017 (as amended).

The associated afforestation of alternative lands equivalent in area to lands being permanently clearfelled (in this case, for wind farm construction) can occur anywhere in the State and is also subject to licencing by the Forest Service ('afforestation licencing').

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[1] https://www.agriculture.gov.ie/media/migration/forestry/forestpolicyreviewforestsproductsandpeople/00487%20Forestry%20Review%20-%20web%2022.7.14.pdf

[2] https://www.irishstatutebook.ie/eli/2014/act/31/section/17/enacted/en/html#sec17

[3] https://assets.gov.ie/96814/4830fc08-0227-4504-83fa-2fd90a7942f2.pdf

Section 11(d) of the Forestry Act requires the Minister, in the performance of his functions, to determine whether screening for EIA or AA is required and whether EIA or AA are required and, if so, to ensure that they are carried out. This obligation applies to both forestry felling and afforestation licencing.

As the Board is aware section 34(13) and section 37H(6) of the Planning and Development Act 2000 (as amended) make clear that a person is not entitled to carry out a development merely because they have obtained planning permission, i.e. the planning permission does not obviate the need to have all other statutory and legal consents required to carry out the proposed development.

Afforestation Licence

The requirements for afforestation licencing are set out in the Forestry Regulations 2017 - this includes consideration of EIA and AA as set out in parts 7 and 8 respectively. Further detail is set out in the Environmental Requirements for Afforestation (DAFM, 2016)[4], copy included in Appendix 2. This ensures that afforestation takes place in a way that complies with environmental legislation and enhances the contribution new woodlands and forests can make to the environment and to the provision of ecosystem services, such as water protection and landscape enhancement.

The typical environmental effects of afforestation include potential effects on biodiversity, soils and geology, hydrology and hydrogeology, cultural heritage, landscape and visual, and air and climate.

In regard to biodiversity there are potential effects on existing habitats and species present at and in the vicinity of the site. In regard to soils and geology there are potential effects on the existing soil environment resulting from ground preparation, the construction of drains and tree planting. In relation to hydrology and hydrogeology there are potential effects on existing drainage patterns and water quality during site preparation. In relation to cultural heritage there are potential effects on the known and unknown cultural heritage features in the environment. In relation to landscape and visual there are potential effects on visual amenity and the landscape character of the area. In relation to air and climate there are potential effects on atmospheric carbon balances. There are also potential effects on the existing land use.

As part of the comprehensive environmental review and documentation to support any licence application, any potential negative effects arising are fully considered and avoided where possible or reduced where appropriate to an acceptable standard through mitigation measures. With careful management, and mitigation measures such as careful site selection, set-back from streams, careful drainage design and management, etc. afforestation can be carried out at appropriate locations without significant effects on the environment or adverse effects on the integrity of European sites. Before a license is granted the Minister as competent authority will carry out an EIA, if required, for the purposes of the EIA Directive and an appropriate assessment, if required, for the purposes of the Habitats Directive.

The Environmental Requirements for Afforestation sets out the typical sequence of tasks to be undertaken in order to proceed with afforestation activities (pre-application design, Forest Service licencing, site works and on-going management). It identifies key environmental issues namely water, biodiversity, archaeology, and landscape and sets objectives for their protection during design as follows:

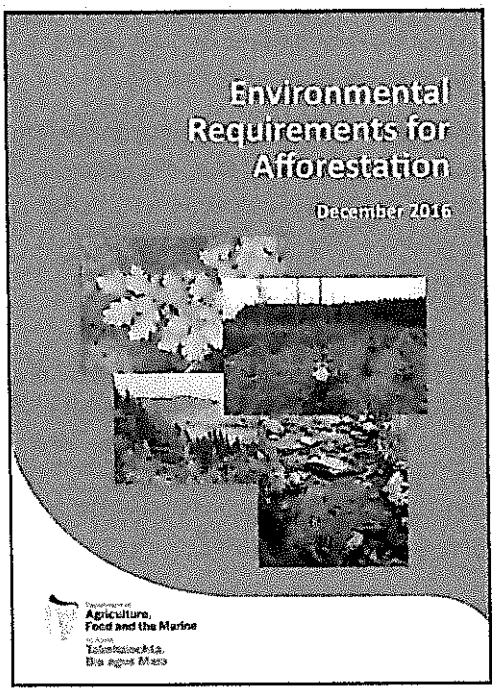
[4] https://www.gov.ie/en/publication/642e6-forestry/#environmental-requirements

Water Objective:	To protect water and aquatic habitats and species, during afforestation and throughout the remainder of the forest rotation.
Biodiversity Objectives:	To ensure that afforestation does not adversely impact designated conservation areas, protected habitats, or protected species of fauna or flora and their habitat. To enhance the biodiversity value of the new forest throughout its rotation.
Archaeology and built heritage objective:	To seek to ensure that proposed afforestation development projects do not adversely impact directly or indirectly on known or suspected archaeological sites and monuments or on other important built heritage structures or features. This includes protecting their amenities and where relevant, their wider landscape setting, in particular, their relationship with other roughly contemporary or determinably linked sites, monuments, structures or features. Where afforestation is approved near known or suspected archaeological sites and monuments or other important built heritage structures or features, to seek to ensure that: (i) appropriate exclusion zones, fencing, access paths and other relevant measures are incorporated into the project design; (ii) there is an appropriate response should any previously unrecorded archaeological site, monument, object, structure or feature be discovered during site work; and (iii) any approved design is sympathetic to and provides an appropriate visual setting for such sites, monuments, structures or features.
Landscape Objective:	To ensure that the proposed forest is designed so that it is visually acceptable and in keeping with landscape and amenity sensitivities.

Design considerations and parameters are also set out in the document and include for example:

- Examination of the proximity and connectivity of the lands to Designated Conservation Areas or Priority 8 Freshwater Pearl Mussel Catchment areas
- Examination for the presence of Protected Habitats or Protected Species of fauna or flora and their habitat
- Retention of Protected Areas as well as other notable biodiversity features such as existing hedgerows, existing broadleaf scrub/woodland, veteran trees or other ecologically important features such as water flushes, etc.
- Provision of water setbacks, appropriate site drainage design and acceptable ground cultivation techniques to protect aquatic zones both during afforestation and throughout the remainder of the forest rotation
- Provision of other environmental setbacks (unplanted/undisturbed open spaces) to buffer retained habitats, archaeological features, public roads or ROWs, cultural features or utilised buildings
- Identification and protection of any existing (or later discovered) archaeological or cultural features, including setbacks, provision for future access to/protection of the site by fencing
- Sensitive planting design so that the proposed forest is visually acceptable and in keeping with the local landscape and local amenities

It should be noted that the granting of all afforestation licences is subject to conditions, including environmental conditions, that must be adhered to.



Contents

Figure 1: Forest Standards Manual Nov. 2015; Environmental Requirements for Afforestation Dec 2016.

<u>Consideration of Afforestation in the Context of Planning Submissions</u>

The developer is seeking a ten-year planning permission which incorporates time to secure a grid connection agreement, a route to market (RESS or equivalent Power Purchase Agreement), select the preferred equipment suppliers and put the necessary capital funding in place to allow construction and delivery to commence. This application for planning permission considers the environmental impacts of the felling activities required to deliver the project infrastructure and operate the proposed wind farm.

While the environmental impacts of the felling activities are considered at this application stage it is noted the felling of trees at the site for the purposes of the wind farm is subject to and can only occur following the grant of a felling licence by the Forest Service. Planning permission for the project may not be granted or, if granted, may have amendments introduced by condition(s). Therefore, the extent of felling required to be licensed for the purpose of giving effect to the windfarm project can only be determined once planning permission for the windfarm project has been granted. Furthermore, it will be a condition of the felling licence that an equivalent area of land required to be felled shall be replanted as per Forest Service Felling and Reforestation Policy. Thus, the extent of the lands required for afforestation can also only be known once planning permission has been granted for the windfarm project. In these circumstances, the application for the licence can, in practical terms, only be made once planning permission has been granted.

It is, in any event, environmentally prudent to progress the felling and afforestation licences closest to the time when the proposed felling activities are required, rather than long in advance during the wind farm planning submission stage, when the project programme remains uncertain and the exact areas cannot be fully confirmed.

If a licence was obtained prior to seeking and/or obtaining planning permission, it is highly likely that any licencing approvals sought from the Forest Service would have expired before it could be taken up due to the time required for the planning processes and post-planning delivery preparations. The Forest Service Afforestation Licences expire after 3 years from when they are consented.

Critically given the dynamic nature of the receiving environment, the identification and licensing of alternative afforestation lands at a later point in time (post planning consent) has the added benefit of ensuring that the licensing process fully reflects current legislative requirements, and, more importantly, the most up-to-date environmental information and that the cumulative / in-combination assessment considers the wider environmental impacts at that point in time

As mentioned above, key environmental issues relating to afforestation include water, soils, biodiversity, archaeology, landscape and climate. Each is subject to regular updates in terms of best practice, guidelines, standards and national policies. For example, the EPA regularly update the water quality status of rivers across the country, and planning authorities review their landscape strategies in line with their review of County Development Plans every six years. Delaying the identification of alternative afforestation lands until such time as they are required enables identification of optimum lands available (from an environmental) perspective for afforestation at that time.

In light of the foregoing and for the purposes of this project, the developer commits that the location of any replanting (alternative afforestation) associated with the project will be greater than 10km from the wind farm site and also outside any potential hydrological pathways of connectivity i.e. outside the catchment within which the proposed project is located. On this basis, it is reasonable to conclude that there will be no more than imperceptible indirect or in-combination effects associated with the replanting.

In addition, the developer commits to not commencing the project until both a felling and afforestation licence(s) is in place and therefore (as discussed above) this ensures the afforested lands are identified, assessed and licenced appropriately by the relevant consenting authority.

References

Forestry Regulations 2017 (S.I. No. 191 of 2017).
http://www.irishstatutebook.ie/eli/2017/si/191/made/en/print

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Appendix 1

Section 5.3 of the Felling and Reforestation Policy (DAFM, 2017)

5.3 Supporting renewable energy and energy security

5.3.1 Overview

The development of renewables is at the heart of the Government's energy policy, as laid out in the document *Strategy for Renewable Energy: 2012-2020* (Department of Communications, Energy & Natural Resources, 2012). Under Directive 2009/28/EC, Ireland is legally obliged to ensure that by 2020 at least 16% of all energy consumed in the State is from renewable sources. Ireland must ensure that there is a steady, progressive and measurable increase between now and the year 2020, in the amount of renewable energy consumed in the electricity, heat and transport sectors, commensurate with the achievement of the national target.

Underpinning the Government's energy and economic policy objectives are five Strategic Goals reflecting the key dimensions of the renewable energy challenge to 2020. The first Strategic Goal refers to wind and aims to have "*Progressively more renewable electricity from onshore and offshore wind power for the domestic and export markets.*"

It is Forest Service policy to facilitate wind energy as much as possible within the context of sustainable forest management and efforts to expand the national forest estate.

5.3.2 Policy on felling licences for wind farm development

Where a developer intends to construct a wind farm that is within or partially within a forest or that will require tree felling, it is extremely important that the developer consults the Forest Service at the *earliest possible stage* of the project. This may help to develop a collaborative approach that will ensure that all forestry issues are identified and mitigated at the earliest opportunity.

In line with general Forest Service policy, where grant-aided forestry is to be used for wind farm development, any grants and premiums already paid out by the Forest Service in relation to the areas felled for the turbine bases, roads and infrastructure must be repaid where the forest is still in receipt of afforestation premiums and / or still in contract under the Afforestation Scheme.

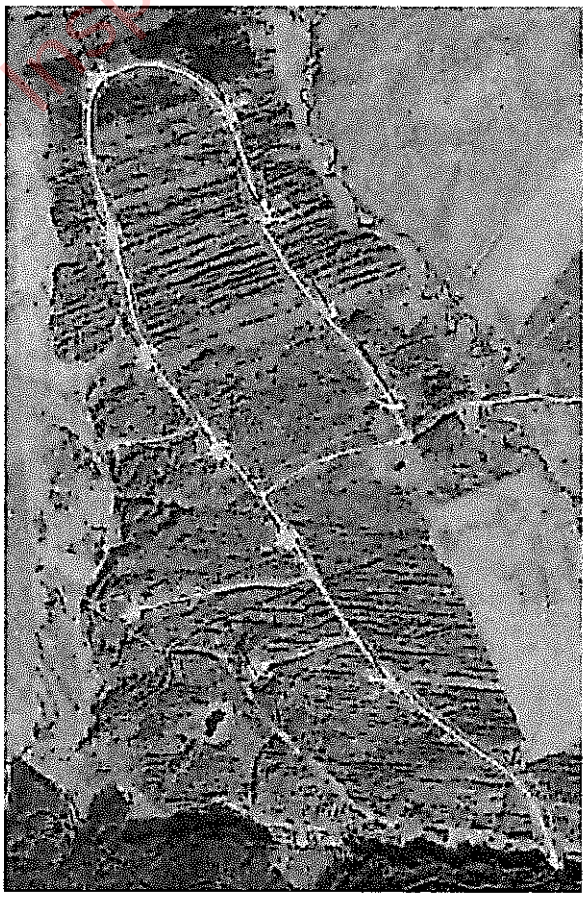


Photo 8 *A wind farm within a forest plantation. Forest Service policy is to facilitate wind energy within the context of SFM and the expansion of the national forest estate.*

Wind farm construction typically encompasses three categories of tree felling: infrastructure; construction; and turbulence. Each category requires a felling licence. Table 6 and the following sections detail the specific requirements regarding each category. Also, Case Study 2 provides for three worked examples of wind farm development, and associated licensing issues.

5.3.2.1 General requirements

Notwithstanding any requirement for the wind farm developer to produce an Environmental Impact Statement (EIS) in respect of the development and the requirement to assess the impact of tree felling / reforestation proposals in an EIS, when felling licence applications are made, the Forest Service may require the developer to report on the potential loss of soil and biomass CO_2, and the reduction in productivity of the forest area associated with different wind farm forest management and landscape plans. Potential impacts to be reported on and assessed may also include site stability, water quality, habitats and species, landscape, archaeology, and other issues that may be deemed appropriate by the Forest Service.

If Planning Permission has been granted for the development by the local authority or by an Bord Pleanála, a copy of the full Planning Permission should be submitted to support the felling licence application. Also, if an EIS or a Natura Impact Statement have been prepared, these need to be submitted to support the felling licence application.

Table 6 Requirements for each category of felling associated with wind farm development, regarding reforestation, alternative afforestation, and the refunding of grant and premiums.

Category of tree felling		Reforestation of felled area required?	Alternative afforestation required? (See Note 1)	Refunding of grant & premiums required? (See Note 2)
Infrastructure felling		No	Yes	Yes
Construction felling		Yes	No	No
Turbulence felling	≤20 ha	Yes	No	No
	>20 ha	Yes	Yes, 10% turbulence fell area – see Section 5.3.2.4	No

Note 1 If 'YES', the alternative site must be of an area equivalent in size. Section 5.7 sets out the procedures required. If the forest area proposed for permanent removal is still in receipt of premiums and / or is still in contract under the Afforestation Grant & Premium Scheme, the alternative site may be eligible under the Afforestation Grant & Premium Scheme.

Note 2 If 'YES', the refunding of any afforestation grants and premiums already paid out by the Forest Service is required if the forest area proposed for permanent removal is still in receipt of premiums and / or is still in contract under the Afforestation Grant & Premium Scheme. Also, if 'YES' or 'NO', if premiums are still being paid, premium payments on the area will cease.

5.3.2.2 Infrastructure felling

Infrastructural felling relates to trees that are permanently removed from the site in order to make way for infrastructure associated with the wind farm, such as access roads and turbine bases.

For infrastructure felling, the afforestation of alternative land and the repayment of grant and premium payments are required – see Table 6 and Section 5.7 for details. In addition, where the infrastructure fell area is still in receipt of premiums, then premium payments will cease, i.e. the felled area will not continue to receive premium payments.

5.3.2.3 Construction felling

During the construction phase of the wind farm development, there are forest areas that require the temporary removal of tree cover to facilitate construction, e.g. 'borrow pits' for stone. Once construction is completed, the land is reforested.

For construction felling, the afforestation of alternative land and the repayment of grant and premium payments are not required – see Table 6. In addition, where the construction fell area is still in receipt of premiums, then premium payments will cease, i.e. the felled area will not continue to receive premium payments.

5.3.2.4 Turbulence felling

Turbulence felling is deemed to be felling in the vicinity of turbines for the purpose of avoiding air turbulence that can be created by the forest canopy. It is carried out in order to increase the efficiency of the turbine by reducing turbulence in the airflow, and to reduce vibrations through the turbine blades, thereby lowering stress on the turbine components.

Turbine manufacturers assess the forest layout, age profile and management plans for the forest along with topography and wind mast data. Based on that assessment, some manufacturers will require turbulence felling as part of the terms of supplying turbines for a particular site. In the case of many wind farms, the manufacturer's requirements are therefore not known until late in the planning of the project, as no turbine will have been selected. In general, manufacturers recommend that tree height is restricted within 300 metres, in the dominant wind direction.

Turbulence felling may be allowed in certain cases, and subject to reforestation requirements. For completeness and to ensure that the EIS itself is valid, it is important that the EIS takes into account the maximum turbulence felling that could potentially occur under the project.

Felling Licence requirements in relation to turbulence felling include the following:

1. The repayment of afforestation grants and premiums already paid out by the Forest Service is not required. In addition, where the turbulence fell area is still in receipt of premiums, then premium payments will cease, i.e. the felled area will not continue to receive premium payments.
2. The granting of a licence for a turbulence felling will be subject to the normal checks carried out by the Forest Service in respect of silvicultural, environmental and landscape considerations, etc. A felling coupe is defined for this purpose as a contiguous or adjacent area, any part of which is felled in a 2 (calendar) year period.
3. A distinction is made between turbulence felling ≤20 ha and >20 ha. Excluding the area

for the turbine bases, etc. from the limit, the 20 ha limit specified in this section is a total limit for the entire wind farm development. The limit is not interpreted as 20 ha per turbine or any other interpretation that is deemed by the Minister to be in excess of a total of 20 ha per wind farm development. In terms of reforestation, the following applies:

- Where the felling coupe area for turbulence felling is less than or equal to 20 ha, this is considered consistent with sustainable forest management. Where the cumulative total area of 20 ha or less is adjacent to one or more turbines and it is proposed to fell this area in accordance with normal good forest practice, such felling will not be considered turbulence felling. There is no requirement to afforest additional land. The area where the trees are being felled must be reforested.

Case Study 2: Windfarm development

The following tables provide examples of typical windfarm applications.

Site 1 Sitka spruce, 10 yrs. Reforest with North Coastal Lodgepole pine.

Felling type	Area (ha)	Reforest felled site	Alternative afforestation	Refund Afforestation Grant & Premium
Infrastructure	10	No	Yes (10 ha)	Yes
Construction	2	Yes	No	No
Turbulence	35	Yes	Yes (3.5 ha)	No

Site 2 Sitka spruce, 25 yrs. Reforest with Sitka spruce.

Felling type	Area (ha)	Reforest felled site	Alternative afforestation	Refund Afforestation Grant & Premium
Infrastructure	5	No	Yes (5 ha)	No
Construction	0.5	Yes	No	No
Turbulence	16	Yes	No	No

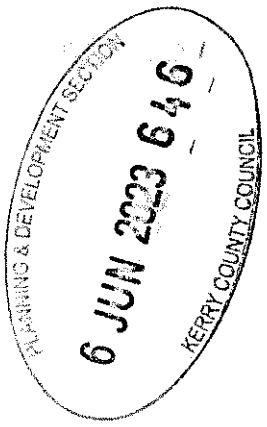
Site 3 Sitka spruce, 14 yrs. Reforest with Sitka spruce.

Felling type	Area (ha)	Reforest felled site	Alternative afforestation	Refund Afforestation Grant & Premium
Infrastructure	5	No	Yes (5ha)	Yes
Construction	0.5	Yes	No	No
Turbulence	16	Yes	No	No

- Where the felling coupe area for turbulence felling is greater than 20 ha, the applicant is required to reforest the area. In addition, 10% of the turbulence felling coupe area must be afforested on an alternative site to allow for the increase in soil carbon emissions at afforestation and the loss of potential carbon sequestration due to the proposed method of forest management. See Section 5.7 for details regarding the afforestation procedure.
- Subsequent to a licence being granted for 20 ha or less, any cumulative felling applied for above the 20 ha limit will be considered to be turbulence felling. Therefore, the original area of 20 hectares or less that was licensed will also then be regarded as turbulence felling. For example, if 20 hectares are felled in the first year and a further 12 hectares of felling is applied for in (e.g.) Year 3, then the additional 12 ha (if granted) and the original 20 ha will be treated as 32 ha of turbulence felling. The rules for turbulence felling will then apply to all 32 ha.

Appendix 2

Environmental Requirements for Afforestation (DAFM, 2016)



Environmental Requirements for Afforestation

December 2016

Department of
Agriculture,
Food and the Marine
An Roinn
Talmhaíochta,
Bia agus Mara

The Forest Service of the Department of Agriculture, Food and the Marine is responsible for ensuring the development of forestry within Ireland in a manner and to a scale that maximises its contribution to national socio-economic well-being on a sustainable basis that is compatible with the protection of the environment. Its strategic objectives are:

1. To foster the efficient and sustainable development of forestry
2. To increase quality planting
3. To promote the planting of diverse tree species
4. To improve the level of farmer participation in forestry
5. To promote research and training in the sector
6. To encourage increased employment in the sector

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Tel. 053 91 63400 / Lo-Call 1890 200 509
E-mail forestservice@agriculture.gov.ie
Web www.agriculture.gov.ie/forestservice

All photos Forest Service unless otherwise stated.
Illustrations by Aislinn Adams

December 2016

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Section 1
Introduction

1.1 Context

National forest policy - as set out in *Forests, Products and People* (2014) - is to increase the forest area in accordance with sustainable forest management (SFM) principles, in order to support a long-term sustainable roundwood supply, and associated employment and economic activity. As the consenting authority for afforestation, the Forest Service of the Department of Agriculture, Food & the Marine must ensure that this increase takes place in a way that complies with environmental legislation and that enhances the contribution new woodlands and forests can make to the environment and to the provision of ecosystem services, such as water protection and landscape enhancement.

The overall aim of these *Environmental Requirements for Afforestation* is to ensure that the establishment of new woodlands and forests is carried out in a way that is compatible with the protection and enhancement of our environment, including water quality, biodiversity, archaeology and landscape. (Sites proposed for afforestation must also meet the minimum timber productivity requirement set out in the Forest Service *Land Types for Afforestation* document, and this assessment should be carried out by the Registered Forester before advancing to application stage.)

In assessing an application for afforestation, the Forest Service is required to consider potential impacts across a range of issues and sensitivities. This includes in-combination impacts regarding water, biodiversity, landscape, social issues, etc. The following lists the primary components of the legal, regulatory and funding framework that apply:

- European Communities (Forest Consent & Assessment) Regulations 2010 (S.I.558 of 2010), as amended
- European Union rules governing the Forestry Programme

Sensitively sited, designed and established plantations adding to Ireland's expanding forest resource.

- Forestry Programme
- Legally protected species and habitats and associated designations (e.g. Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas) and procedures (e.g. Appropriate Assessment)
- Water Framework Directive
- Legislation regarding archaeology and built heritage, including the National Monuments Acts 1930 to 2014
- Forest Service requirements, procedures and protocols, e.g. the terms and conditions of the Afforestation Scheme (if grant aid is being sought), the *Forestry Standards Manual*; the *Forestry & Freshwater Pearl Mussel Requirements*; the *Forestry & Kerry Slug Guidelines*; the *Forestry & Otter Guidelines*; and the *Forest Protection Guidelines*.

(For further details, refer to the **SUPPORTING DOCUMENT** on the Forest Service website - see below for details.)

Any statutory approval (with or without grant aid) for afforestation is conditional on adherence to the measures set out in these *Environmental Requirements for Afforestation*, to the conditions of approval, and to the standards and procedures set out in the *Forestry Standards Manual*. Where a parallel approval for grant aid has been issued, the Afforestation Scheme Terms & Conditions also apply.

Any divergence from the measures set out in these Requirements must be fully described in the initial application and depicted clearly on the Biodiversity Map, for consideration by the Forest Service.

1.2 About these Environmental Requirements

The *Environmental Requirements for Afforestation* replace those measures relating to afforestation contained within the following Forest Service Environmental Guidelines: *Forestry & Water Quality Guidelines*, *Forestry & Archaeology Guidelines*, *Forestry & the Landscape Guidelines*, and *Forest Biodiversity Guidelines*. (Note, however, that these guidelines still apply to other Forest Service regulated activities, as specified in any approval, consent or licence issued.)

The *Environmental Requirements for Afforestation* are set out in three stages. These reflect the typical sequence of activities undertaken by an Applicant and her / his Registered Forester and the corresponding environmental requirements that apply, throughout afforestation and up to the end of the premium period (or 15 years, for non-grant aided forests). These three stages are as follows:

1. Pre-Application Design
2. Site Works
3. Ongoing Management

This document is accompanied by a web-based document entitled *Environmental Requirements for Afforestation: SUPPORTING DOCUMENT* (see www.agriculture.gov.ie/forestservice/grantsandpremiumschemes2015-2016/). This web-based document is an integral part of the Requirements and is referred to throughout, as the '**SUPPORTING DOCUMENT**'.

Section 2
Design

2.1 Overview

During Stage 1: Pre-Application Design, the Registered Forester assesses the site and carries out various checks, and subsequently designs the afforestation proposal in a way that addresses the various environmental features and sensitivities identified. This design is then reflected in the subsequent application (Form 1) for technical approval (and financial approval, if sought) submitted to the Forest Service for assessment. Please note, it is the responsibility of the Applicant to provide the relevant information needed to enable the Forest Service to make a full assessment of the application.

2.2 Background checks

Various sources of information can be checked by the Registered Forester early in the pre-application design stage, to identify environmental features and sensitivities. Relevant safeguards can then be incorporated into the design to avoid possible negative impacts and to enhance positive impacts. Potentially, this may also shorten and streamline the assessment process.

iNET provides the primary source of information and provides a platform for mandatory Form 1 checks regarding water, designated sites, archaeology, etc. However, other important sources of environmental information are available - see the **SUPPORTING DOCUMENT**. Dialogue with the Applicant may also reveal more subtle sensitivities that might exist.

2.3 Basic requirements at design stage

The basic design-stage requirements in relation to water, biodiversity, archaeology and landscape are set out below. Note the following:

- If faced with a particularly sensitive and complex site in relation to a particular environmental feature or sensitivity, a Registered Forester may propose measures above and beyond the minimum requirements set out in this document. Examples include wider-than-normal water setbacks due to a downstream Special Area of Conservation (SAC).
- Furthermore, a relevant expert (e.g. hydrologist, ecologist, archaeologist, landscape architect) may be engaged early in the process, to assess the feature / sensitivity and to propose appropriate measures. This may result in a more refined application and may avoid complexities and delays in the application process. For example, it may avoid the need for the Forest Service to seek further information, and may allay the concerns of local people and statutory consultees.
- An individual site or part of a site may be deemed eligible from a productivity perspective (following the Land Types for Afforestation assessment process) but unsuitable from an environmental perspective. These sites may become apparent to Registered Foresters at the early design stage, following his / her onsite assessment and background checks, and *should not be advanced to application stage*.

2.4 Water

OBJECTIVE: TO PROTECT WATER AND AQUATIC HABITATS AND SPECIES, DURING AFFORESTATION AND THROUGHOUT THE REMAINDER OF THE FOREST ROTATION.

The Registered Forester must assess the potential risk of sedimentation and nutrient runoff entering into 'receiving waters' (streams, rivers, lakes), both during afforestation and throughout the remainder of the rotation, and adapt the forest design and planned operations accordingly. Key factors include soil type, slope, available pathways for water, the erodibility of the soil and subsoil, downstream SACs, and the status objective of the waterbody itself. Regarding the latter, particular regard is needed if the proposed afforestation site is within the catchment area of a high status objective waterbody or a waterbody at risk of decline in status.

For guidance, the **SUPPORTING DOCUMENT** gives examples of scenarios that (alone or in combination) can heighten the risk to water.

During site assessment, identify and map (on the required Biodiversity Map) the water features defined in Table 1, each of which require a water setback.

2.4.1 Water setback

A water setback(*) is an area of a defined width, positioned adjoining the water features defined in Table 1, and left largely undisturbed during afforestation and throughout the remainder of the rotation, specifically for the protection of water. All new drains installed as part of the afforestation project must terminate in sediment traps *outside* the water setback. The relevant setback for each water feature is set out in Section 2.8.

(* Formerly referred to as 'aquatic buffer zone'.)

The protection of water quality and aquatic habitats and species is a key requirement for all new afforestation projects.

Table 1 Water features requiring water setbacks.

Type of water feature	Definition
Aquatic zone	A permanent or seasonal river, stream or lake shown on an Ordnance Survey 6 inch map. (Note, the EPA water layer on iNET may not capture all aquatic zones onsite.)
Relevant watercourse	A watercourse that is not shown on an OS 6 inch map but which: ➢ is connected to an aquatic zone onsite, adjoining the site or elsewhere; and ➢ has the potential to carry significant amounts of sediments / nutrients, or shows evidence of erosion / deposition. Relevant watercourses are often artificial, and include existing drains and channels and other potential pathways that may contain flowing water during and immediately after rainfall. Note, not every watercourse may be a 'relevant watercourse'. For example, a well-vegetated agricultural drain on moderately sloping ground may not be a relevant watercourse.
Hotspot	An area (often localised) that is a potential source for sediment / nutrient loss during afforestation and / or future forestry operations. Examples include soft wet ground, flushes and springs, and pockets where machine access is difficult due to low ground-bearing capacity.
Water abstraction point	Abstraction point of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme.

2.4.2 Drainage and cultivation

Drainage and cultivation are necessary on most afforestation sites, to enable establishment. Typical methods include conventional mounding (with mound drains), ripping, inverted mounding and scrap mounding. Key factors are as follows:

- It is critical that water collected within drains flows slowly, both during afforestation and throughout the remainder of the forest rotation. This minimises the potential for erosion and the transport of sediments and nutrients to receiving waters. This requires an assessment of soil, slope and likely rainfall, and the selection and refinement of the most appropriate option(s), incorporating correct drain alignment, spacing and depth, and the proper deployment of sediment traps. Refer to the *Forestry Standards Manual* for specifications regarding drains, sediment traps, mounding, ripping, etc. Additional information is contained in the *Forest Road Manual* and *Forest Drainage Engineering: A Design Manual*. For details on operational safeguards (e.g. sediment trap distribution), see Section 3.7.1.
- All new drains must terminate in an appropriately-sized sediment trap located *outside* the water setback. New drains *must not* enter into or traverse the water setback itself (an exception exists for flat difficult-to-drain sites – see Section 3.7.1 for details.)

A well-defined water setback early in the afforestation process, with natural ground vegetation emerging.

- Match drainage and cultivation to the specific conditions that exist in different parts of the site, selecting the least intensive options and specifications needed to successfully establish and grow the forest. Where site conditions allow (e.g. on naturally free-draining sites), consideration should first be given to the least impacting techniques, such as ripping and inverted mounding. In water-sensitive parts of the site, inverted mounding or simple pit planting should be considered.
- The drainage and cultivation proposed for different plots must be determined during the design stage and accurately depicted on the submitted Biodiversity Map. Also depict any additional safeguards deemed necessary (see Section 3.7.1).
- Of particular concern are peat soils, steep slopes capable of generating higher water velocities, and old land drains and other possible pathways that may become reactivated. Also of particular concern is the capacity of the new drainage network to withstand high rainfall events, without the failure of sediment traps and water setbacks.

2.4.3 Water crossings

Water features may need to be crossed for site development works and ongoing site management. Crossings may be temporary in nature or may comprise permanent structures intended to link in with a future forest road.

The following requirements apply:

- Any work in an aquatic zone should be limited to the period May to September, inclusive.
- Crossings should be designed so that:
  - the number of crossings over a given aquatic zone is minimised;
  - disruption to the bank, bed and adjacent water setback is minimised;
  - the water flow is crossed at a right angle;
  - cement or uncured concrete is kept out of the aquatic zone, with 'cast-in-place' concrete isolated from any water which might enter the aquatic zone, until the

concrete is cured;

- local stone is used for bridge kerbs and end treatments for culverts;
- all timber treatment is carried out off-site.

- Consult with the Inland Fisheries Ireland at least 6 weeks prior to constructing any crossing of an aquatic zone.
- If planning a permanent structure intended to link in with a future forest road, consider whether or not the location of the crossing is environmentally appropriate for that future use.
- Bridge construction is necessary where culverts may restrict fish migration.
  - All supports and buttresses should be completely out of the stream.
  - Do not create shallow or shooting flow at the bridge aprons, to ensure that water velocities do not impede fish movement.
- Fords are not desirable and should only be used where the design is approved by Inland Fisheries Ireland.
- All culverts should be well-bedded and of sufficient size to carry normal flow, to accommodate 25-year storm events, and to avoid blockages and washouts. Ends should be tapered to match the embankment slope. If greater than 1.0 metre in diameter, culverts should be buried to a depth of 30 cm or 20% of their height (whichever is greater) below the streambed, and the original bed material placed in the culvert.

If proposing a crossing, submit full design details with the afforestation application, and clearly indicate the proposed location on the Biodiversity Map. Also provide details regarding removal and site restoration, where the proposed crossing is temporary in nature.

2.5 Biodiversity

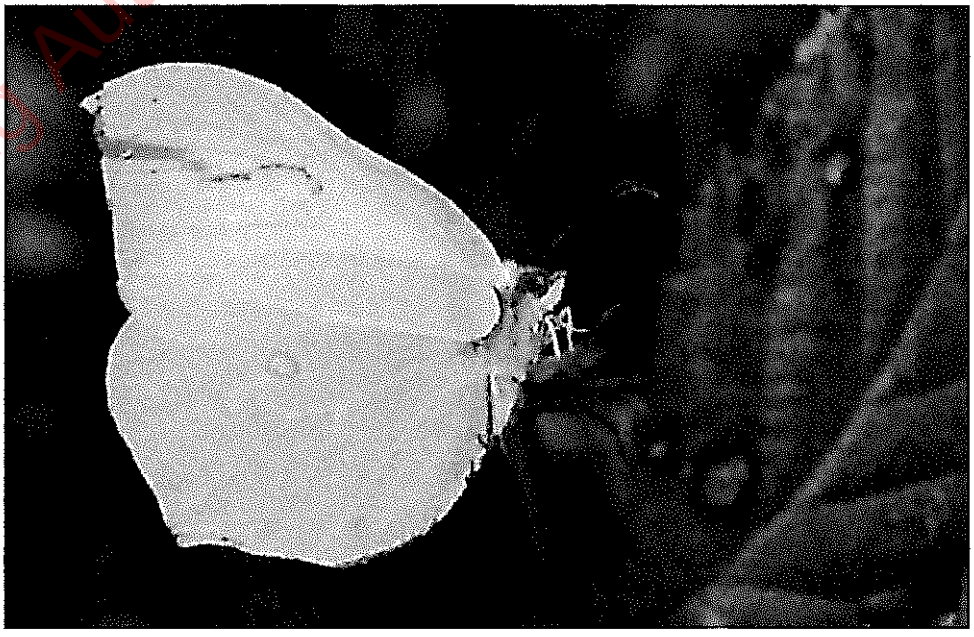
OBJECTIVES:

- **TO ENSURE THAT AFFORESTATION DOES NOT ADVERSELY IMPACT DESIGNATED CONSERVATION AREAS, PROTECTED HABITATS, OR PROTECTED SPECIES OF FAUNA OR FLORA AND THEIR HABITAT.**
- **TO ENHANCE THE BIODIVERSITY VALUE OF THE NEW FOREST THROUGHOUT ITS ROTATION.**

Biodiversity is the variety of living organisms, including: (i) the diversity of species; (ii) the genetic diversity or variation within the species; and (iii) the ecosystems in which species live. Conifer, broadleaf and mixed woodlands and forests can contribute greatly to biodiversity, both within their boundaries and as wildlife corridors and refuges in the wider landscape.

2.5.1 Protected habitats and species

Afforestation can impact of a range of habitats and species protected under various legislation. Table 2 sets out various scenarios that may apply, and the likely outcome regarding any proposed afforestation application. Applicants are encouraged to seek ecological input early in the design stage in situations where one or more of these scenarios apply, and to tailor any subsequent application accordingly before submission to the Forest Service.



Yellow brimstone. Sensitive design at afforestation will enhance the forest's biodiversity value throughout the entire rotation.

Table 2 Various scenarios that may apply regarding protected habitats and species, and the likely outcome regarding the proposed afforestation application. (Note, the use of the term 'the project' below relates to afforestation and management of the forest rotation.)

1. Is the plot(s) within a Special Area of Conservation (SAC), Special Protection Area (SPA), a Natural Heritage Area (NHA) or proposed NHA, a Nature Reserve, a National Park, or a Refuge for Flora and Fauna? These sites are designated for the conservation of habitats and species. For example, SACs are designated under the Habitats Directive to create a coherent European ecological network in order to ensure the restoration or maintenance of habitats (Annex I) and animal and plant species (Annex II) of Community interest at a favourable conservation status. *Relevant legislation:* EU Habitats Directive; EU Birds Directive; Wildlife Act 1976; Wildlife (Amendments) Act 2000; European Communities (Birds and Natural Habitats) Regulations 2011 (S.I.477 of 2011)	If '*Yes*', the Forest Service may require an ecological report demonstrating how the project can take place in a manner compatible with the ecological objectives of the designation. ➢ In relation to NATURA sites (SACs and SPAs), the Forest Service will undertake screening and where necessary, appropriate assessment, and can only approve the project if it is satisfied that it will not adversely affect the integrity of the NATURA site, either alone or in combination with other plans or projects. See the Forest Service *Forestry Standards Manual* for details of this Appropriate Assessment Procedure. ➢ *Do not submit any area of a habitat listed as a qualifying interest of the SAC.* ➢ The Forest Service is not in a position to approve afforestation applications within Hen Harrier SPAs, pending the completion of the Threat Response Plan. ➢ In relation to proposed afforestation within NHAs, the Forest Service requires the submission of a completed Notifiable Action Form (which documents National Parks & Wildlife Service consent) with the initial Afforestation Application (Form 1).
2. In non-designated areas, is there a habitat listed in Annex I of the Habitats Directive, known to be present or observed within the plot(s)? See **SUPPORTING DOCUMENT** for a list of Annex I habitats (and the corresponding Fossitt (2000) habitat classification) that may occur on afforestation sites. *Relevant legislation:* Habitats Directive.	If '*Yes*', the Forest Service may require an ecological report assessing the habitat and its extent and identifying mitigation measures capable of ensuring that the project can take place in a manner compatible with the maintenance or restoration to a favourable conservation status of that habitat. NOTE, at a site level, the Forest Service will not approve the afforestation of a non-designated Annex I habitat that is deemed to be a favourable condition, based on an assessment of its area, structure and function, and future prospects. Such habitat must be excluded from the application or incorporated as a retained habitat. In both cases, an appropriate habitat setback will also be required so as not to impact on future prospects.

3. Is the plot(s) within one of the Priority 8 Freshwater Pearl Mussel (FPM) Catchments (as listed in the SUPPORTING DOCUMENT)? FPM is a freshwater shellfish that is highly vulnerable to siltation and nutrient runoff and other water impacts, and is a highly threatened species of European importance. The *Strategy for Conservation of the Freshwater Pearl Mussel* (September 2011) prioritises the conservation of FPM populations within 8 sub-basin catchments. See the **SUPPORTING DOCUMENT** for details. *Relevant legislation:* Habitats Directive; European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (S.I.296 of 2009)	If '*Yes*', afforestation approval is dependent *inter alia* upon the submission and subsequent evaluation by the Forest Service, of a Form A (Site Assessment) and Form B (Mitigation Measures) from the *Forestry & Freshwater Pearl Mussel Requirements*. The Forest Service may also request a NATURA Impact Statement (NIS). Note that, if approved, afforestation within these catchments is likely to be limited to native woodland establishment under GPC9 and GPC10.
4. Is the plot(s) within the 6 km zone of any other Freshwater Pearl Mussel Catchment listed in the SUPPORTING DOCUMENT? For details of FPM, see above. *Relevant legislation:* Habitats Directive; European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009.	If '*Yes*', afforestation approval is dependent *inter alia* upon the submission and subsequent evaluation by the Forest Service, of a Form A (Site Assessment) and Form B (Mitigation Measures) from the *Forestry & Freshwater Pearl Mussel Requirements*. The Forest Service may also request a NIS.
5. Is there an Annex IV species or its habitat (if in the species range) known to be present or observed within the plot(s)? Species listed in Annex IV of the Habitats Directive are strictly protected. It is an offence to deliberately disturb the species or damage or destroy its breeding or resting places wherever it occurs, whether inside or outside designated areas. Annex IV species include otter, Kerry slug and bats. *Relevant legislation:* Habitats Directive.	➢ If *'Yes'* for otter, follow the requirements set out in the Forest Service *Forestry & Otter Guidelines*. ➢ If *'Yes'* for Kerry slug, follow the requirements set out in the Forest Service *Forestry & Kerry Slug Guidelines* ➢ If *'Yes'* for any other Annex IV species, the Forest Service may require an ecological report demonstrating how the project can and will be designed and implemented in a manner compatible with the protection of the species and its habitat.

6. Is there an Annex II species and / or its habitat known to be present or observed within the plot(s)? Species listed in Annex II of the Habitats Directive are animal and plant species of Community interest whose conservation requires the designation of SACs. Outside of SACs, these species are protected against damage that impacts their favourable conservation status (or ability to achieve that status) (for example, damage that reduces the natural range of the species). There are a number of Annex II species, included the Killarney Fern, Yellow Marsh Saxifrage and River Lamprey. *Relevant legislation:* Habitats Directive; Environmental Liability Directive; European Communities (Environmental Liability) Regulations 2008 (S.I.547 of 2008).	If '*Yes*', the Forest Service may require an ecological report confirming the presence of the species or its known habitat, a determination regarding whether or not the project would impact on the species' favourable conservation status (or its ability to achieve that status), and if so, required mitigation.
7. Is the application located on sandstone geology in West Cork or Kerry, as illustrated in Figure 1 of the Forest Service *Forestry & Kerry Slug Guidelines*? As an Annex IV species under the Habitats Directive, the Kerry slug (*Geomalacus maculosus*) is strictly protected wherever it occurs. It is an offence to deliberately disturb the species or damage or destroy its breeding or resting places wherever it occurs, whether inside or outside designated areas. It is also an offence under national legislation (Wildlife Act 1976, Wildlife (Amendment) Act 2000) to deliberately destroy or damage the slug or its habitat. *Relevant legislation:* Habitats Directive; Wildlife Act 1976; Wildlife (Amendment) Act 2000.	If '*Yes*', follow the decision path set out in the Forest Service *Forestry & Kerry Slug Guidelines*. Detail both the outcome of this process and any resulting amendments to forestry operations required (as set out in these Guidelines) in the proposed application for afforestation.
8. Is there a population of a species protected under the Flora (Protection) Order 2015 (S.I.356 of 2015) known to be present or observed within the plot(s)? The Flora (Protection) Order 2015 protects various plants (see SUPPORTING DOCUMENT). It is an offence (save under a licence granted under Section 21 of the Wildlife Act 1976) to (*inter alia*) wilfully alter, damage, destroy or interfere with the habitat or environment of these plants. This applies to wherever the plants are found, whether inside or outside designated areas. See SUPPORTING DOCUMENT for relevant sources of information. *Relevant legislation:* Wildlife Act 1976; Wildlife (Amendment) Act 2000; Flora (Protection) Order 2015 (S.I.356 of 2015).	If '*Yes*', the Forest Service may request the submission of an ecological report confirming the presence (or otherwise) of the species, and required mitigation.
Note regarding species of animal protected under the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000 Mammal, amphibian, reptile and invertebrate species protected under the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000 (see SUPPORTING DOCUMENT for list) are protected from injury or from disturbance / damage to their breeding or resting place, wherever these occur. The majority of these species are considered by other scenarios listed above. Further cover is provided by specific Forest Service requirements for Kerry slug and otter and guidance for bat species, Therefore, to avoid duplication, the above does not contain a specific question dealing directly with the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000.	

2.5.2 Areas for Biodiversity Enhancement

During onsite assessment, identify Areas for Biodiversity Enhancement, or ABEs. Their function is (*inter alia*) to conserve existing habitats and biodiversity features onsite and to promote the development of biodiversity generally within the new forest.

ABEs comprise environmental setbacks, future operational areas and retained habitats, as described below.

- An **environmental setback** is a (largely) unplanted and undisturbed open space of a defined width (as set out in Section 2.8) installed to protect a particular environmental feature or sensitivity. Different types apply (as listed below) depending on the feature or sensitivity involved:
    - water setback
    - retained habitat setback
    - archaeological setback
    - public road setback
    - utilised building setback
    - landscape setback

  In addition to their main protective role, these environmental setbacks are important biodiversity features in their own right, providing open and edge habitats along the forest margin. As described later, this role can be enhanced further through simple design and additional planting.

- A **future operational area** is an open space left unplanted in order to facilitate the future management of the plantation (e.g. a rideline) or to accommodate future infrastructure (e.g. a forest road or landing bay). In addition to their primary management function, these operational areas are also important biodiversity features in their own right, and this value can be enhanced further through simple design and additional planting.

- A **retained habitats** is an existing onsite habitat selected for retention within the future forest. These can be area-based features (e.g. a localised flush), linear features (e.g. a hedgerow) or point features (e.g. a veteran tree). Design must aim to protect and enhance these habitats throughout the forest rotation, and to allow associated native flora and fauna to develop. This may involve the addition of a habitat setback, to prevent future impacts (e.g. overshadowing) from the growing forest canopy – see Section 2.8 for details.

  (Note, it may be necessary to exclude from the afforestation application, areas containing certain habitats or species that require grazing to persist. Otherwise, these areas will become overgrown as the result of fencing.)

Ensure that future operational areas for future forest roads do not overlap with environmental setbacks for water, archaeology and retained habitats.

Tables 3 and 4 list the various features that are eligible as ABEs for the purpose of grant and premium calculation.

Table 3 Site features and their eligibility as ABEs. (Also see Table 4 regarding woody habitats.)

Site features	Eligible as ABE?
Water setback	Yes
Retained habitat setback	Yes
Archaeological setback	Yes
Public road setback	Yes
Utilised building setback	Yes
Landscape setback	Yes
Hedgerows and other woody habitats	See Table 4
Created lakes / reservoirs	Yes
Railway setbacks	Yes
Drains	Yes
Future operational areas left for planned forest roads, turning bays, ridelines, etc.	Yes
Unplantable areas	No
Areas of shallow, rocky soil	No
Rock and scree	No
Aquatic zones (as defined in Table 1)	No
Rights-of-way held by 3rd parties	No
Areas with turbary or grazing rights held by 3rd parties	No
Major water mains	No
Power line corridors	No
Gas pipeline corridors	No
Public roads	No
Other features	If deemed appropriate by the Forest Service

Table 4 Woody habitat types, their eligibility as ABEs, and available options.

Type of woody habitat	Eligibility as ABE and available options(*)	Comment
Area of scrub (e.g. elder) and non-high forest species (e.g. blackthorn, hawthorn, willow)	Eligible as ABE. Therefore, either: ➢ include as retained habitat; OR ➢ clear(**) and plant; OR ➢ exclude from the application.	Non-high forest species often have a high biodiversity value.
Individual high forest trees (e.g. oak, ash, beech, hazel(***), birch, pine)	Eligible as ABE. Therefore, include as retained habitat (i.e. point features).	Individual trees such as these can have a high biodiversity value.
Areas of high forest trees (see above examples) less than 0.1 ha in size	Eligible as ABE. Therefore, either: ➢ include as retained habitat; OR ➢ exclude from the application.	Groups comprising trees such as these can have a high biodiversity value.
Areas of high forest trees (see above examples) 0.1 ha or greater in size	Not eligible as ABE. Therefore, exclude from the application.	Such areas meet the definition of a forest, and existing forests cannot receive afforestation payments.
Hedgerows	Eligible as ABE. Therefore, either: ➢ include as retained habitat *plus* setback; OR ➢ include as retained habitat.	Apply habitat setback as per Section 2.5.4. Otherwise, no habitat setback required.
Rhododendron / laurel	Not eligible as ABE. Therefore, either: ➢ clear and plant, OR ➢ exclude from the application.	These are non-native invasive species and must not be retained as ABE.

* Each relevant option can be applied to all of the corresponding woody habitat type onsite, or to different sections of it.

** Under a Felling Licence, if required. Note, the retention of alluvial woodland comprising willow may require prioritisation within the wider landscape, due to ecological considerations and water protection.

*** Hazel may be classed as 'scrub' where it has encroached in the last 5 years.

2.5.3 ABE criteria

ABE eligibility criteria are as follows:

- Between 10-15% of the afforestation site must be treated with particular regard to biodiversity, comprising a combination of open spaces (i.e. environmental setbacks and future operation areas) and retained habitats. Where ABEs add up to more than 15% of the total area, the claim area must be reduced accordingly, as set out in the *Forestry Standards Manual*.
- ABEs must comprise areas suitable for planting, but where the potential for a commercial forest crop is foregone for the purpose of retaining habitats and creating open spaces in order to (*inter alia*) promote biodiversity within the future forest. Areas that are unsuitable for planting are not eligible as ABEs.
- ABEs must be an integral part of the site. For example, an ABE plot cannot be in an adjoining field / land parcel or in a separate plot away from the main area of the plantation.

- Generally, identify ABEs using the following sequence:
  - Step 1: Identify environmental setbacks (for water, archaeology, landscape, etc.) and future operational areas, to allow for the environmental features / sensitivities identified and management needs envisaged.
  - Step 2: Select the 'best quality' habitats(*) onsite for retention, together with any habitat setbacks deemed necessary to prevent future impacts (e.g. overshadowing) from the growing forest canopy.
- Applicants must not remove habitats prior to submission of the afforestation application. Otherwise, the application may be refused.
- The submitted Biodiversity Map must show any proposed ABEs (i.e. environmental setbacks, future operational areas and retained habitats) as Bio Plots and as linear or point features, and state the equivalent area. The *Forestry Standards Manual* sets out the mapping requirements. It is critical that the Biodiversity Map accurately depicts all relevant environmental features and sensitivities (including biodiversity features), proposed cultivation and drainage, and the location of setbacks and other protective measures.

  (* A basic level of ecological assessment by the Registered Forester will help to identify which habitats will have the greatest biodiversity value. When identifying and mapping retained habitats, use the Level 2 (or Level 3, if possible) habitat classification in Fossitt's *A Guide to Habitats in Ireland* (2000) (PDF available at www.heritagecouncil.ie).)

2.5.4 Hedgerows

Hedgerow networks are one of the most widespread semi-natural habitats in the countryside, due to their extent, connectivity, structure and composition. In addition to their biodiversity value, hedgerows form part of the cultural and historic heritage of the country, and are important landscape features. As such, they must be regarded carefully during pre-application design and subsequent site works.

All hedgerows must be retained. In general, do not break through hedgerows during afforestation. Similarly, do not use hedgerow trees as makeshift straining posts for fencelines.

A habitat setback (5 metres minimum) should also be considered in relation to particular hedgerows onsite, to ensure their continued presence as the surrounding canopy develops. This decision should be informed by the quality of the hedgerow (in terms of its age, species composition and structure), its landscape importance, and other attributes (e.g. whether or not the hedgerow represents a townland boundary or if it is associated with another habitat such as a stream).

Other situations can arise where a hedgerow setback is desirable, e.g. to create a future wind-firm edge to enable staggered felling later, or to realise the potential role of a hedgerow as part of water management onsite.

Hedgerows with setbacks will also act as links and corridors for many species of flora and fauna between other areas of semi-natural habitat within the wider landscape. Therefore, consider applying setbacks to one or more contiguous lengths of hedgerow that run from one side of the afforestation site to the other, to promote this habitat connectivity.

2.6 Archaeology and built heritage

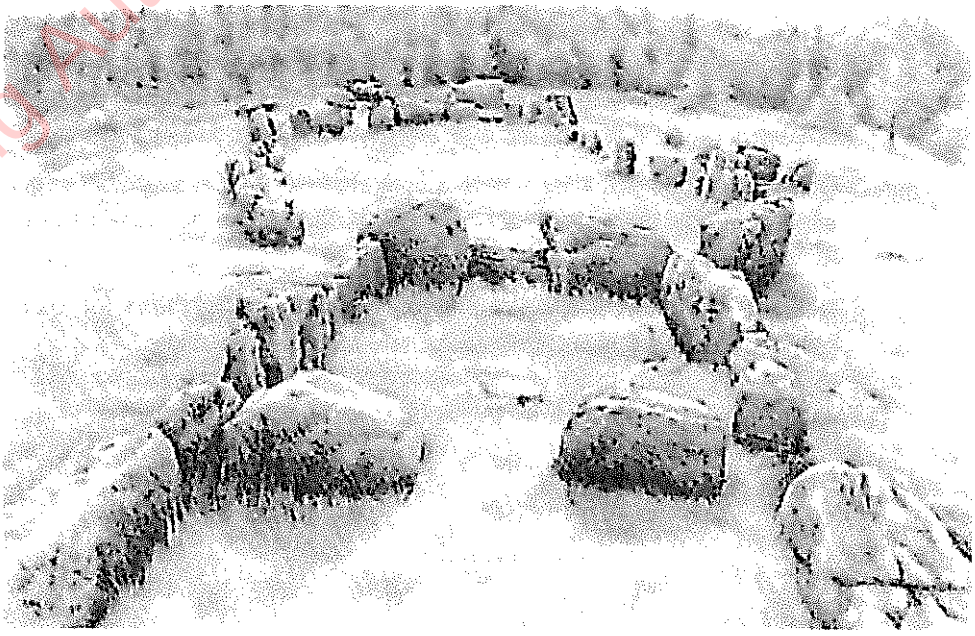
OBJECTIVES:

- **TO SEEK TO ENSURE THAT PROPOSED AFFORESTATION DEVELOPMENT PROJECTS DO NOT ADVERSELY IMPACT DIRECTLY OR INDIRECTLY ON KNOWN OR SUSPECTED ARCHAEOLOGICAL SITES AND MONUMENTS OR ON OTHER IMPORTANT BUILT HERITAGE STRUCTURES OR FEATURES. THIS INCLUDES PROTECTING THEIR AMENITIES AND WHERE RELEVANT, THEIR WIDER LANDSCAPE SETTING, IN PARTICULAR, THEIR RELATIONSHIP WITH OTHER ROUGHLY CONTEMPORARY OR DETERMINABLY LINKED SITES, MONUMENTS, STRUCTURES OR FEATURES.**
- **WHERE AFFORESTATION IS APPROVED NEAR KNOWN OR SUSPECTED ARCHAEOLOGICAL SITES AND MONUMENTS OR OTHER IMPORTANT BUILT HERITAGE STRUCTURES OR FEATURES, TO SEEK TO ENSURE THAT: (I) APPROPRIATE EXCLUSION ZONES, FENCING, ACCESS PATHS AND OTHER RELEVANT MEASURES ARE INCORPORATED INTO THE PROJECT DESIGN; (II) THERE IS AN APPROPRIATE RESPONSE SHOULD ANY PREVIOUSLY UNRECORDED ARCHAEOLOGICAL SITE, MONUMENT, OBJECT, STRUCTURE OR FEATURE BE DISCOVERED DURING SITE WORK; AND (III) ANY APPROVED DESIGN IS SYMPATHETIC TO AND PROVIDES AN APPROPRIATE VISUAL SETTING FOR SUCH SITES, MONUMENTS, STRUCTURES OR FEATURES.**

2.6.1 Potential impacts

The Irish countryside is rich in the physical remains of human activity stretching back over the millennia. These vary from the more obvious and iconic monument types such as megalithic tombs, standing stones, ringforts, crannógs, churches and graveyards, burial grounds and medieval castles, to the less well-known and less visible or entirely below-ground surface monument types such as ancient timber and gravel roadways (toghers), cooking places (fulachta fiadh) and settlement sites. All archaeological sites and monuments can have or may survive solely as associated artefacts and features. Examples include stone or metal tools, pottery sherds, post holes or refuse pits. These are often only uncovered during ploughing, drainage works, construction or turf cutting.

Archaeological sites and monuments and other important built heritage structures and features are part



A central court tomb, Magheraghanrush or Deerpark, Co. Sligo (Coillte property). (Illustration Aislinn Adams)

of our national heritage. There is a wealth of information to be gathered from such sites, monuments, structures and features, both from those which are visible above the ground and from those which have little or no surface expression. In addition to their educational value in terms of informing current and future generations and visitors about the history and development of our culture and society, they are also important recreational and tourism resources at local, regional and national levels.

2.6.2 Procedures

Land proposed for afforestation may contain or be located adjacent to archaeological sites and monuments and built heritage structures and features. For the purpose of these Requirements, these are grouped into three categories:

- **'Designated' archaeological sites and monuments**, which include those: entered onto the Record of Monuments and Places (RMP) or the Register of Historic Monuments (RHM); National Monuments in the ownership or the guardianship of the Minister for Arts, Heritage, Regional, Rural & Gaeltacht Affairs or a Local Authority; or those subject to a Preservation Order (PO) or a Temporary Preservation Order (TPO). Also included are sites and monuments newly discovered at the pre-application design stage or during the site works stage, post-approval. Examples include megalithic tombs, cairns, barrows, mounds, ringforts, enclosures, churches and graveyards, castles, tower houses and children's burial grounds.
- **'Designated' buildings and structures or parts of structures which form part of the architectural heritage and which are of special interest**, i.e. those entered onto the Record of Protected Structures (RPS) in the relevant County Development Plan or those entered into the National Inventory of Architectural Heritage (NIAH). Examples include vernacular cottages and houses, country houses and lodges, designed gardens and parklands, parish churches, historic creameries, military fortifications, mine engine houses, water mills, canals, locks and lock houses, and old school houses.
- **'Non-designated' built heritage structures**, e.g. lime kilns, sheep folds, creamery stands, stiles, townland boundaries, pumps and pump houses, mill ponds, and derelict dwellings / farm buildings.

Given the nature of afforestation (site selection, ground preparation operations, canopy development, and making provisions for future management operations), the potential for damage to our archaeological and built heritage clearly exists. For example, soil cultivation and drainage works can directly or indirectly disturb or impact both upstanding and sub-surface archaeological sites and monuments and associated features and artefacts. Even the digging of drains and sediment traps near such sites or monuments may cause organic deposits and artefacts (e.g. structural timbers, wooden artefacts or leather) preserved by anaerobic conditions to decay quicker as the soil deposit dries out. Similarly, changes caused to soil chemistry (e.g. from needle fall) may cause metal artefacts or ceramics to decay quicker.

The early identification of the nature, extent, setting, visual envelope and linkages of archaeological sites and monuments or other important built heritage structures or features, and the incorporation of these considerations both at the pre-application design stage and during site works (where afforestation is approved near known or suspected archaeological sites and monuments) will help to avoid or minimise the risk of damage.

Examples of measures to avoid, reduce or mitigate adverse impacts include:

- avoidance of areas of known or suspected elevated archaeological potential;
- incorporation of appropriate archaeological setbacks;

- access routes;
- unplanted lines of sight;
- arranging for in-works supervisory safeguards such as archaeological monitoring; and
- the sensitive design of the forest edge adjoining archaeological setbacks, to provide an appropriate setting.

The Registered Forester must identify known archaeological sites and monuments or other important built heritage structures or features, on and adjoining a site proposed for afforestation, through review of the relevant layers on iNET, and through a thorough onsite assessment.

The Forester should also utilise readily accessible sources of information. For example, the online digital service - the Historic Environment Viewer - provided by the Department of Arts, Heritage, Regional, Rural & Gaeltacht Affairs, facilitates access to the databases of the National Monuments Service (NMS) Sites and Monuments Record (SMR) and the NIAH. In addition, the RPS for each county is normally accessible on-line, and can usually be found as an appendix to the published County Development Plan. See the *Forestry Standards Manual* for further details.

Where possible, include all reference numbers (e.g. RMP number) on the Biodiversity Map submitted with the application. Doing so may expedite the Forest Service assessment of the application.

Once the various archaeological sites and monuments and other important built heritage structures or features (including those both 'designated' and 'non-designated') have been identified, the relevant minimum archaeological setbacks detailed in Section 2.8 apply, as well as any other measures proposed to address considerations such as the nature, extent, setting, visual envelope and linkages of these sites, monuments, structures or features.

2.6.3 Conditions attached to or further information required in approvals

As a general rule, the archaeological conditions that may be attached to any approval for afforestation will be taken from, but are not limited to, one or more of a tiered hierarchy of archaeological mitigation responses. These include:

- archaeological setbacks (including fenced-off exclusion zones);
- access routes;
- unplanted lines of sight;
- increasing the size of the archaeological setbacks;
- the exclusion of a larger area or areas of archaeological potential;
- archaeological monitoring of specified areas by an independent archaeological consultant retained by the Applicant or the Registered Forester;
- refusal of either part or all of the development, pending the consideration by the Forest Service and NMS of an archaeological assessment and an archaeological impact statement prepared by an independent archaeological consultant retained by the Applicant or the Registered Forester; or
- refusal after submission, where warranted due to significant adverse impacts that are evident at the very outset of the Forest Service assessment, or which become so as the assessment continues.

Note, as explained above, where it is evident to the Forest Service at the outset or where it becomes

Ogham Stone, Knickeen, Co. Wicklow (Coillte property).

evident as the assessment progresses, that a proposed development is likely to have significant adverse impacts on archaeological, historical or cultural sites or features, and which in its opinion cannot be adequately addressed by conditions based on the tiered hierarchy of archaeological mitigation responses listed above, the application may be refused entirely.

2.6.4 Archaeological finds at the pre-application design stage

Note that, during the onsite assessment or with local knowledge, the Registered Forester may also encounter a previously unrecorded archaeological site or monument at the pre-application design stage. If discovered, the location of any new or suspected new archaeological site or monument must be included on the Biodiversity Map, and a clear reference included in the map's table legend. Furthermore, a clear description must be provided in the 'Other Environmental Considerations' section of the Afforestation Application Form 1.

The Forest Service will consider such reports as part of its assessment of the application. Following referral to the NMS, it may impose one or more relevant archaeological conditions, with a default position being to favour preservation *in situ* of any new archaeological site or monument so identified (in accordance with the principles and approach as set out in Part III of *Framework and Principles for the Protection of the Archaeological Heritage* (Department of Arts, Heritage, Gaeltacht and the Islands, 1999)).

Where an archaeological object is discovered at this stage, it must by law be reported within a reasonable time period (and not longer than 96 hours) to the Garda Síochána or the National Museum of Ireland. Also, unless there is reasonable cause to believe that removal or interference is necessary to preserve it or to keep it safe, it must not be disturbed. The unsupervised recovery of archaeological objects by untrained persons can greatly diminish or entirely eliminate any knowledge or research value that might be gained from a particular discovery. It is important that, wherever possible, archaeological objects are recovered in a structured scientific manner, with careful recording made of their association with other objects, structures, features and soil layers.

(Note, see Section 3.8 for details regarding archaeological finds discovered during site works.)

2.7 Landscape

OBJECTIVE: TO ENSURE THAT THE PROPOSED FOREST IS DESIGNED SO THAT IT IS VISUALLY ACCEPTABLE AND IN KEEPING WITH LANDSCAPE AND AMENITY SENSITIVITIES.

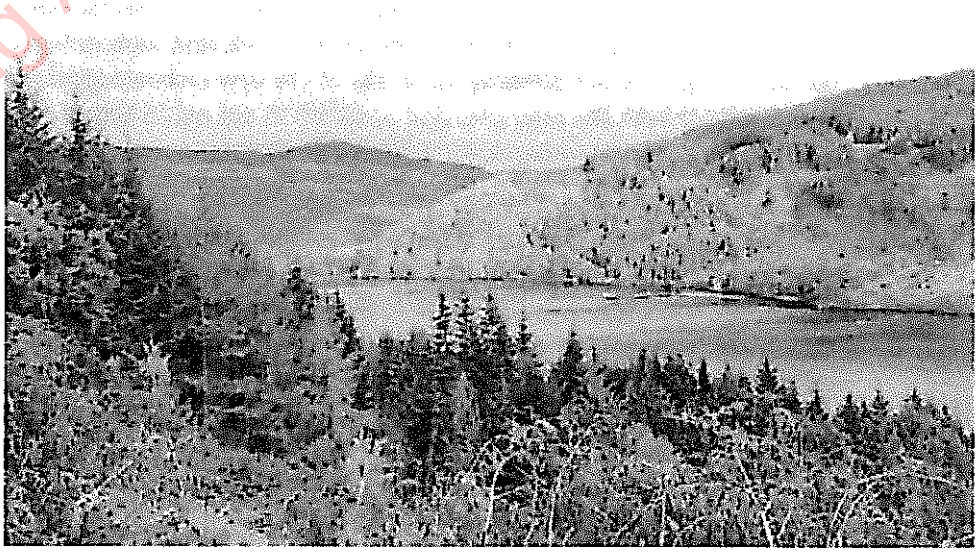
The predominantly open landscape of Ireland is a result of the progressive clearance of the natural woodland cover through the centuries, primarily for agriculture. In such an open landscape, afforestation is a major change. Registered Foresters should therefore apply attention to shape, scale, species diversity, margins, open spaces and views, to ensure that the new forest complements the character of the landscape, and to avoid intrusive and monotonous plantations. Careful design of forests at the pre-application design stage is important, as only limited improvements can be made later on.

The Registered Forester should consult with the relevant County Development Plan (both Draft and Final Plans), which will identify areas of particular landscape sensitivity and important views. The Registered Forester should also view the site from various vantage points and approaches, to identify how best to design the forest(*).

(* Within sensitive landscapes, it may be advisable for Registered Foresters to submit a series of photographs of the site, as viewed from various approach roads and local vantage points, together with an OS Discovery map indicating where each photo was taken. This will enable to Forest Service to assess how the afforestation will fit into the landscape, as viewed from these positions. Some digital cameras and smartphones have a function to take panoramic photographs, which are ideally suited for this purpose.)

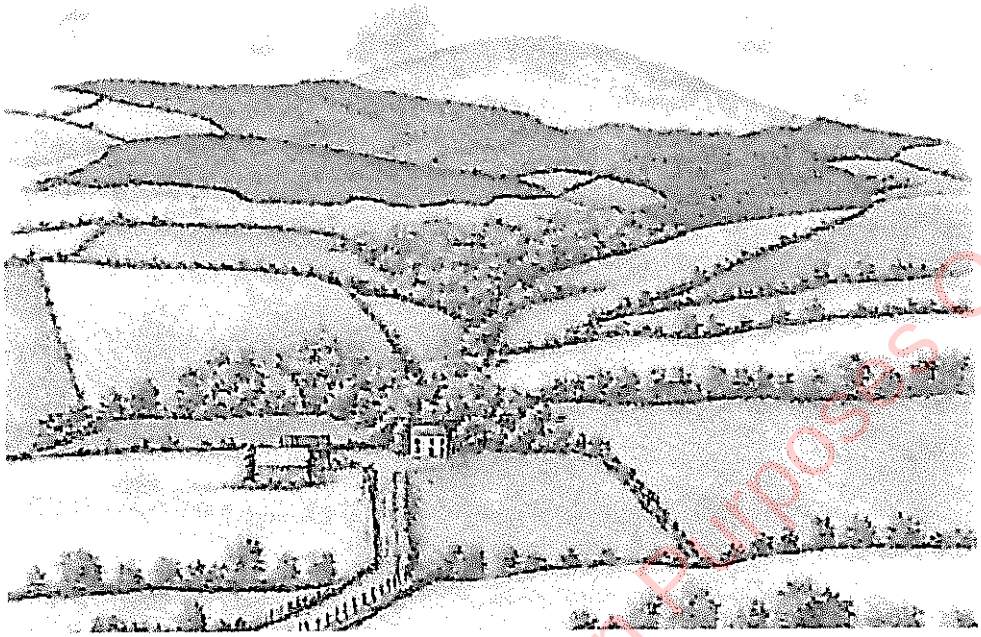
Achieving an acceptable landscape design can be a subjective exercise. However, the following measures can be applied as required, taking account of the size of the proposed plantation, its position in the landscape, and its visibility from key vantage points, near and far. For example, a plantation on a visible hillside within a sensitive landscape will require a greater degree of design compared to a plantation within a lowland area with hedgerows, where measures may be limited to well-designed setbacks adjoining dwellings and public roads.

It is important that any measure applied is done so at an appropriate scale, in order to have the desired impact.



When appropriately sited and with sensitive layout and design, new woodlands and forests make a significant contribution to the landscape. (Photo Gillian Mills)

Shape, margins and diversity are key considerations in forest landscape design. (Illustration Aislinn Adams)



2.7.1 Shape

- Shape is the dominant landscape feature. It refers to the forest outline and also to the pattern of different species within it.
- Overall straight or horizontal lines and geometric or regular shapes should be avoided, where possible. These are often imposed by property boundaries, but can be mitigated by landscape setbacks (see Section 2.8).
- The planting of single, small groups and irregular belts of native species (e.g. birch, rowan, oak and Scots pine, as site conditions allow) along the forest edge or within any environmental setback will also add visual interest – see Sections 3.5.3 and 3.5.4.
- On hillsides, planting should conform to the overall pattern in the landscape, whether natural landforms or field patterns, and follow the same rounded or irregular shapes.
- Large open landscapes are more suited to relatively large forested areas, while smaller and more regular shapes fit in better within a lowland pattern of fields and hedgerows.

2.7.2 Margins

- Avoid abrupt margins between the forest and open ground, between different species and between different Grant & Premium Category (GPC) plots.
- On sites approaching the skyline, the upper margin should be in line with the predominant landscape characteristics, be they irregular or smooth. Avoid leaving a narrow parallel band of open ground near the skyline. The open ground should reflect the scale of the hill or ridge. At lower points, planting can be carried right over the skyline.
- In upland areas, long straight vertical boundaries should be avoided. Instead, a diagonal trend should be maintained.
- Along highly visible forest margins, localised areas of spruce and pine trees towards the outer 10-15 metres of the forest can be planted at wider and irregular spacing. This measure, when

used in conjunction with forest edge planting, can promote the sense of a natural tree line, therefore softening the external margin.

- In lowland areas, straight boundaries can be acceptable where they reflect the agricultural field pattern.
- On lower margins, plantations can be blended into the agricultural landscape by introducing and extending broadleaf plots and additional broadleaves upwards in amongst conifer plots, especially following hollows in the landform.

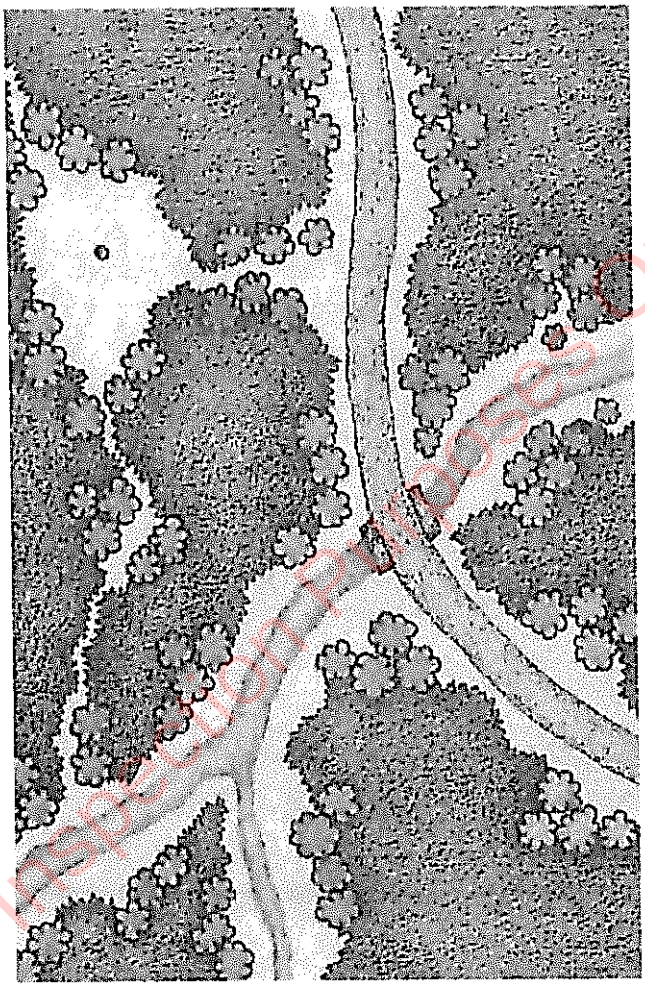
2.7.3 Diversity

- Diversity can be promoted by using a variety of species and by incorporated and reinforcing open spaces and retained habitats.
- Too much variety, however, should be avoided. It is usually desirable that one species dominates by about two-thirds.
- To be considered eligible under the Afforestation Scheme, the proposed plantation must have a minimum of 10% broadleaves, either as plots of minimum width and / or as single, small groups and irregular belts of additional broadleaves. Furthermore, each plot must comply with one of the GPCs described in the *Forestry Standards Manual*, and its corresponding requirements, including species composition.
- Promote an interlocking pattern along the margin between plots of different species. This can be achieved by extending groups and single trees of one species into the other, within the scope allowed under the GPCs involved.
- Avoid creating long rows of single species or rows or blocks of alternate species.
- Avoid species boundaries crossing the skyline.
- Plot outlines and group planting should follow ground vegetation patterns – this will help maintain a natural appearance.
- Reinforce the outline of retained woody habitats, by planting broadleaves in adjoining tongues or groups.
- The planting of single, small groups and irregular belts of native species (e.g. birch, rowan, oak and Scots pine, as site conditions allow) along the forest edge or within any environmental setback will add visual interest – see Sections 3.5.3 and 3.5.4.

2.7.4 Environmental setbacks and future operational areas

Within the overall plantation boundary, the pattern created by environmental setbacks and future operation areas must be taken into account. The layout and design of these open spaces is set out elsewhere in this document. As an overall measure, where these features intersect with each other, introduce appropriately-scaled bell mouths in order to eliminate stark junctions and corners that may be visible from outside the plantation. The use of forest edge planting and environmental setback planting (see Sections 3.5.3 and 3.5.4) can also soften harsh angles.

Integrate environmental setbacks and future operational areas, to create a more natural landscape design. (Illustration Aislinn Adams)



2.7.5 Other considerations

- Where possible, ridelines and firebreaks through forests should follow landform and make use of natural features. They should follow an irregular route that avoids dividing a plantation into equal parts, and they should not be sited at right angles or parallel to contours.
- Landscape setbacks and appropriate edge design for public roads and dwellings are important – see Section 2.8 for requirements.

2.8 Environmental setbacks

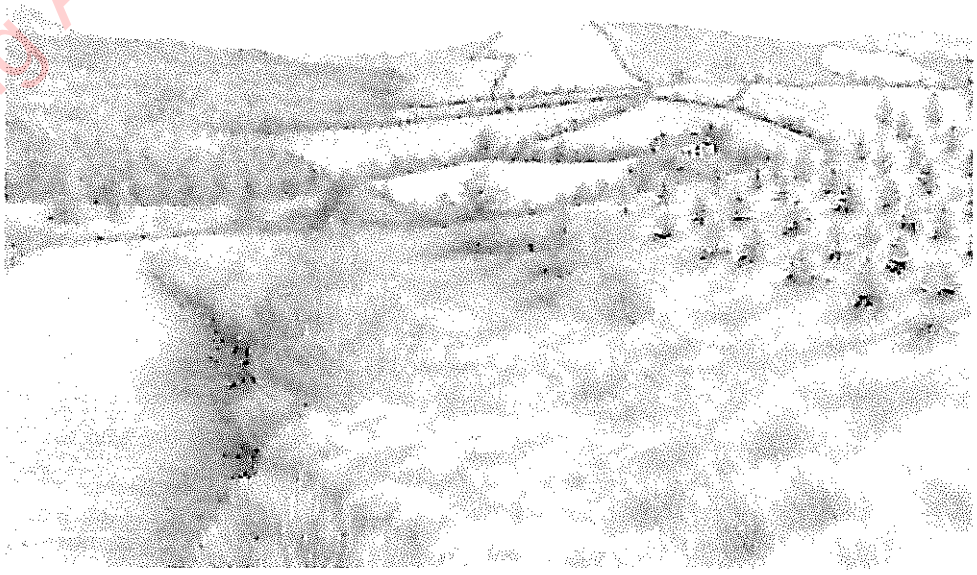
An environmental setback is a (largely) unplanted and undisturbed open space of a defined width, installed to protect a particular environmental feature or sensitivity. Different types apply, depending on the feature or sensitivity involved, i.e.

- water setback
- retained habitat setback
- archaeological setback
- public road setback
- utilised building setback
- landscape setback

Table 5 describes the minimum setback width (as measured horizontally) and setback treatment for each of the above. Note, the Forest Service may stipulate, on a site-specific basis, greater setback widths than those prescribed, or setbacks in relation to other types of features or sensitivities (e.g. swallow holes).

In all cases:

- Where different setbacks overlap, the greater setback width applies.
- The setbacks described in Table 5 are eligible as ABEs.
- In general, setbacks are to remain undisturbed at afforestation and throughout the remainder of the rotation, and allowed to develop naturally. Setbacks will typically develop a sward of natural ground vegetation accompanied over time by (potentially) pockets of native woody growth.
- The ongoing treatment of setbacks during Site Works and Ongoing Site Management are detailed in those chapters.



Water setbacks and setbacks from other environmental features and sensitivities are a key part of forest design. (Illustration Aislinn Adams)

Table 5 Environmental setback type and purpose, and corresponding minimum setback distance and additional design requirements.
Note, all setbacks are measured in metres *horizontally*.

WATER SETBACK

Purpose: To create at the outset, a buffer of natural ground vegetation positioned between defined water features and the forest crop and associated operations, in order to protect water quality and aquatic ecosystems from possible sediment and nutrient runoff from the site at afforestation and throughout the remainder of the forest rotation.

Minimum setback width, as measured from the nearest bank / edge of the water feature, as observed on-the-ground (setback applies to each side of the water feature, e.g. to both banks of an aquatic zone):

Aquatic zone (as per Table 1):

Slope leading to the aquatic zone (apply as appropriate, where slope varies over the site)	Setback width	Setback width for peat soils and for sites within the catchment area of high status objective waterbodies (see note opposite)
Moderate (even to 1-in-7 / 0-15%)	10 metre	20 metre
Steep (1-in-7 to 1-in-3 / 15-30%)	15 metre	25 metre
Very steep (1-in-3 / >30%)	20 metre	25 metre

Relevant watercourse: 5 metre

Hotspot: 5 metre

Drinking water abstraction point: 20 metre

Additional design:

- Widen the water setback at various points along its length, to include adjoining wet hollows and other low-lying areas where water gravitates towards as it drains from the land.
- Based on the immediate landform / topography, vary the setback to avoid artificial lines and to create a naturally undulating forest edge.

NOTE, if the afforestation site is within the catchment area of a high status objective waterbody, the required setback width (as per the 3rd column opposite) can be reduced by 10 metres (from the landward side) if an appropriate GPC9 or GPC10 plot is included instead of this 10 m strip. For example, where a 25 m setback applies, this can be reduced to 15 m by applying the following sequence: aquatic zone → 15 m unplanted water setback → GPC9 or GPC10 plot. Standard requirements for GPC9 & GPC10 plots apply, as per *NWS Establishment GPC9 & GPC 10: Silvicultural Standards*.

HABITAT SETBACK

Purpose: To create adequate space adjoining a retained habitat to avoid or reduce any impacts arising from the emerging forest and its canopy.

Different habitats identified as retained habitats (either as biodiversity plots or as linear or point biodiversity features) may require an unplanted habitat setback to prevent undue impact (such as shading) from the emerging forest. Setback width depends on the habitat and the potential impact(s). Apply careful design, e.g. focus the habitat setback mainly on the south-western, southern and south-eastern side of the habitat, to minimise the blockage of sunlight as the adjoining forest canopy grows. Note that the retained habitat itself must remain undisturbed (unless otherwise agreed or prescribed).

ARCHAEOLOGICAL SETBACK

Purpose: To physically separate the archaeological site or monument or other important built heritage structures or features from afforestation works, the emerging forest, and future forest operations.

Site, monument, building, structure	Minimum setback from the outermost extent of the archaeological site, monument, important built heritage structures or features, as evident onsite
'Designated' archaeological sites and monuments (see note opposite)	20 metre exclusion zone
'Designated' buildings and structures or parts thereof which form part of the architectural heritage and which are of special interest (see note opposite)	30 metre exclusion zone for upstanding structures (e.g. building) Otherwise, 20 metre exclusion zone
Non-designated built heritage structures, e.g. lime kilns, sheep folds, creamery stands, stiles, pumps and pump houses, mill ponds, and derelict dwellings / farm buildings	10 metre unplanted setback (demarcating fencing not required) Where there is a cluster of such structures (e.g. a ruined dwelling and a number of out-buildings, often enclosed in a yard or by a boundary wall), the 10 metre unplanted setback to be measured from the enclosing boundary wall, or edges of the outermost buildings. Where there are associated features such as boundary walls, mill races, or historic foot paths, 5 metre unplanted setbacks may also be applied to those features. Similarly for townland boundaries.

NOTE, for designated archaeological sites and monuments and for designated buildings and structures (as defined in Section 2.6), the following applies:

- It is essential that the full extent (i.e. the outermost extent) of these features is known, so that the exclusion zone can be correctly identified. Where there is any doubt, the Registered Forester should seek advice from the relevant designating authority or the Forest Service Archaeologist.
- The boundary of the exclusion zone must be clearly demarcated by fencing, and pedestrian access routes must also be maintained or established (see Section 3.5.1 for details).

PUBLIC ROAD SETBACK

Purpose: To ensure adequate clearance to prevent tunnelling along the public road, to retain sightlines, and to create visual diversity for road users.

Minimum setback, as measured from the surfaced edge of the public road:

10 metre (average, within any one application) (For conifer plots, note the additional requirement regarding edge planting – see Section 3.5.3.)

Additional design:

- Based on the immediate landform / topography, vary the setback to avoid artificial lines and to create a naturally undulating forest edge.
- Provisions for future extractions should be planned and associated open spaces retained along the forest edge. Retain locally important views from the public road, by introducing open spaces through the forest. Also introduce open spaces that highlight natural features visible along the roadside.
- Increase setback, where appropriate, to allow for greater visibility at bends in the road.

UTILISED BUILDING SETBACK

Purpose: To prevent encroachment and isolation, the blocking of light and the curtailment of views in relation to dwellings, associated buildings, and roofed farm buildings.

Minimum setback, as measured from the outer wall of the roofed building:

Dwelling houses:

- 60 metre minimum
- Smaller setback allowable (to a minimum of 30 metre), if written agreement of the neighbouring dweller is provided at Form 1 stage

Roofed farm buildings: 10 m

Temporary buildings (e.g. timber sheds, kennels & buildings less than 25 m^2): No setback required

Additional design:

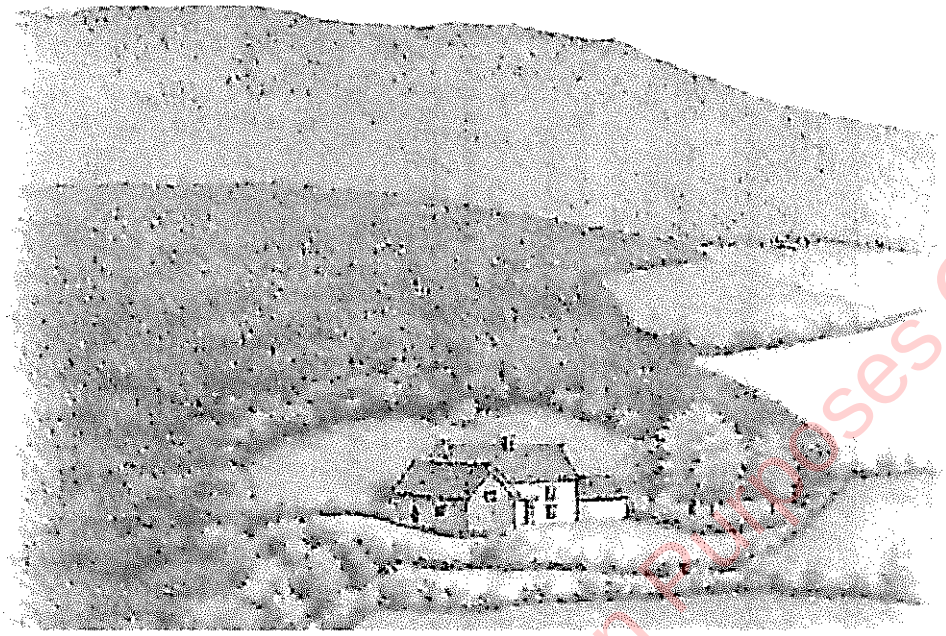
- Setback distance is most critical when a building is surrounded by forest on two or more sides.
- Based on the immediate landform / topography, vary the setback to avoid artificial lines and to create a naturally undulating forest edge.
- Consider retaining locally important views from the dwelling, by introducing open spaces through the forest. Also introduce open spaces that highlight natural features visible from the dwelling.
- In relation to setbacks from dwellings, setback planting is encouraged within the 30 m to 60 m zone, if agreed to by the neighbouring dweller.

LANDSCAPE SETBACK

Purpose: To disrupt artificially straight lines and sharp angles along other visible sections of the plantation's outer perimeter, and to create stronger visual 'tie-in' with adjoining hedgerows and other semi-natural / natural features.

Setback and design as appropriate. Will vary, depending on site details – see Section 2.7.

Appropriate setbacks from dwellings, designed with appropriate edge planting with native broadleaf species, will avoid overshadowing and a sense of isolation. (Illustration Aislinn Adams)



2.9 Future operational areas

Future operational areas are areas left unplanted in order to facilitate the future management of the plantation (e.g. a rideline) or to accommodate future infrastructure (e.g. a forest road or landing bay). In addition to their primary management function, these operational areas are also important biodiversity features in their own right, and this value can be enhanced further through simple design and additional planting. The following applies:

- Edge design should take account of good landscaping practices and the local topography. Avoid creating an unnaturally straight forest edge. Instead, taking account of the immediate landform, create a more naturally undulating edge.
- Where possible, orientate in an east-west direction, to maximise sunlight throughout the day and the seasons.

2.10 Open spaces and deer management

Forest design at afforestation should incorporate measures to facilitate future deer management. Environment setbacks and future operational areas may provide suitable open spaces to apply control, complete with appropriate shooting positions and safe back stops. However, these may need to be augmented by additional future operational areas, specifically for this purpose. Also, in the case of open spaces likely to be used for deer management purposes, avoid landscape and biodiversity planting within these spaces and along the adjoining forest edge, in order to retain clear lines of sight.

A deer hide overlooking an open space. During afforestation, incorporate features that will facilitate deer management in the future.

2.11 Site inputs

At design stage, planned site inputs such as fertilisers and herbicides should be tailored to the specific requirements of each plot. Aim to achieve successful establishment with the minimal level of artificial inputs possible.

Regarding fertilisers, phosphorus (P) is the main nutrient fertiliser applied at afforestation, with nitrogen (N) and potassium (K) occasionally applied as remedial fertilisation. Note that peat soils have a very low capacity to bind phosphorus. Slow-release formulations may be appropriate on more sensitive parts of the site.

The afforestation application must detail:

- the proposed fertiliser type and application rate; and
- the proposed method of vegetation control (including herbicide type and application rate, if applicable).

Note that further operational safeguards regarding fertiliser and herbicide application are set out in Section 3.7.

2.12 Further environmental assessment

Stage 1: Design culminates in the submission of a Form 1 for afforestation approval. This triggers the Forest Service assessment of the proposal. In some situations, the Forest Service may seek specific environmental information regarding the proposal, before it can continue with its assessment. In such cases, a request for further information will be sent to the Applicant and his / her Registered Forester.

In a minority of cases, the information sought may entail the following, which typically involve the input of a specialist:

- Ecological Report

- Archaeological Assessment / Archaeological Impact Statement
- Water Management Plan
- Visual Impact Assessment
- NATURA Impact Statement (NIS)
- Environmental Impact Statement (EIS)

See the **SUPPORTING DOCUMENT** for further details.

Section 3
Site Works

3.1 Overview

Stage 2: Site Works spans the period between the receipt of the technical approval for afforestation up to the completion of initial site works and (where grant-aided) Form 2 submission.

The technical approval will set out conditions that must be adhered to. If uncertainty exists regarding any condition, contact the Forest Service for clarity before proceeding with any work.

Note the following:

- Site works can only commence after receipt of the technical approval (note, in order to be eligible for grant aid, projects submitted under the Afforestation Scheme must await financial approval, before commencing.)
- The Registered Forester must secure written Forest Service agreement before pursing any material change to a project post-approval. Not doing so may invalidate the technical approval and the financial approval (where relevant) issued.

3.2 Site management

The Registered Forester must ensure that all operators are fully aware of, and properly implement, all relevant measures set out in these Requirements and all environmental conditions attached to the technical approval issued. This should be carried out *via* onsite management and supervision. 'Tool box' meetings are encouraged, whereby the Registered Forester reviews the various sensitivities and safeguards during an onsite meeting with the operators before operations commence.

Onsite activities should also be reviewed periodically during the site works, to ensure that related safeguards are in place and that contingency planning (see below) is functioning.

3.3 Oversight by other specialists

Conditions attached to the technical approval may stipulate the onsite presence of a specialist during site works. For example, a condition may stipulate the archaeological monitoring of specified areas. Archaeological monitoring involves having a suitably qualified archaeologist present during certain operations, or during the course of the carrying out of certain parts of approved development works, in order to identify and protect archaeological deposits, features or objects that may be uncovered or otherwise impacted by those operations. In such cases:

- an independent archaeological consultant must be retained by the Applicant or Registered Forester to carry out the monitoring;
- as set out in Section 3.8, the archaeologist will be empowered by the approval conditions to stop any works in the immediate area of any new discoveries *inter alia*, so as to ensure the timely notification of the relevant authorities, the proper recording of any exposed archaeological material, and the preservation by record or preservation *in situ* of the

elements of the archaeological heritage, as appropriate;

- there will be a condition requiring the archaeological consultant to submit a full report on the results of the archaeological monitoring (including any discoveries made and any subsequent archaeological work undertaken) to the Forest Service, the NMS and the National Museum of Ireland; and
- failure to ensure that the archaeological monitoring is undertaken during the course of the carrying out of the specified parts of approved development or to submit the required report on this monitoring before or at latest at Form 2 stage, may be deemed to be:
  - a breach of the statutory approval for afforestation; and / or
  - a breach of the specific environmental conditions attached to the approval for grant aid and may: (i) delay the progress of the Form 2 (Application for 1st Grant Instalment); and (ii) be subject to a penalty.

Sanctions may also applied, as set out in the *Terms & Conditions for the Registration of Foresters and Forestry Companies*.

3.4 Contingency measures

Ensure that an adequate contingency plan is prepared. This plan must clearly inform operators how to react and who to contact, should an unexpected event arise that may create a risk to the environment, e.g. a period of intense rainfall, an accidental spillage of chemicals, the discovery of an unidentified archaeological site, monument or object. The plan should be readily available onsite and all operators should be made familiar with its content.

The **SUPPORTING DOCUMENT** contains a template contingency plan, to be completed as relevant.

3.5 Treatment of setbacks

As set out in Stage 1: Design, the following setbacks, comprising (largely) unplanted and undisturbed open spaces of a defined width, are required to protect different environmental features and sensitivities:

- water setbacks
- retained habitat setbacks
- archaeological setbacks
- public road setbacks
- utilised building setbacks
- landscape setbacks

See Table 5 for setback widths and design details. The treatment of these setbacks during Stage 2: Site Works is set out below.

The Registered Forester must ensure that all operators are aware of the importance of any environmental setbacks required onsite, their location and extent, and what is and is not permitted within them (as per Table 6 below). An environmental setback must not be used for any forest operation or for any other purpose which could compromise its protective function or which could

damage the environmental feature or sensitivity being protected.

Under the* Forestry Schemes Penalty Schedules, *failure to adhere to the required environmental setbacks can incur significant penalties.

3.5.1 Installing environmental setbacks

It is good forest practice to mark out environmental setbacks *before* operations commence, to avoid incursions. The following guidance applies:

- Mark off the setback using temporary markers, e.g. posts or bamboos with hi-vis tape, securely driven into the soil with approximately 1.5 metres remaining visible above ground.
- Marker spacing will vary depending on setback shape, e.g. 10 metre spacing for setbacks which vary in width; 30 metre spacing for long linear setbacks.
- Linear setbacks (e.g. archaeological sight lines) can be demarcated by markers set along the centre line.
- Also use markers to indicate the position of any additional enhancement planting proposed along the forest edge or within the setback itself (see below).

Note that specific requirements apply regarding 'designated' archaeological sites and monuments and 'designated' buildings and structures or parts of structures which form part of the architectural heritage and which are of special interest:

- Unless the conditions attached to the technical approval specify otherwise, erect a permanent fence comprising two strands of plain wire on the outer edge of the archaeological / built heritage exclusion zone. Adhere to the standard Forest Service fencing specifications, including the use of IS 436 stakes (see the *Forestry Standards Manual*)(*). Note, where the outer edge of an archaeological monument / built heritage structure or feature is not evident on-the-ground, the advice of the Forest Service Archaeologist or a consultant archaeologist retained by the Applicant or her / his Registered Forester should be sought. (*This fence must be stock proof, if it represents an external boundary of the plantation.)
- Existing access routes to an archaeological site must be left unplanted and undisturbed, and must be left open for pedestrian access by archaeological officials throughout the rotation. If there is no existing access route, leave an unplanted 4 metre wide route suitable for pedestrian access from the direction of the nearest public road, forest road or track.

3.5.2 Subsequent treatment

Table 6 details what is and is not permitted within the various environmental setbacks.

Table 6 Treatment of environmental setbacks during site works. Note, if setbacks overlap, the more environmentally stringent set of requirements apply.

	Operation						
Setback type	***Forest edge planting***	***Environmental setback planting***	***Demarcation fencing with stakes and wire***	***Machine traffic***	***Cultivation / Drainage***	***Fertiliser application / Vegetation management***	***Temporary onsite storage of fertiliser, fuel, etc. associated with afforestation***
Water setback	Encouraged – see Section 3.5.3.	Encouraged – see Section 3.5.4.	Not required	Exclude	Exclude. New drains must not enter into or traverse the water setback, or discharge directly into the aquatic zone or into an existing drain (with an exception detailed in Section 3.7.1).	Permitted if required to establish setback planting, based on the following requirements: ➢ Fertiliser application limited to the manual application of an appropriate slow-release formulation into the planting pit. ➢ Regarding vegetation management, herbicide use is prohibited. Use non-herbicide methods instead, such as trampling, mulches and mats.	Exclude
Habitat setback	Encouraged – see Section 3.5.3.	Exclude	Not required	Exclude	Exclude	Exclude	Exclude
Archaeological setback	Encouraged – see Section 3.5.3.	Exclude	Required for designated archaeological features – see Section 3.5.1 for details.	Exclude	Exclude	Exclude	Exclude

Setback type	*Forest edge planting*	*Environmental setback planting*	*Demarcation fencing with stakes and wire*	*Machine traffic*	*Cultivation / Drainage*	*Fertiliser application / Vegetation management*	*Temporary onsite storage of fertiliser, fuel, etc. associated with afforestation*
Public road setback	Mandatory for roadside conifer plots – see Section 3.5.3.	Exclude	Not required	Permitted	Exlude	Exclude	Permitted, subject to safeguards under Section 3.7.5.
Utilised building setback	Mandatory for setbacks from dwellings – see Section 3.5.3.	In relation to setbacks from dwellings, setback planting is encouraged within the 30 m to 60 m zone, if agreed to by the neighbouring dweller. See Section 3.5.4.	Not required	Permitted	Exclude	Permitted if required to establish setback planting, based on the following requirements: ➢ Fertiliser application limited to the manual application of an appropriate slow-release formulation into the planting pit. ➢ Regarding vegetation management, herbicide use is prohibited. Use non-herbicide methods instead, such as trampling, mulches and mats.	Permitted, subject to safeguards under Section 3.7.5. However, if within a setback from a dwelling, exclude the preparation and storage of herbicides (and other pesticides, if used).
Landscape setback	Encouraged – see Section 3.5.3.	Encouraged – see Section 3.5.4.	Not required	Permitted	Permitted, for setback planting.	Permitted, for setback planting.	Permitted, subject to safeguards under Section 3.7.5.

3.5.3 Forest edge planting

- Forest edge planting comprises the planting of single, small groups and irregular belts of native species (e.g. birch, rowan, oak and Scots pine, as site conditions allow) along the outer edge of conifer GPC plots, typically those adjoining environmental setbacks.
- This measure enhances the landscape and biodiversity value of the forest edge.
- Forest edge planting is mandatory within conifer plots adjoining:
  - utilised building setbacks created for dwellings; and
  - public road setbacks, where the strip 10 metres to 20 metres from the road must be planted with broadleaf trees, to give a minimum two-thirds coverage within this strip.
- Forest edge planting is encouraged in relation to all other environmental setbacks, as site conditions allow - see Table 6.
- Where applied, forest edge planting must not encroach into the environmental setback itself, in order to maintain the necessary setback width. Forest edge planting forms part of the GPC plot.
- Where applied as single trees, ensure that the tree is adequately protected against grazing, using a standard tree shelter or a deer guard, as necessary.
- Where applied as groups, adopt a robust planting design using trees with compatible growth rates, planted with necessary protection against grazing. Group size may vary from 5-10 trees to 50 trees and over, depending on landscape scale. In deer-prone areas, wider spacing and the use of deer guards may be appropriate - specify details on the Certified Species Map.

3.5.4 Environmental setback planting

- Environmental setback planting comprises the planting of single, small groups and irregular belts of native species (e.g. birch, rowan, oak and Scots pine, as site conditions allow) ***within*** an environmental setback.

Forest edge planting, using deer shelters.

- This measure enhances the environmental role of the setback itself, e.g. planting within a landscape setback will create better visual 'tie-in' between the surrounding landscape and the forest edge.
- Apply environmental setback planting as per Table 6 and as site conditions allow.
- Where applied as single trees, ensure that the tree is adequately protected against grazing, using a standard tree shelter or a deer guard, as necessary.
- Where applied as groups, adopt a robust planting design using trees with compatible growth rates, planted with necessary protection against grazing. Group size may vary from 5-10 trees to 50 trees and over, depending on landscape scale. In deer-prone areas, wider spacing and the use of deer guards may be appropriate - specify details on the Certified Species Map.
- Environmental setback planting should not exceed 20% of the area of the setback.
- Note, setback planting may be counter-productive within setbacks likely to be important for deer management, as it may obstruct sight lines.
- The following applies specifically in relation to planting within water setbacks:
  - Strategic planting within water setbacks may help to deliver direct in-stream ecosystem services such as bank stabilisation, cooling / shading, and food drop into the aquatic ecosystem.
  - Pursue water setback planting only where agreed in advance with Inland Fisheries Ireland and (where relevant) NPWS.
  - Limit to single or small groups (5-10 trees) of native riparian species (birch, willow, and occasional alder and pedunculate oak) at strategic points within the water setback.
  - Such trees should be pit-planted and protected from grazing, as necessary.

3.6 Treatment of future operational areas

Treat future operational areas (as described in Section 2.5.2) as follows, to enhance their landscape and biodiversity value:

- As per good practice, mark out these areas *before* operations commence (see Section 3.5.1).
- Based on the immediate topography, vary their width to avoid artificially straight lines and to create a naturally undulating forest edge.
- Consider forest edge planting (see Section 3.5.3).

3.7 Operational safeguards

Mandatory measures to protect the environment during operations are set out below. Conditions attached to the technical approval may also contain additional measures to be adhered to. Also note Section 3.1 (regarding material changes post-approval) and Section 3.4 (regarding contingency planning).

3.7.1 Drainage and cultivation

A key requirement regarding drainage and cultivation is the protection of aquatic zones (streams, rivers and lakes) from any sediment and nutrients contained in water draining off the site, both during afforestation and throughout the remainder of the forest rotation. The following measures apply.

- Review Section 2.4.2 regarding key factors dictating selection and design.
- It is critical that water collected in drains flows slowly, both during afforestation and throughout the remainder of the rotation.
- Adhere to the overall drainage and cultivation plan approved for the project, and to the specifications set out in the *Forestry Standards Manual*.
- Select machinery based on soil, drainage and slope, to minimise the risk of rutting.
- In relation to water setbacks for aquatic zones and other water features (see Section 2.8):
    - Ensure that all new drains end in an appropriately-sized sediment trap or an interceptor drain(*) positioned *outside* of the water setback. This will allow discharged water to seep through the water setback, enabling ground vegetation to filter out sediments and nutrients.
    - Do not carry out any cultivation within the water setback itself.
    - New drains must not enter into or traverse the water setback, or discharge directly into the aquatic zone or into an existing drain(**).

  (* Interceptor drains are constructed along the outer edge of the water setback. They collect the discharge from the drained area and allow it to overflow into the water setback. See *Forestry Standards Manual* for details.)

  (** An exception applies to flat difficult-to-drain sites, where it may be necessary to link drains directly into the aquatic zone or an existing drain, provided it can be assured (based on site factors and / or sediment traps and other safeguards) that sediment and nutrients will not enter the aquatic zone. (If linking into an existing drain, the following applies: Existing drains may be 'greened over' to varying degrees, and this vegetation plays an important role in filtering out sediments and nutrients. Therefore, if the existing drain needed to be cleaned out, consider doing so in sections over several years, as opposed to a single operation.) Note, no linkage into aquatic zones and existing drains is permitted where the *Forestry & Freshwater Pearl Mussel Requirements* apply or anywhere within the Priority 8 Freshwater Pearl Mussel Catchments. This restriction may result in the site falling under the category 'Unsuitable Land Type' (see FS-DAFM *Land Types for Afforestation*) and therefore ineligible for funding under the Afforestation Scheme.)
- In general, do not carry out any drainage or cultivation within any other environmental setback. See Table 6 for details.
- Collector drains that receive water from mound drains should be no more than 80 metres apart. The angle of descent within these collector drains, as measured within the channel of the drain itself, should be no greater than 2 degrees (1-in-30). Collector drains should be excavated to a depth no more than 15 cm below the depth of the mound drains. The

Conventional mounding (left) and invert mounding for more sensitive sites (right).

intersection between mound drains and collector drains must be offset along the length of the collector drains, to ensure that individual mound drains do not continue in long unbroken runs down the slope.

- Regarding sediment traps:
  - The number, design and size of sediment traps must be sufficient to protect against the sedimentation of any receiving aquatic zone during afforestation and throughout the remainder of the forest rotation.
  - In order to capture sediment as close to the source as possible, sediment traps must be installed *throughout* the drainage network. The number of sediment traps installed must reflect the risk of sediment becoming mobilised.
  - Sediment traps are required at the end of all new drains leading to the water setback. These sediment traps must be located *outside* the water setback.
  - Sediment traps should be located on level ground (where possible) and should be rectangular in nature, with the longer side orientated parallel to the flow.
  - Sediment traps can represent a site hazard and may require specific health and safety measures such as fencing.
  - Monitor sediment traps throughout operations. If sediment traps are filling up, clear out the built-up sediment and deposit it on level ground several meters away.
- Stop all drainage and cultivation operations during periods of rainfall, in situations where rainfall level and site conditions create the risk of sediment becoming mobilised onsite. Operations can only recommence once an adequate period of time has elapsed for the risk to abate. This safeguard is triggered by tracking weather forecasts and by contingency planning.
- Where the drainage network and sediment traps are under pressure and signs of failure are evident, additional measures will be required, often in the form of additional sediment traps. In complex situations, the input of a hydrologist or an engineer may be required.

In-drain sediment trap (left) and a sediment trap adjoining a water setback (foreground) (right).

Additional safeguards include the following:

- Small dams positioned within drains and comprising timber, stone or staked geotexile, can be used to slow water flow and to encourage sediment deposition. These should have a 'V'-shape in their centre, to control the overflow of water and to prevent the scouring out of the sides of the channel during flood events.
- It may be necessary to install large settling ponds into which site drains flow. These settling ponds must be appropriately sized (i.e. sufficient to contain flow from high rainfall events), strategically located within the main body of the plantation and away from aquatic zones, and properly maintained.
- Favour plots of more species-diverse GPCs in areas adjoining water setbacks, where site conditions allow.
- Design the drainage network in a way that will eliminate or reduce water-related risks during operations later in the forest rotation, e.g. roading, thinning.
- Develop windfirm edges within the forest (e.g. using ridelines or retained hedgerows with habitat setbacks) to enable the future harvesting of smaller coupe sizes over staggered periods of time.

3.7.2 Fertiliser application

A key consideration regarding fertiliser application during site works is to eliminate the risk of run-off into receiving waters. The following apply:

- Match fertiliser type and application rate to specific plots – aim to achieve successful establishment with the minimal level of fertiliser input possible. Do not apply fertiliser if it is not needed.
- Where available, granular formulations should be used to reduce the potential for drift and wash-off into receiving waters.
- Fertiliser application is not permitted within the water setback (some exceptions apply - see Table 6) or within 20 metres of the aquatic zone, whichever is greatest. Manual fertiliser application only is permitted from this point back to 50 metres from the aquatic zone.
- In general, fertiliser application is not permitted within water setbacks or other environmental setbacks. However, some exceptions apply - see Table 6.
- Do not apply fertiliser if heavy rainfall is predicted, or during heavy rainfall and / or high winds. Following heavy rainfall, commence application only after the site has dried out sufficiently for runoff not to pose a risk.
- Apply fertiliser manually, where possible.
- Consider using alternative slow-release fertilisers in more sensitive parts of the site.

3.7.3 Vegetation management using herbicides and other methods

Vegetation management during afforestation typically involves the use of herbicide. Regarding the use of pesticides, including herbicides:

- The use of pesticides is governed by the European Communities (Sustainable Use of Pesticides) Regulations 2012 (S.I.155/2012). Users of pesticides should familiarise themselves with these Regulations and adhere to them.
- Only a registered professional user can apply pesticides authorised for professional use. A professional user is any person who applies / sprays professional use products (regardless of the quantity or method of application), including operators, technicians, employees and self-employed people, both in the farming and other sectors.
- All users of pesticide products registered for professional use must follow the principles of Good Plant Protection Practice, available for download at www.pcs.agriculture.gov.ie/sud/professionalusersprayeroperators/
- Appendix I to the above Good Plant Protection Practice document sets out general principles of integrated pest management, which all professional users are required to follow. Appendix II sets out other legal requirements relating to the safe use of plant protection products.
- Any pesticide to be used in forestry must be approved for use in Ireland. Details of approved products can be checked on the Pesticide Control Service section of the DAFM website (see www.pcs.agriculture.gov.ie).

Herbicide application within the forestry context must foll must follow the principles of Good Plant Protection Practice.

A key consideration regarding herbicide application during site works is to eliminate the risk of runoff into receiving waters. The following apply:

- Aim to achieve successful establishment with the minimal level of herbicide input possible. Do not apply herbicides if they are not required.
- Do not apply herbicide if heavy rainfall is predicted, or during heavy rainfall and / or high winds. Following heavy rainfall, only recommence application after the site has dried out sufficiently for runoff not to pose a risk.
- Fully adhere to the manufacturer's instructions and also measures set out in the Forest Service *Forest Protection Guidelines* and *Guidelines for the Use of Herbicides in Forestry*.
- Do not apply herbicides within the following areas, relying instead on non-herbicide methods such as trampling, mulches and mats:
    - within the water setback or within 20 metres of the aquatic zone, whichever is greatest;
    - within the water setback of a relevant watercourse or hotspot;
    - within specified distances from different types of water abstraction points, as prescribed by S.I.155/2012 - see Table 7;
    - within 15 metres of a landscape feature known to be a groundwater vulnerable area, including karst areas, sinkholes and collapse features; or
    - within a utilised building setback created for a dwelling.
- Herbicides are not permitted in sites within SACs and SPAs without completing a risk assessment (this may form part of a NIS, where sought). Preference should be given to low risk plant protection products or biological and cultural control measures in cases where their use is unavoidable.

Table 7 Distances from different types of water abstraction points, within which pesticide (including herbicide) application is prohibited under Schedule 2 of S.I.155/2012.

Type of abstraction point	***Prohibited distance***
Abstraction point of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme supplying 1 m^3 or less of water per day or serving 10 or less persons	5 metres
Abstraction point of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme 25 m supplying 1 - 10 m^3 of water per day or serving 10 - 50 persons	25 metres
Abstraction point of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme 100 m supplying 10 m^3 or more of water per day or serving 50 - 500 persons	100 metres
Abstraction point of any surface waters, borehole, spring or well used for the abstraction of water for human consumption in a water scheme supplying 100 m^3 or more of water per day or serving 500 or more persons	200 metres

3.7.4 Other pesticide use

Other pesticides may be needed on rare occasions within the context of afforestation. In such cases, the above requirements regarding herbicides apply at a minimum, and more stringent measures may also be required. Regarding the risk of Pine Weevil outbreak (e.g. an afforestation site adjoining a recent conifer clearfell), any necessary dipping of planting stock must be carried out off-site in the forest nursery, with onsite application permitted only in response to an ongoing outbreak. Alternative control measures are encouraged, e.g. the use of larger planting stock.

3.7.5 Preparation, storage and use of potentially hazardous material

Spillage or leakage of fertilisers, herbicides (and other pesticides), fuel and machine oils can be highly damaging to the environment, especially water. The following apply regarding these materials:

- Minimise onsite storage and preparation.
- If unavoidable, store and prepare (if relevant) at a dry, elevated location at least 50 metres from any aquatic zone and at least 20 metres from all other water features (as listed in Table 1). This also applies to all machine refuelling, maintenance and repair work.
- Do not discharge any substance into an aquatic zone, relevant watercourse or hotspot, or into any drain or sediment trap.
- Do not rinse out containers onsite.
- Do not clean equipment within 50 metre of any aquatic zone or within 20 metres of any other water feature (as listed in Table 1). All wash waters must be disposed of carefully.
- Collect and retain spent machine oil for appropriate disposal off-site.
- Remove all empty fertiliser bags, pesticide and oil containers, and all general refuse, from the site during and after site works, for appropriate disposal off-site.
- Regarding pesticides (including herbicides), adhere to the principles of Good Plant Protection Practice (see Section 3.7.3) and to relevant sections of the *Forest Protection Guidelines* and *Guidelines for the Use of Herbicides in Forestry*.

3.8 Archaeological finds discovered during site works

Previously unidentified archaeological sites or artefacts may be exposed during the course of site work, particularly during cultivation and drainage. These include artefact scatters, objects such as pottery, flint and other stone artefacts, bronze or iron tools and quern stones, as well as burials and structural features such as the foundations of buried structures or trackways. For example, the presence of a spread of black soil or charcoal and burnt and heat-shattered stone is likely to indicate the presence of a levelled cooking place (i.e. a fulacht fiadh) or other human activity in the past.

If an archaeological find is discovered, the following applies:

- The Garda Síochána, the National Museum of Ireland or the National Monuments Service must be notified immediately.
- The archaeological object(s) or feature(s) must be left undisturbed. A minimum exclusion zone 20 metres in radius centred on its location, and preferably larger, must be immediately created until the site of the find has been investigated.
- Where an archaeological object is discovered other than by a qualified archaeologist operating under an excavation licence issued by the NMS, it must be reported in the same way as described in the Section 2.6.4.
- Where feasible, all operations should be switched to some other part of the afforestation site, as far away as practically possible, until the investigation is complete.

As outlined above, clear contingency planning must be in place covering the possibility whereby an unidentified archaeological site or object is discovered during site works.

3.9 Burning

The burning of woody vegetation may occasionally be necessary to facilitate afforestation. This is normally carried out during the season prior to planting.

Note that, under the Wildlife (Amendment) Act 2000, it is an offence to cut, grub, burn or otherwise destroy, during the period 1st March to the 31st August inclusive, any vegetation growing on any land not then cultivated.

Furthermore, under no circumstances should such material be burned on or near a known or suspected archaeological site or monument or other important built heritage structure or feature or within the archaeological setback / exclusion zone, as this could cause damage to the site, monument, structure or feature as well as to underlying archaeological deposits.

For details, see the Forest Service *Prescribed Burning: Code of Practice - Ireland* (www.agriculture.gov.ie/forestservice/firemanagement/)

3.10 Form 2 submission

Where the project has received financial approval and the 1st grant instalment is being sought, the Registered Forester must walk the site within 2 months prior to submitting the relevant Form 2, and satisfy her- / himself that the plantation is compliant (*inter alia*) with all relevant measures set out in these Requirements and with all environmental conditions attached to the technical approval issued. If not, rectify any outstanding issue(s) before submitting the Form 2.

As set out in the *Forestry Standards Manual*, a subsequent Forest Service inspection may stipulate remedial works is cases where the plantation is not compliant.

Section 4
Ongoing Management

4.1 Overview

Stage 3: Ongoing Management spans the period from the completion of initial site works (and payment of the 1st grant instalment, if grant-aided) up to Year 15 (i.e. the end of the premium period, if applicable).

During this part of the forest rotation, there are generally no major site inputs required. However, basic environmental measures apply, in addition to any specific conditions attached to the original approval. Other silvicultural requirements also apply during the premium payment period, as set out in the *Forestry Standards Manual* (e.g. the maintenance of stocking levels, fence lines and fire breaks, fertiliser application) all of which must be carried out appropriately to prevent environmental impacts.

Key will be the ongoing monitoring of the site, to ensure compliance with silvicultural and environmental standards, requirements and conditions and also to check that potential threats to the environment do not emerge (particularly in relation to drains and sediment traps) and that various protective measures (principally setbacks) are functioning as intended.

4.2 Site inputs

Site inputs during Stage 3 are generally limited to the first 4 years up to submission of the Form 3 (if grant-aided). At this point, the forest should be fully established(*), with all plots having at least 90% of the original stocking spread evenly throughout the plot, with originally approved species represented proportionately, and with trees free from competing vegetation and free-growing (see the *Forestry Standards Manual*). Such inputs include herbicide application and possible fertiliser application, if nutrient deficiencies arise. Both inputs must adhere to measures set out in Sections 3.7.2 and 3.7.3 of these Requirements. (*Note, establishment may take longer on some sites.)

Regarding fertiliser application, assess exact requirements through a foliage analysis, following the procedures set out in the *Forestry Standards Manual.*

(Over larger areas, aerial fertilisation may be required. No aerial fertilisation can be undertaken unless an Aerial Fertilisation Licence as been obtained from the Forest Service. Refer to the separate *Aerial Fertilisation Requirements* for details.)

Ensure that any necessary filling-in prior to Form 3 submission reflects the diversity of the original planting, in relation to biodiversity and landscape.

4.3 Drains and sediment traps

Check drains and sediment traps regularly up to Year 4 and periodically thereafter, particularly during and after heavy rainfall, in order to assess how effectively they are working.

If sediment traps are filling up, clear out the built-up sediment and dispose of it on level ground several meters away. Where the drainage network and sediment traps are under pressure and signs of failure are evident, additional measures will be required, often in the form of additional sediment

traps. In complex situations, the input of a hydrologist or an engineer may be required.

In most cases, drains will stabilise and 'green-up' with colonising vegetation over time.

4.4 Treatment of setbacks

As set out in Stage 1: Design and Stage 2: Site Works, the following setbacks, comprising (largely) unplanted and undisturbed open spaces of a defined width, are required to protect different environmental features and sensitivities:

- water setbacks
- retained habitat setbacks
- archaeological setbacks
- public road setbacks
- utilised building setbacks
- landscape setbacks

The treatment of these setbacks during Stage 3: Ongoing Management is as follows:

1. The intended protective function of these setbacks must be maintained throughout this stage of the forest's development. This generally entails leaving these areas undisturbed and allowing natural ground vegetation to develop. Management may be required in some cases, e.g. to control woody growth within a setback adjoining a dwelling, to retain an important view or to prevent fire risk.
2. Monitor the development of forest edge planting and environmental setback planting (where undertaken) and maintain trees as appropriate (e.g. vegetation management, replacement of mortalities, adjustment and eventual removal of tree shelters) until the trees are established and free of grazing pressure.

A well-established water setback adjoining a broadleaf plot.

3. Adhere to the specifications set out in Table 6 regarding permitted operations within setbacks.
4. The type of natural vegetation that will emerge within the various setbacks will vary according to soil, elevation, aspect, grazing pressure, etc. On most sites, a mosaic of natural ground vegetation and pockets of woody growth will typically emerge throughout this stage.
5. Monitor and apply appropriate control to prevent the colonisation of setbacks by rhododendron and other exotic invasives. This requirement also applies to paths required in relation to 'designated' archaeological sites and monuments and 'designated' buildings and structures, to maintain access by archaeological officials.
6. The colonisation of the water setback with exotic invasives, in particular, Japanese knotweed, Himalayan balsam and rhododendron, is of significant concern regarding water quality. Where best practice involves herbicide use, consult with Inland Fisheries Ireland and other relevant bodies in advance. Controlling such species is difficult and expensive, and often requires a wider catchment approach for progress to be sustained.

Note, 2 and 5 above also apply to the treatment of future operational areas (see Section 2.9) during this stage of the rotation.

Inchamore Wind Farm,

Co. Cork

Appendices

Chapter 4 – Population & Human Health

May 2023

APPENDIX 4.1:

SHADOW FLICKER ASSESSMENT

Appendix 4.1a

Specimen Turbine

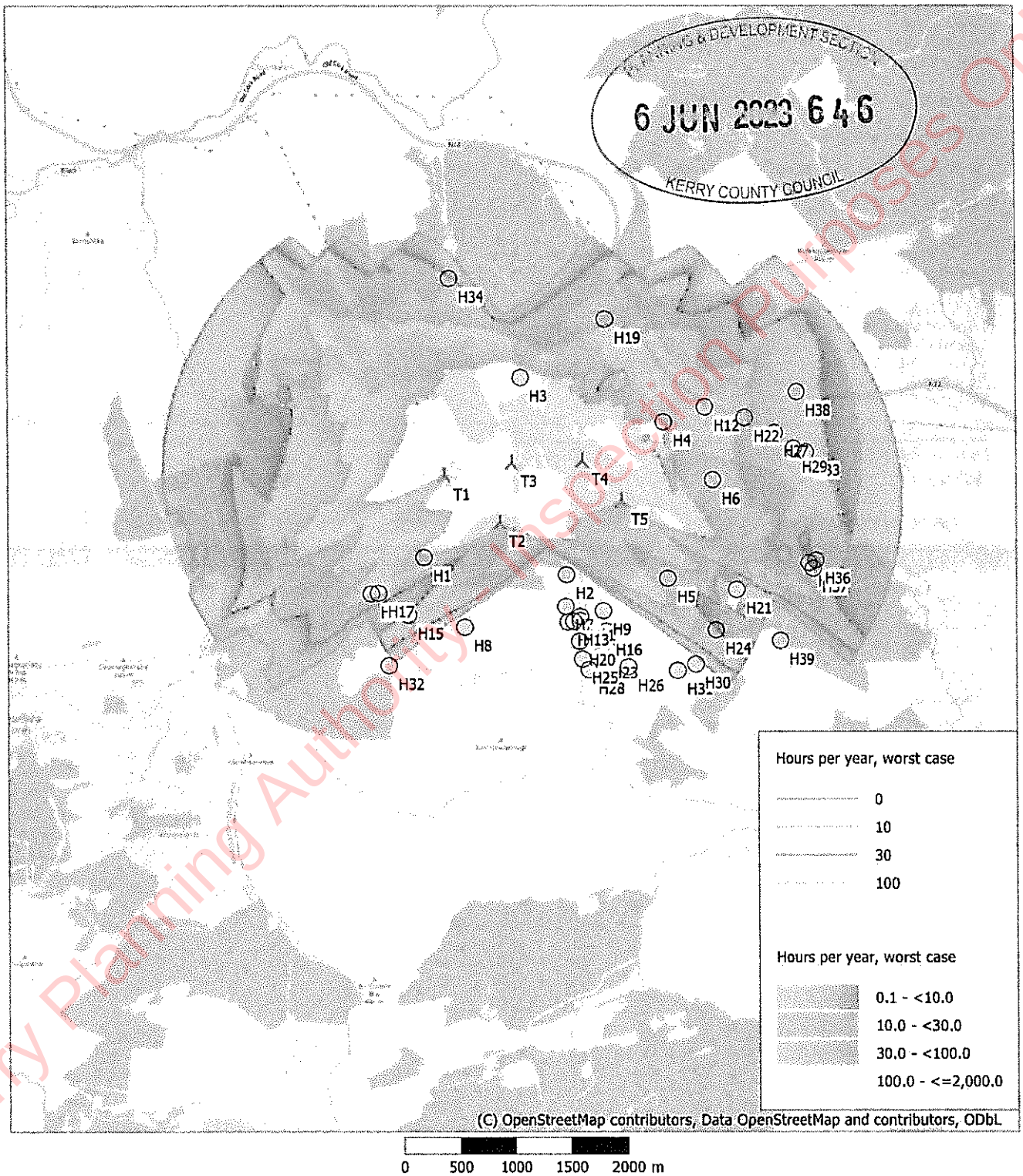
Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 15:50/3.6.355

SHADOW - Map

Calculation: Specimen Turbine Worst Case



0 500 1000 1500 2000 m

Map: EMD OpenStreetMap , Print scale 1:50,000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 512,970 North: 578,100

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg (3)

Time step: 2 minutes, Day step: 3 days, Map resolution: 10 m, Visibility resolution: 5 m, Eye height: 1.5 m

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 14:10/3.6.355

SHADOW - Main Result

Calculation: Specimen Turbine

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

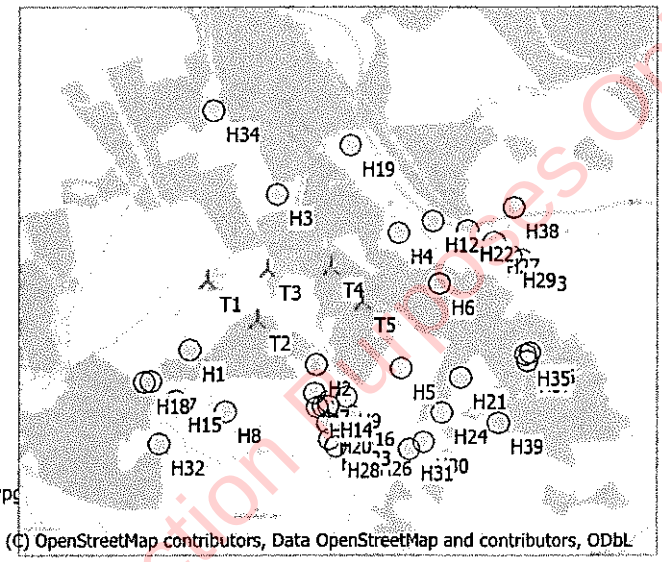
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg
Receptor grid resolution: 1.0 m

All coordinates are in
Irish ITM-IRENET95 (IE), geocentric, GRS80



Scale 1:75,000

New WTG Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	512,358	578,940	448.5	T1	No	Siemens Gamesa	SG 6.0 6600-6,600	6,600	155.0	107.5	2,500	9.3
2	513,947	578,689	369.0	T5	No	Siemens Gamesa	SG 6.0 6600-6,600	6,600	155.0	107.5	2,500	9.3
3	513,613	579,050	374.1	T4	No	Siemens Gamesa	SG 6.0 6600-6,600	6,600	155.0	107.5	2,500	9.3
4	512,852	578,514	369.6	T2	No	Siemens Gamesa	SG 6.0 6600-6,600	6,600	155.0	107.5	2,500	9.3
5	512,972	579,041	400.0	T3	No	Siemens Gamesa	SG 6.0 6600-6,600	6,600	155.0	107.5	2,500	9.3

Shadow receptor-Input

No.	Name	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	H1	512,160	578,211	346.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
B	H2	513,445	578,031	285.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
C	H3	513,072	579,801	338.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
D	H4	514,329	579,384	289.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
E	H5	514,339	577,982	318.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
F	H6	514,756	578,856	262.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
G	H7	513,435	577,744	264.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
H	H8	512,511	577,570	263.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
I	H9	513,762	577,696	259.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
J	H10	513,449	577,603	249.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
K	H11	513,566	577,655	253.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
L	H12	514,700	579,510	276.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
M	H13	513,505	577,609	248.6	2.0	2.0	0.5	90.0	"Green house mode"	2.5
N	H14	513,565	577,612	248.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
O	H15	512,009	577,691	278.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
P	H16	513,794	577,514	246.6	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Q	H17	511,756	577,894	314.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
R	H18	511,689	577,885	311.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
S	H19	513,838	580,300	300.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
T	H20	513,548	577,431	232.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
U	H21	514,950	577,873	283.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
V	H22	515,053	579,406	282.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
W	H23	513,747	577,308	221.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
X	H24	514,759	577,513	272.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Y	H25	513,572	577,269	216.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Z	H26	513,974	577,197	219.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5

To be continued on next page...

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 14:10/3.6.355

SHADOW - Main Result

Calculation: Specimen Turbine

...continued from previous page

No.	Name	Easting	Northing	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
AA	H27	515,322	579,275	275.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AB	H28	513,631	577,179	207.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AC	H29	515,488	579,130	260.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AD	H30	514,568	577,209	245.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AE	H31	514,413	577,149	233.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AF	H32	511,831	577,246	253.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AG	H33	515,603	579,094	254.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AH	H34	512,444	580,689	261.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AI	H35	515,614	578,103	249.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AJ	H36	515,672	578,122	245.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AK	H37	515,646	578,046	243.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AL	H38	515,525	579,630	278.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AM	H39	515,332	577,403	242.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5

Calculation Results

Shadow receptor

		Shadow, worst case			**Shadow, expected values**
No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
A	H1	93:18	118	1:13	18:06
B	H2	0:00	0	0:00	0:00
C	H3	121:06	98	1:42	11:51
D	H4	98:51	153	0:48	11:24
E	H5	21:15	75	0:24	4:41
F	H6	49:31	102	0:42	9:56
G	H7	0:00	0	0:00	0:00
H	H8	0:00	0	0:00	0:00
I	H9	0:00	0	0:00	0:00
J	H10	0:00	0	0:00	0:00
K	H11	0:00	0	0:00	0:00
L	H12	52:06	114	0:50	6:28
M	H13	0:00	0	0:00	0:00
N	H14	0:00	0	0:00	0:00
O	H15	12:33	57	0:18	2:25
P	H16	0:00	0	0:00	0:00
Q	H17	36:13	83	0:40	6:50
R	H18	40:24	89	0:41	7:40
S	H19	27:12	86	0:26	2:28
T	H20	0:00	0	0:00	0:00
U	H21	0:00	0	0:00	0:00
V	H22	32:34	79	0:37	4:47
W	H23	0:00	0	0:00	0:00
X	H24	10:35	46	0:18	2:16
Y	H25	0:00	0	0:00	0:00
Z	H26	0:00	0	0:00	0:00
AA	H27	18:54	59	0:27	3:01
AB	H28	0:00	0	0:00	0:00
AC	H29	14:29	52	0:22	2:27
AD	H30	0:00	0	0:00	0:00
AE	H31	0:00	0	0:00	0:00
AF	H32	0:00	0	0:00	0:00
AG	H33	12:46	50	0:21	2:12
AH	H34	10:36	40	0:19	0:58
AI	H35	10:28	37	0:21	2:19
AJ	H36	9:24	35	0:21	2:05
AK	H37	10:31	39	0:21	2:19
AL	H38	13:21	54	0:20	1:52
AM	H39	0:00	0	0:00	0:00

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 14:10/3.6.355

SHADOW - Main Result

Calculation: Specimen Turbine

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	T1	51:48	6:31
2	T5	204:51	29:03
3	T4	162:25	24:57
4	T2	108:42	21:18
5	T3	72:45	7:36

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

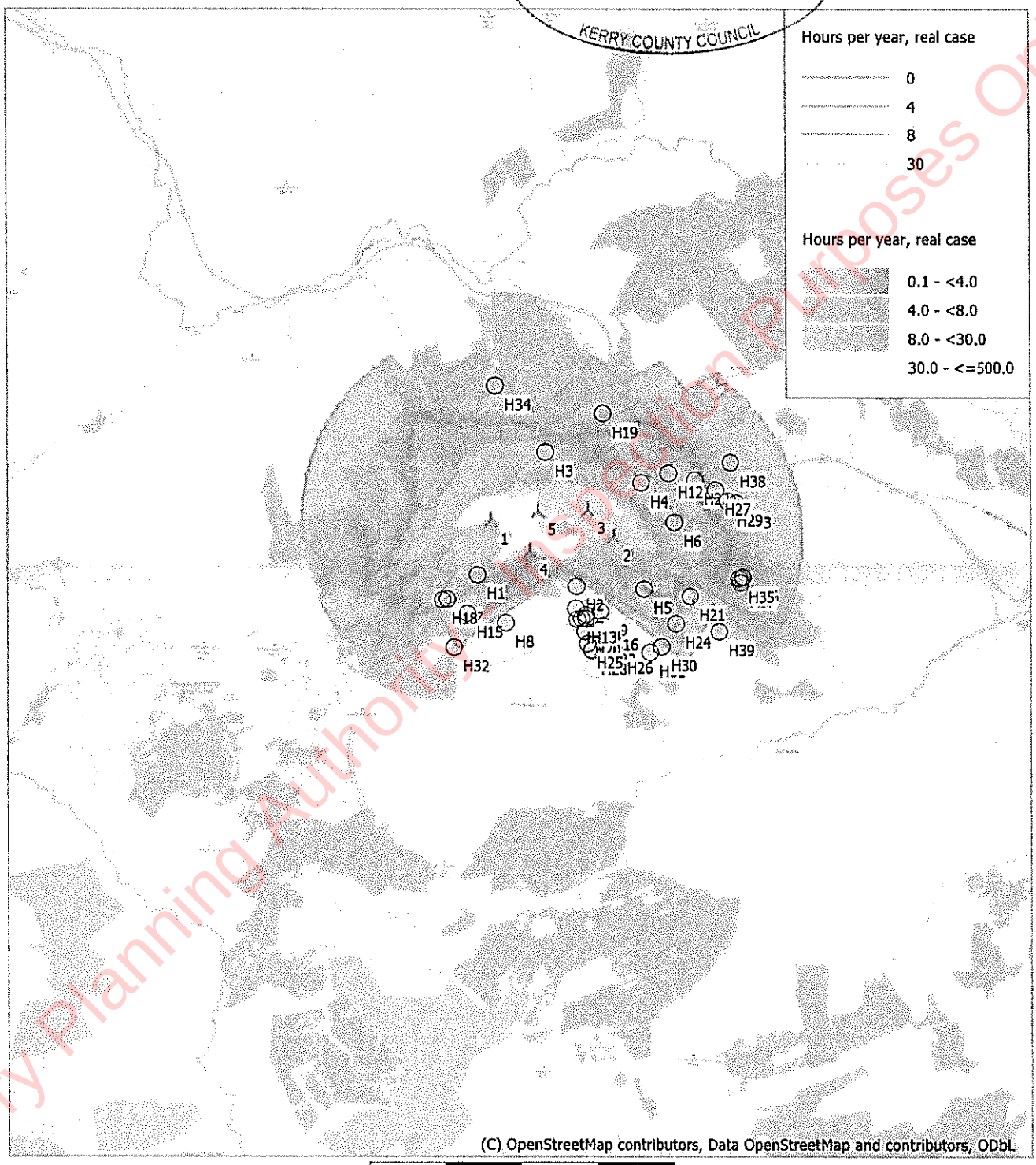
Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 14:10/3.6.355

SHADOW - Map

Calculation: Specimen Turbine



0 1 2 3 4 km

Map: EMD OpenStreetMap , Print scale 1:75,000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 512,730 North: 578,100

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg (3)

Time step: 4 minutes, Day step: 14 days, Map resolution: 30 m, Visibility resolution: 15 m, Eye height: 1.5 m

Appendix 4.1b

Scenario 1

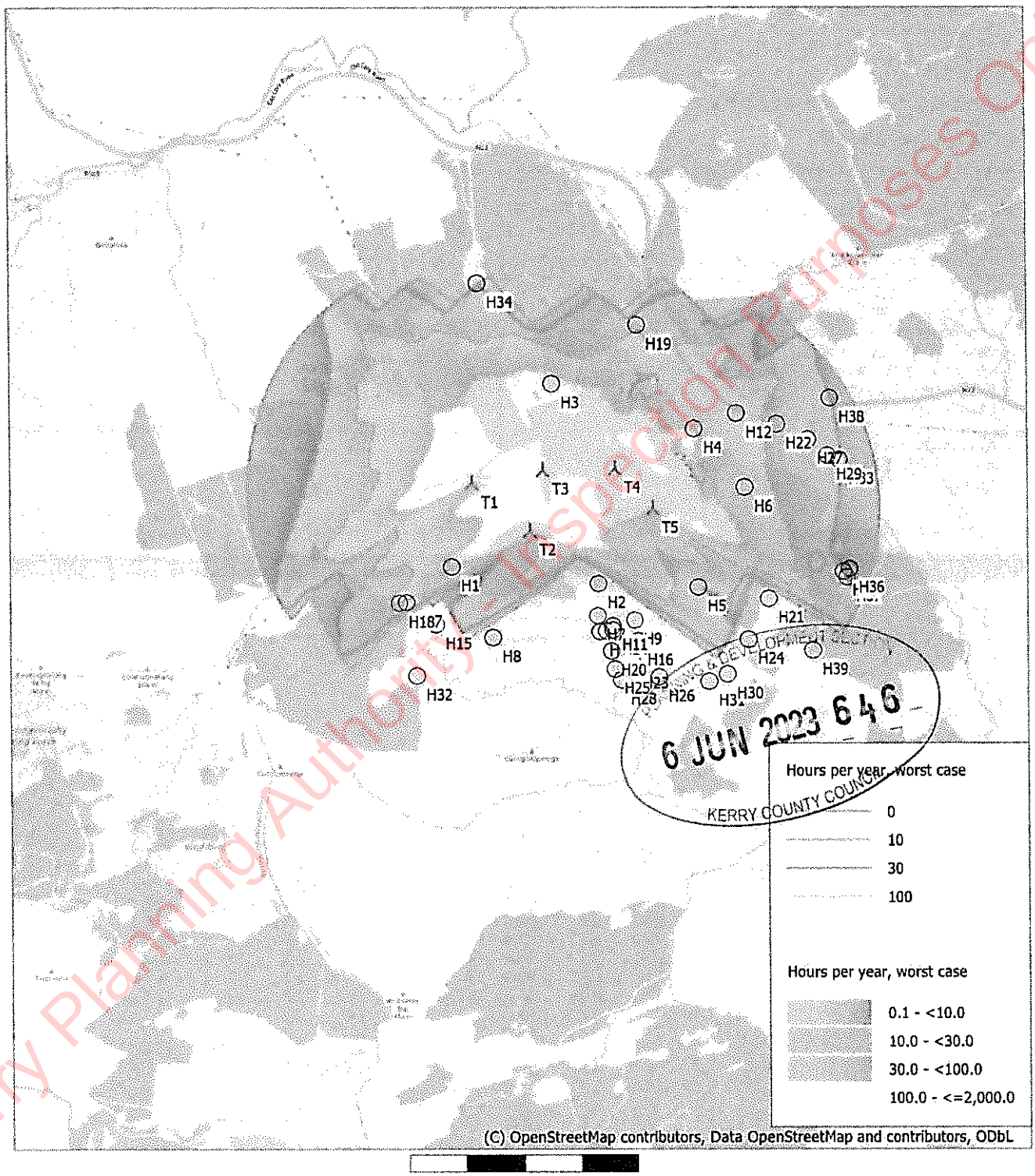
Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 15:32/3.6.355

SHADOW - Map

Calculation: Alternative Scenario 1 Worst Case



Map: EMD OpenStreetMap , Print scale 1:50,000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 512,770 North: 578,100

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg (3)

Time step: 2 minutes, Day step: 3 days, Map resolution: 10 m, Visibility resolution: 5 m, Eye height: 1.5 m

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 15:10/3.6.355

SHADOW - Main Result

Calculation: Alternative Scenario 1

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

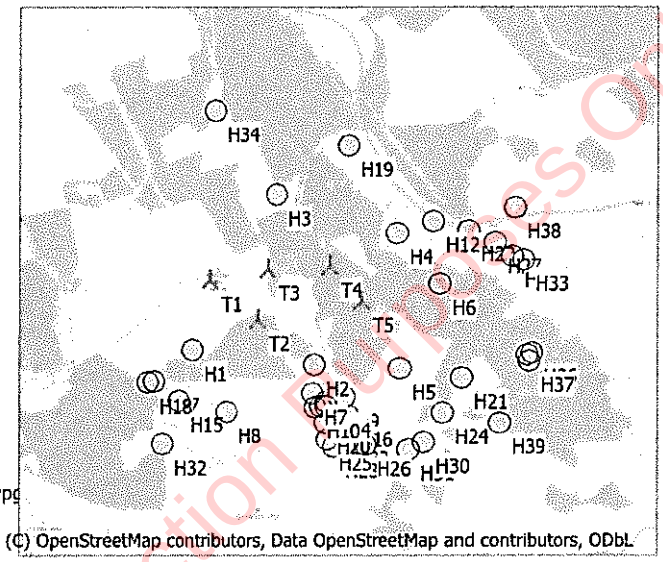
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg
Receptor grid resolution: 1.0 m

All coordinates are in
Irish ITM-IRENET95 (IE), geocentric, GRS80



Scale 1:75,000

New WTG Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	512,358	578,940	448.5	T1	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	102.5	2,007	9.3
2	513,947	578,689	369.0	T5	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	102.5	2,007	9.3
3	513,613	579,050	374.1	T4	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	102.5	2,007	9.3
4	512,852	578,514	369.6	T2	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	102.5	2,007	9.3
5	512,972	579,041	400.0	T3	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	102.5	2,007	9.3

Shadow receptor-Input

No.	Name	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	H1	512,160	578,211	346.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
B	H2	513,445	578,031	285.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
C	H3	513,072	579,801	338.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
D	H4	514,329	579,384	289.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
E	H5	514,339	577,982	318.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
F	H6	514,756	578,856	262.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
G	H7	513,435	577,744	264.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
H	H8	512,511	577,570	263.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
I	H9	513,762	577,696	259.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
J	H10	513,449	577,603	249.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
K	H11	513,566	577,655	253.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
L	H12	514,700	579,510	276.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
M	H13	513,505	577,609	248.6	2.0	2.0	0.5	90.0	"Green house mode"	2.5
N	H14	513,565	577,612	248.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
O	H15	512,009	577,691	278.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
P	H16	513,794	577,514	246.6	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Q	H17	511,756	577,894	314.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
R	H18	511,689	577,885	311.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
S	H19	513,838	580,300	300.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
T	H20	513,548	577,431	232.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
U	H21	514,950	577,873	283.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
V	H22	515,053	579,406	282.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
W	H23	513,747	577,308	221.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
X	H24	514,759	577,513	272.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Y	H25	513,572	577,269	216.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Z	H26	513,974	577,197	219.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5

To be continued on next page...

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 15:10/3.6.355

SHADOW - Main Result

Calculation: Alternative Scenario 1

...continued from previous page

No.	Name	Easting	Northing	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
AA	H27	515,322	579,275	275.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AB	H28	513,631	577,179	207.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AC	H29	515,488	579,130	260.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AD	H30	514,568	577,209	245.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AE	H31	514,413	577,149	233.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AF	H32	511,831	577,246	253.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AG	H33	515,603	579,094	254.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AH	H34	512,444	580,689	261.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AI	H35	515,614	578,103	249.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AJ	H36	515,672	578,122	245.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AK	H37	515,646	578,046	243.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AL	H38	515,525	579,630	278.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AM	H39	515,332	577,403	242.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5

Calculation Results

Shadow receptor

		Shadow, worst case			Shadow, expected values
No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
A	H1	94:17	120	1:12	18:19
B	H2	0:00	0	0:00	0:00
C	H3	118:24	96	1:42	11:31
D	H4	98:24	151	0:48	11:18
E	H5	11:50	40	0:24	2:38
F	H6	49:40	104	0:42	9:56
G	H7	0:00	0	0:00	0:00
H	H8	0:00	0	0:00	0:00
I	H9	0:00	0	0:00	0:00
J	H10	0:00	0	0:00	0:00
K	H11	0:00	0	0:00	0:00
L	H12	52:10	117	0:47	6:22
M	H13	0:00	0	0:00	0:00
N	H14	0:00	0	0:00	0:00
O	H15	0:00	0	0:00	0:00
P	H16	0:00	0	0:00	0:00
Q	H17	25:43	60	0:31	4:48
R	H18	28:30	66	0:30	5:22
S	H19	17:20	50	0:26	1:28
T	H20	0:00	0	0:00	0:00
U	H21	0:00	0	0:00	0:00
V	H22	24:26	71	0:28	3:30
W	H23	0:00	0	0:00	0:00
X	H24	0:00	0	0:00	0:00
Y	H25	0:00	0	0:00	0:00
Z	H26	0:00	0	0:00	0:00
AA	H27	17:24	59	0:25	2:44
AB	H28	0:00	0	0:00	0:00
AC	H29	14:31	54	0:22	2:26
AD	H30	0:00	0	0:00	0:00
AE	H31	0:00	0	0:00	0:00
AF	H32	0:00	0	0:00	0:00
AG	H33	12:52	50	0:22	2:13
AH	H34	0:00	0	0:00	0:00
AI	H35	10:22	38	0:21	2:18
AJ	H36	9:21	35	0:21	2:04
AK	H37	10:24	39	0:21	2:18
AL	H38	13:23	53	0:20	1:52
AM	H39	0:00	0	0:00	0:00

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 15:10/3.6.355

SHADOW - Main Result

Calculation: Alternative Scenario 1

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	T1	31:23	3:09
2	T5	187:31	25:25
3	T4	158:22	24:13
4	T2	95:52	18:49
5	T3	60:03	5:43

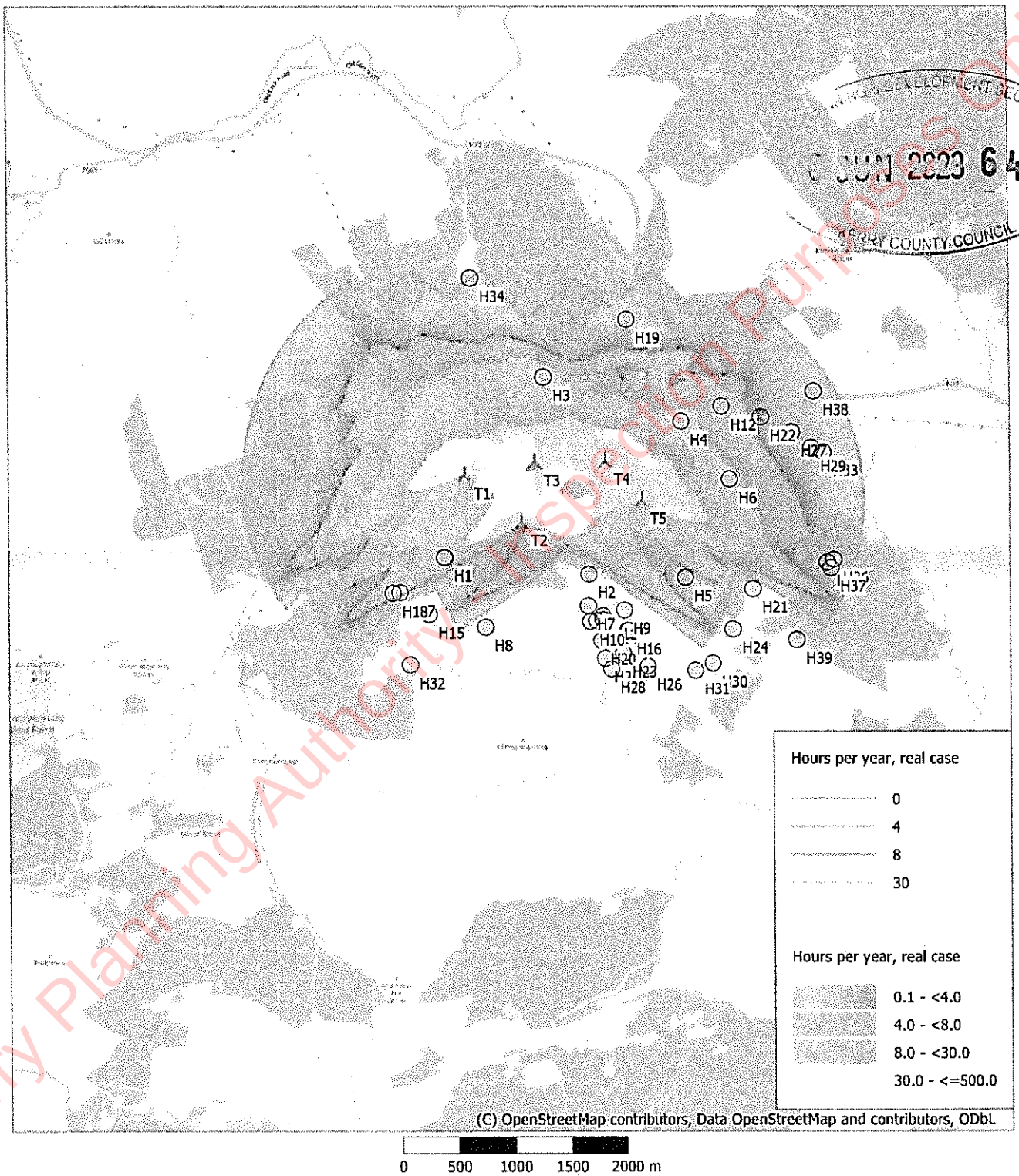
Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 15:10/3.6.355

SHADOW - Map

Calculation: Alternative Scenario 1



0 500 1000 1500 2000 m

Map: EMD OpenStreetMap , Print scale 1:50,000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 512,770 North: 578,100

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg (3)

Time step: 2 minutes, Day step: 3 days, Map resolution: 10 m, Visibility resolution: 5 m, Eye height: 1.5 m

Appendix 4.1c

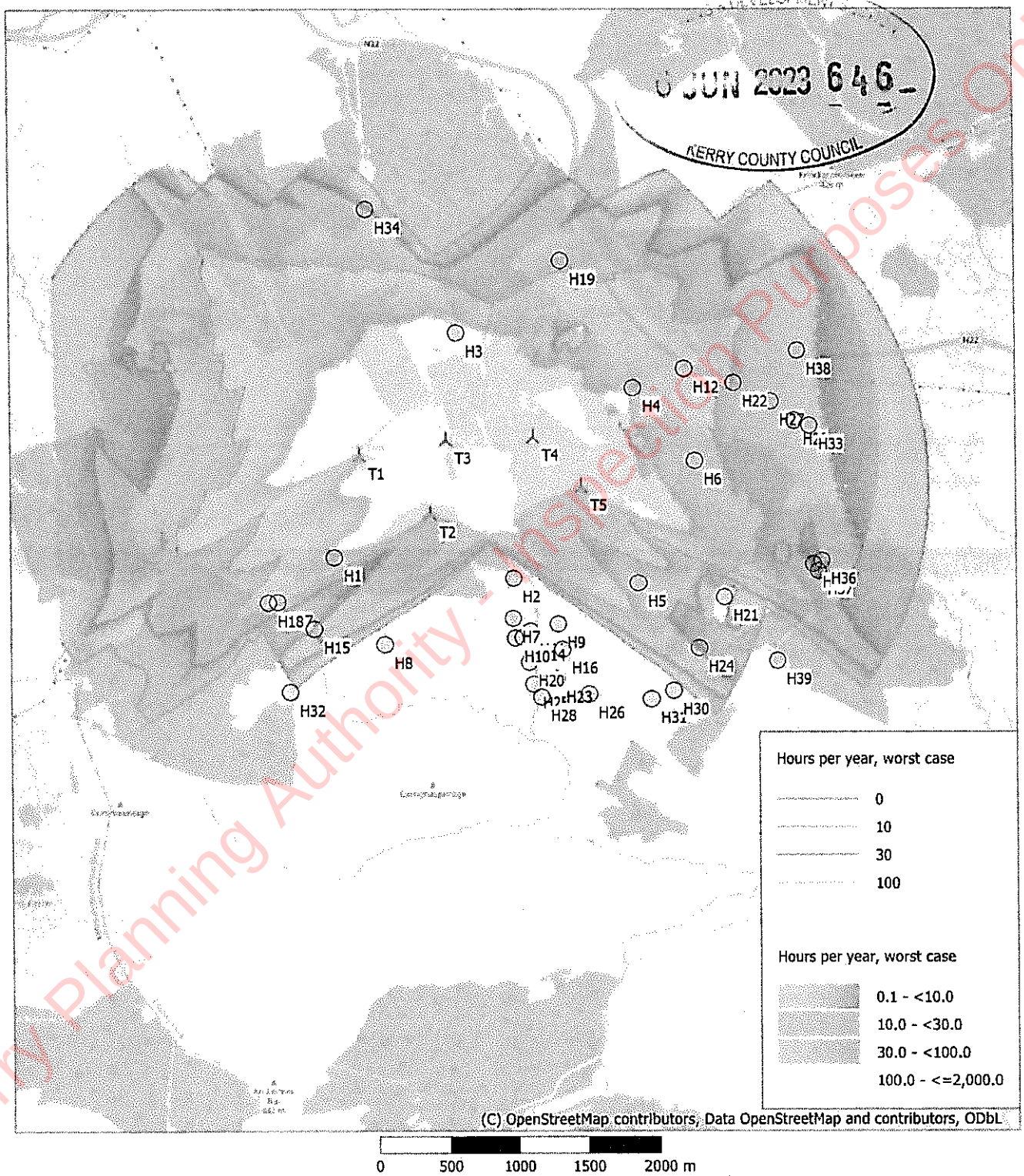
Scenario 2

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com

Calculated:
10/02/2023 15:50/3.6.355

SHADOW - Map

Calculation: Alternative Scenario 2 Worst Case



0 500 1000 1500 2000 m

Map: EMD OpenStreetMap , Print scale 1:40,000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 513,470 North: 578,100

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg (3)

Time step: 2 minutes, Day step: 3 days, Map resolution: 10 m, Visibility resolution: 5 m, Eye height: 1.5 m

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 15:11/3.6.355

SHADOW - Main Result

Calculation: Alternative Scenario 2

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

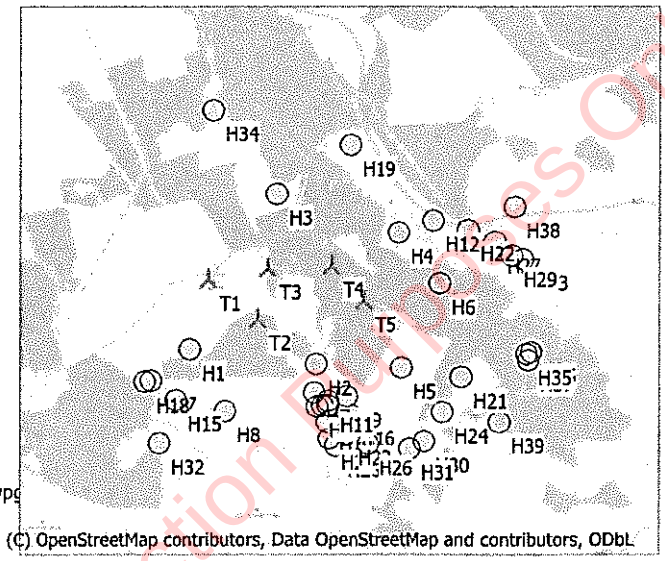
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg
Receptor grid resolution: 1.0 m

All coordinates are in
Irish ITM-IRENET95 (IE), geocentric, GRS80



Scale 1:75,000

New WTG Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	512,358	578,940	448.5	T1	No	Siemens Gamesa	GS 6.0-6,600	6,600	149.0	110.5	2,500	0.0
2	513,947	578,689	369.0	T5	No	Siemens Gamesa	GS 6.0-6,600	6,600	149.0	110.5	2,500	0.0
3	513,613	579,050	374.1	T4	No	Siemens Gamesa	GS 6.0-6,600	6,600	149.0	110.5	2,500	0.0
4	512,852	578,514	369.6	T2	No	Siemens Gamesa	GS 6.0-6,600	6,600	149.0	110.5	2,500	0.0
5	512,972	579,041	400.0	T3	No	Siemens Gamesa	GS 6.0-6,600	6,600	149.0	110.5	2,500	0.0

Shadow receptor-Input

No.	Name	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	H1	512,160	578,211	346.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
B	H2	513,445	578,031	285.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
C	H3	513,072	579,801	338.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
D	H4	514,329	579,384	289.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
E	H5	514,339	577,982	318.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
F	H6	514,756	578,856	262.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
G	H7	513,435	577,744	264.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
H	H8	512,511	577,570	263.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
I	H9	513,762	577,696	259.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
J	H10	513,449	577,603	249.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
K	H11	513,566	577,655	253.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
L	H12	514,700	579,510	276.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
M	H13	513,505	577,609	248.6	2.0	2.0	0.5	90.0	"Green house mode"	2.5
N	H14	513,565	577,612	248.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
O	H15	512,009	577,691	278.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
P	H16	513,794	577,514	246.6	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Q	H17	511,756	577,894	314.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
R	H18	511,689	577,885	311.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
S	H19	513,838	580,300	300.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
T	H20	513,548	577,431	232.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
U	H21	514,950	577,873	283.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
V	H22	515,053	579,406	282.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
W	H23	513,747	577,308	221.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
X	H24	514,759	577,513	272.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Y	H25	513,572	577,269	216.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Z	H26	513,974	577,197	219.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5

To be continued on next page...

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 15:11/3.6.355

SHADOW - Main Result

Calculation: Alternative Scenario 2

...continued from previous page

No.	Name	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
AA	H27	515,322	579,275	275.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AB	H28	513,631	577,179	207.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AC	H29	515,488	579,130	260.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AD	H30	514,568	577,209	245.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AE	H31	514,413	577,149	233.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AF	H32	511,831	577,246	253.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AG	H33	515,603	579,094	254.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AH	H34	512,444	580,689	261.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AI	H35	515,614	578,103	249.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AJ	H36	515,672	578,122	245.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AK	H37	515,646	578,046	243.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AL	H38	515,525	579,630	278.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AM	H39	515,332	577,403	242.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5

Calculation Results

Shadow receptor

		Shadow, worst case			**Shadow, expected values**
No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
A	H1	88:32	115	1:12	17:08
B	H2	0:00	0	0:00	0:00
C	H3	114:36	98	1:37	11:14
D	H4	92:49	150	0:46	10:42
E	H5	19:54	72	0:23	4:24
F	H6	45:52	98	0:41	9:13
G	H7	0:00	0	0:00	0:00
H	H8	0:00	0	0:00	0:00
I	H9	0:00	0	0:00	0:00
J	H10	0:00	0	0:00	0:00
K	H11	0:00	0	0:00	0:00
L	H12	47:39	107	0:48	5:57
M	H13	0:00	0	0:00	0:00
N	H14	0:00	0	0:00	0:00
O	H15	11:39	55	0:17	2:15
P	H16	0:00	0	0:00	0:00
Q	H17	34:23	80	0:40	6:29
R	H18	38:32	87	0:40	7:18
S	H19	25:43	84	0:25	2:19
T	H20	0:00	0	0:00	0:00
U	H21	0:00	0	0:00	0:00
V	H22	30:12	77	0:36	4:27
W	H23	0:00	0	0:00	0:00
X	H24	9:51	45	0:17	2:07
Y	H25	0:00	0	0:00	0:00
Z	H26	0:00	0	0:00	0:00
AA	H27	17:43	57	0:26	2:49
AB	H28	0:00	0	0:00	0:00
AC	H29	13:26	51	0:21	2:16
AD	H30	0:00	0	0:00	0:00
AE	H31	0:00	0	0:00	0:00
AF	H32	0:00	0	0:00	0:00
AG	H33	11:55	48	0:21	2:04
AH	H34	10:14	40	0:19	0:56
AI	H35	9:45	37	0:21	2:10
AJ	H36	8:47	34	0:20	1:57
AK	H37	9:53	38	0:20	2:11
AL	H38	12:16	50	0:19	1:43
AM	H39	0:00	0	0:00	0:00

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 15:11/3.6.355

SHADOW - Main Result

Calculation: Alternative Scenario 2

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	T1	46:59	5:59
2	T5	191:45	27:16
3	T4	153:40	23:36
4	T2	102:10	19:58
5	T3	69:58	7:16

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately.

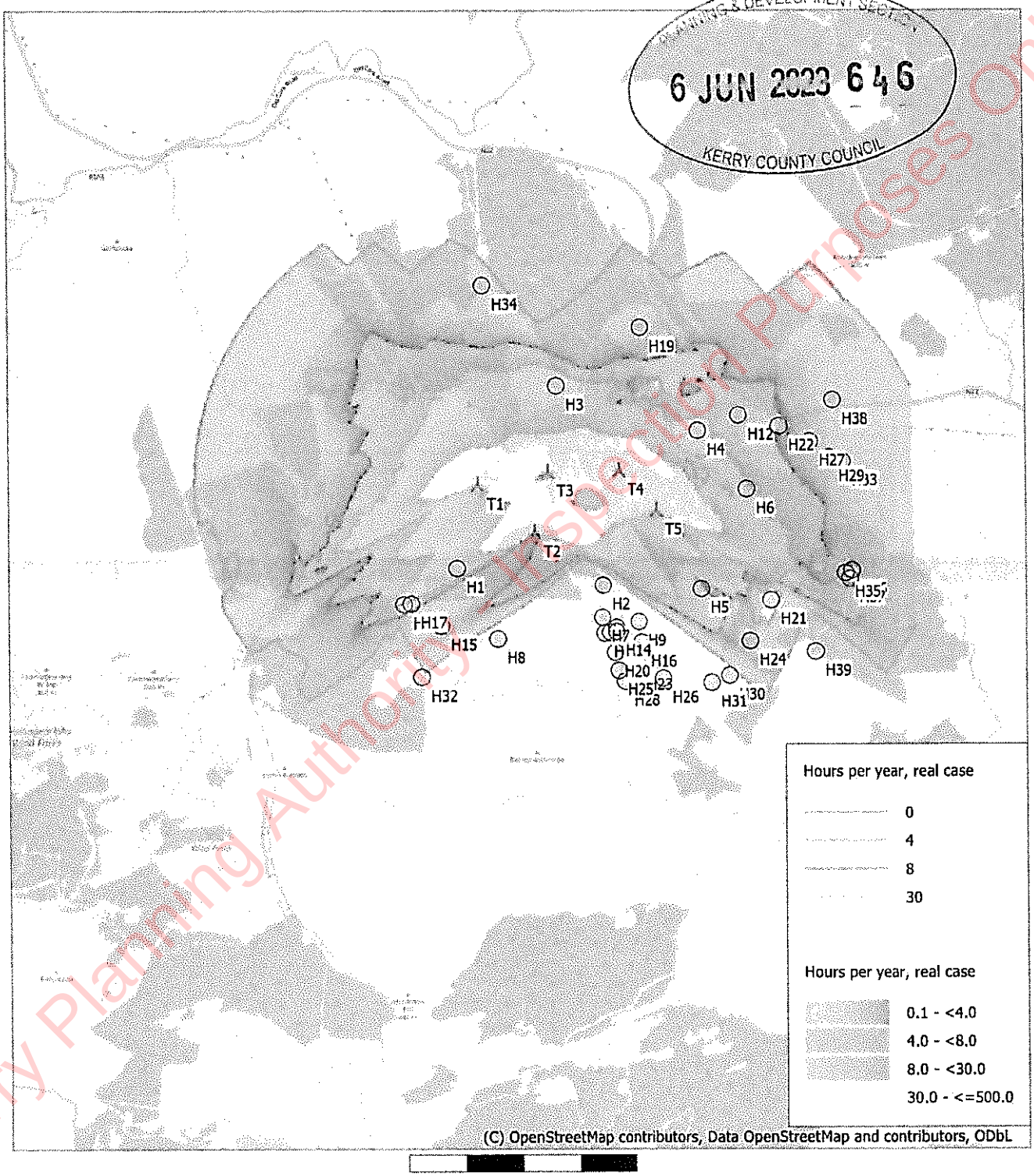
Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/02/2023 15:11/3.6.355

SHADOW - Map

Calculation: Alternative Scenario 2



0 500 1000 1500 2000 m

Map: EMD OpenStreetMap , Print scale 1:50,000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 512,720 North: 578,100

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg (3)

Time step: 2 minutes, Day step: 3 days, Map resolution: 10 m, Visibility resolution: 5 m, Eye height: 1.5 m

Appendix 4.1d

Scenario 3

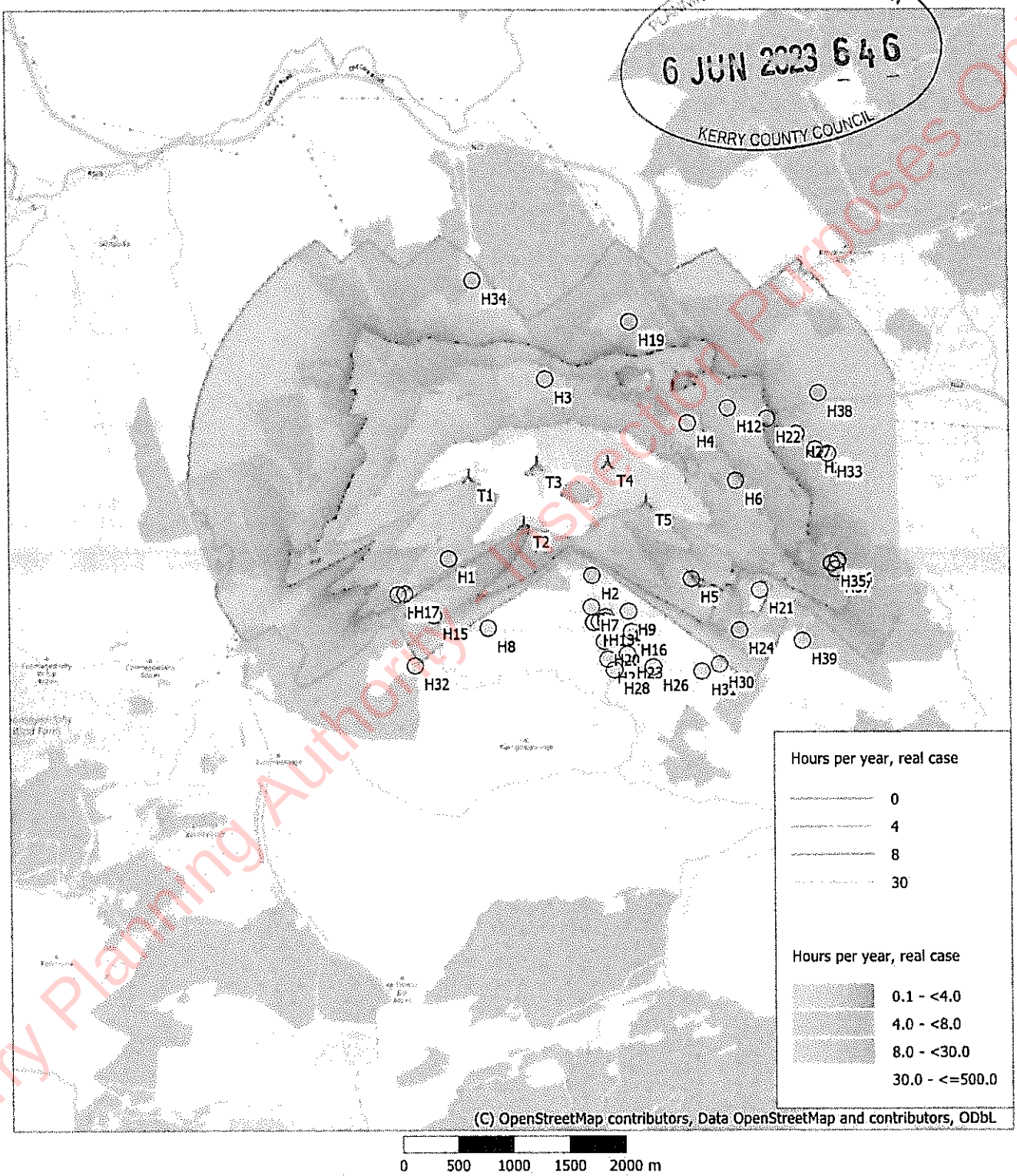
Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Map

Calculation: Alternative Scenario 3 Real Case



0 500 1000 1500 2000 m

Map: EMD OpenStreetMap , Print scale 1:50,000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 512,720 North: 578,100

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg (3)

Time step: 2 minutes, Day step: 3 days, Map resolution: 10 m, Visibility resolution: 5 m, Eye height: 1.5 m

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Main Result

Calculation: Alternative Scenario 3 Real Case

Assumptions for shadow calculations

Maximum distance for influence
Calculate only when more than 20 % of sun is covered by the blade
Please look in WTG table

Minimum sun height over horizon for influence	3 °
Day step for calculation	1 days
Time step for calculation	1 minutes

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

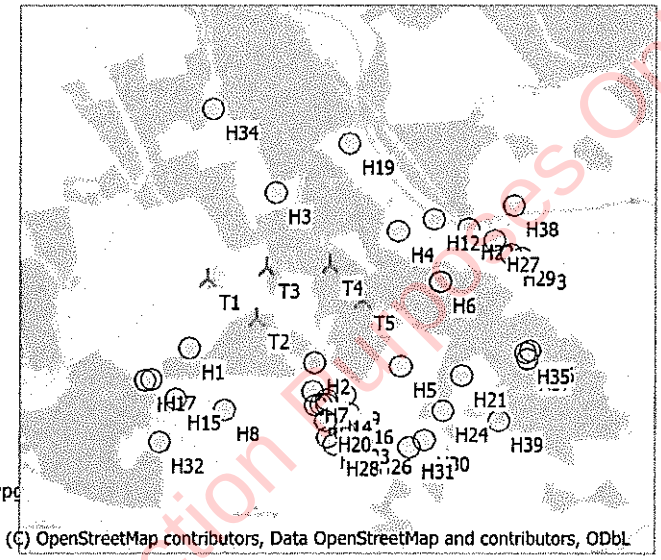
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg
Receptor grid resolution: 1.0 m

All coordinates are in
Irish ITM-IRENET95 (IE), geocentric, GRS80



Scale 1:75,000

New WTG Shadow receptor

WTGs

	Easting	Northing	Z	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Shadow data Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	512,358	578,940	448.5	T1	No	Siemens Gamesa	GS 6.0-6,600	6,600	149.0	102.5	2,500	0.0
2	513,947	578,689	369.0	T5	No	Siemens Gamesa	GS 6.0-6,600	6,600	149.0	102.5	2,500	0.0
3	513,613	579,050	374.1	T4	No	Siemens Gamesa	GS 6.0-6,600	6,600	149.0	102.5	2,500	0.0
4	512,852	578,514	369.6	T2	No	Siemens Gamesa	GS 6.0-6,600	6,600	149.0	102.5	2,500	0.0
5	512,972	579,041	400.0	T3	No	Siemens Gamesa	GS 6.0-6,600	6,600	149.0	102.5	2,500	0.0

Shadow receptor-Input

No.	Name	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
A	H1	512,160	578,211	346.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
B	H2	513,445	578,031	285.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
C	H3	513,072	579,801	338.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
D	H4	514,329	579,384	289.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
E	H5	514,339	577,982	318.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
F	H6	514,756	578,856	262.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
G	H7	513,435	577,744	264.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
H	H8	512,511	577,570	263.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
I	H9	513,762	577,696	259.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
J	H10	513,449	577,603	249.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
K	H11	513,566	577,655	253.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
L	H12	514,700	579,510	276.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
M	H13	513,505	577,609	248.6	2.0	2.0	0.5	90.0	"Green house mode"	2.5
N	H14	513,565	577,612	248.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
O	H15	512,009	577,691	278.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
P	H16	513,794	577,514	246.6	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Q	H17	511,756	577,894	314.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
R	H18	511,689	577,885	311.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
S	H19	513,838	580,300	300.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
T	H20	513,548	577,431	232.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
U	H21	514,950	577,873	283.9	2.0	2.0	0.5	90.0	"Green house mode"	2.5
V	H22	515,053	579,406	282.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
W	H23	513,747	577,308	221.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
X	H24	514,759	577,513	272.4	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Y	H25	513,572	577,269	216.5	2.0	2.0	0.5	90.0	"Green house mode"	2.5
Z	H26	513,974	577,197	219.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5

To be continued on next page...

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Main Result

Calculation: Alternative Scenario 3 Real Case

...continued from previous page

No.	Name	Easting	Northing	Z [m]	Width [m]	Height [m]	Elevation a.g.l. [m]	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
AA	H27	515,322	579,275	275.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AB	H28	513,631	577,179	207.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AC	H29	515,488	579,130	260.2	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AD	H30	514,568	577,209	245.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AE	H31	514,413	577,149	233.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AF	H32	511,831	577,246	253.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AG	H33	515,603	579,094	254.1	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AH	H34	512,444	580,689	261.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AI	H35	515,614	578,103	249.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AJ	H36	515,672	578,122	245.8	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AK	H37	515,646	578,046	243.3	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AL	H38	515,525	579,630	278.7	2.0	2.0	0.5	90.0	"Green house mode"	2.5
AM	H39	515,332	577,403	242.0	2.0	2.0	0.5	90.0	"Green house mode"	2.5

Calculation Results

Shadow receptor

		Shadow, worst case			Shadow, expected values
No.	Name	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Shadow hours per year [h/year]
A	H1	90:23	117	1:11	17:32
B	H2	0:00	0	0:00	0:00
C	H3	110:08	95	1:35	10:43
D	H4	92:31	147	0:46	10:35
E	H5	19:23	72	0:23	4:17
F	H6	45:44	98	0:41	9:07
G	H7	0:00	0	0:00	0:00
H	H8	0:00	0	0:00	0:00
I	H9	0:00	0	0:00	0:00
J	H10	0:00	0	0:00	0:00
K	H11	0:00	0	0:00	0:00
L	H12	49:03	110	0:48	6:02
M	H13	0:00	0	0:00	0:00
N	H14	0:00	0	0:00	0:00
O	H15	10:57	51	0:17	2:07
P	H16	0:00	0	0:00	0:00
Q	H17	35:23	82	0:39	6:40
R	H18	39:06	89	0:39	7:25
S	H19	24:37	84	0:24	2:13
T	H20	0:00	0	0:00	0:00
U	H21	0:00	0	0:00	0:00
V	H22	30:21	80	0:36	4:27
W	H23	0:00	0	0:00	0:00
X	H24	9:33	44	0:18	2:04
Y	H25	0:00	0	0:00	0:00
Z	H26	0:00	0	0:00	0:00
AA	H27	17:40	56	0:26	2:49
AB	H28	0:00	0	0:00	0:00
AC	H29	13:26	51	0:22	2:15
AD	H30	0:00	0	0:00	0:00
AE	H31	0:00	0	0:00	0:00
AF	H32	0:00	0	0:00	0:00
AG	H33	11:58	49	0:20	2:04
AH	H34	9:11	38	0:18	0:50
AI	H35	9:30	35	0:21	2:06
AJ	H36	8:38	34	0:20	1:55
AK	H37	9:36	37	0:20	2:07
AL	H38	12:28	53	0:20	1:45
AM	H39	0:00	0	0:00	0:00

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Main Result

Calculation: Alternative Scenario 3 Real Case

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	T1	48:44	6:04
2	T5	190:43	26:49
3	T4	151:54	23:15
4	T2	104:46	20:32
5	T3	63:32	6:38

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

The calculation of the total expected values for a given receptor assumes a weighted average directional reduction for all WTGs contributing to shadow flicker within the same day. In the case where shadow flicker from different WTGs is not concurrent within the day, the total expected time at a given receptor may deviate marginally from the individual flicker time caused by each turbine separately

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** A - H1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	06:49 (2) 05:25	05:53 (3) 05:22	05:59 (3) 05:58	06:32 (4) 06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	5 06:54 (2) 21:47 69	07:02 (4) 22:01 69	07:08 (4) 21:29 30	07:02 (4) 20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	05:52 (3) 05:22	05:59 (3) 06:00	06:33 (4) 06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48 70	07:02 (4) 22:00 69	07:08 (4) 21:27 28	07:01 (4) 20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:53 (3) 05:23	05:59 (3) 06:01	06:35 (4) 06:51	07:40	07:34	08:25
	16:39	17:28	18:20	20:13	21:04	21:49 70	07:03 (4) 22:00 70	07:09 (4) 21:25 24	06:59 (4) 20:22	19:13	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:52 (3) 05:24	05:59 (3) 06:03	06:37 (4) 06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50 71	07:03 (4) 22:00 69	07:08 (4) 21:24 20	06:57 (4) 20:20	19:10	17:06	16:29
5	08:45	08:12	07:17	07:05	06:02	05:22	05:53 (3) 05:25	05:59 (3) 06:04	06:40 (4) 06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51 70	07:03 (4) 21:59 70	07:09 (4) 21:22 14	06:54 (4) 20:18	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:53 (3) 05:25	05:59 (3) 06:06	06:56	07:45	07:40	08:29
	16:42	17:34	18:25	20:19	21:09	21:52 70	07:03 (4) 21:59 70	07:09 (4) 21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	06:34 (4) 05:20	05:54 (3) 05:26	06:00 (3) 06:08	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11 7 06:41 (4) 21:53 70		07:04 (4) 21:58 70	07:10 (4) 21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	06:29 (4) 05:20	05:53 (3) 05:27	06:00 (3) 06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:13 16 06:45 (4) 21:54 70		07:03 (4) 21:57 70	07:10 (4) 21:17	20:11	19:01	16:59	16:27
9	08:43	08:05	07:08	06:56	05:55	06:27 (4) 05:19	05:54 (3) 05:28	06:00 (3) 06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14 21 06:48 (4) 21:55 70		07:04 (4) 21:57 70	07:10 (4) 21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	06:24 (4) 05:19	05:55 (3) 05:29	06:00 (3) 06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16 26 06:50 (4) 21:55 69		07:04 (4) 21:56 70	07:10 (4) 21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	06:22 (4) 05:18	05:54 (3) 05:30	06:01 (3) 06:14	07:04	07:54	07:49	08:35
	16:49	17:43	18:34	20:27	21:17 29 06:51 (4) 21:56 70		07:04 (4) 21:55 70	07:11 (4) 21:11	20:04	18:54	16:54	16:26
12	08:42	08:00	07:01	06:50	05:50	06:21 (4) 05:18	05:55 (3) 05:31	06:02 (3) 06:15	06:57 (2) 07:06	07:56	07:51	08:36
	16:50	17:45	18:36	20:29	21:19 32 06:53 (4) 21:57 69		07:04 (4) 21:54 69	07:11 (4) 21:09 7	07:04 (2) 20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	06:19 (4) 05:18	05:55 (3) 05:32	06:03 (3) 06:17	06:55 (2) 07:07	07:57	07:52	08:37
	16:52	17:47	18:37	20:30	21:21 34 06:53 (4) 21:58 69		07:04 (4) 21:53 68	07:11 (4) 21:07 11	07:06 (2) 19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	06:19 (4) 05:18	05:56 (3) 05:34	06:04 (3) 06:19	06:53 (2) 07:09	07:59	07:54	08:38
	16:53	17:48	18:39	20:32	21:22 36 06:55 (4) 21:58 69		07:05 (4) 21:53 67	07:11 (4) 21:05 14	07:07 (2) 19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	06:18 (4) 05:17	05:56 (3) 05:35	06:05 (3) 06:20	06:52 (2) 07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24 38 06:56 (4) 21:59 68		07:05 (4) 21:52 66	07:11 (4) 21:03 16	07:08 (2) 19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	06:17 (4) 05:17	05:57 (3) 05:36	06:06 (3) 06:22	06:51 (2) 07:12	08:02	07:58	08:39
	16:56	17:52	18:42	20:36	21:25 39 06:56 (4) 21:59 67		07:05 (4) 21:51 64	07:10 (4) 21:01 17	07:08 (2) 19:52	18:43	16:46	16:25
17	08:38	07:50	06:49	06:39	05:42	06:17 (4) 05:17	05:57 (3) 05:37	06:07 (3) 06:24	06:51 (2) 07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27 40 06:57 (4) 22:00 68		07:05 (4) 21:49 62	07:10 (4) 20:59 18	07:09 (2) 19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:37	05:41	06:15 (4) 05:17	05:57 (3) 05:38	06:08 (3) 06:25	06:52 (2) 07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28 42 06:57 (4) 22:00 69		07:06 (4) 21:48 61	07:10 (4) 20:57 17	07:09 (2) 19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	06:58 (2) 05:39	06:15 (4) 05:17	05:57 (3) 05:40	06:10 (3) 06:27	06:54 (2) 07:17	08:08	08:03	08:42
	17:01	17:58	18:48	20:41 3 07:01 (2) 21:30	43 06:58 (4) 22:00 69		07:06 (4) 21:47 59	07:11 (4) 20:55 15	07:09 (2) 19:45	18:37	16:42	16:27
20	08:35	07:44	06:42	06:32	06:56 (2) 05:38	06:05 (3) 05:17	05:57 (3) 05:41	06:11 (3) 06:28	06:55 (2) 07:19	08:09	08:04	08:42
	17:03	18:00	18:49	20:42 6 07:02 (2) 21:31	47 06:59 (4) 22:01 68		07:06 (4) 21:46 56	07:10 (4) 20:53 13	07:08 (2) 19:43	18:35	16:41	16:28
21	08:33	07:42	06:40	06:30	06:54 (2) 05:37	06:04 (3) 05:17	05:58 (3) 05:42	06:12 (3) 06:30	06:57 (2) 07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44 9 07:03 (2) 21:33	50 06:59 (4) 22:01 67		07:06 (4) 21:45 55	07:10 (4) 20:51 11	07:08 (2) 19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	06:52 (2) 05:35	06:03 (3) 05:18	05:57 (3) 05:44	06:13 (3) 06:32	06:58 (2) 07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46 11 07:03 (2) 21:34	53 07:00 (4) 22:01 68		07:06 (4) 21:44 52	07:09 (4) 20:49 9	07:07 (2) 19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	06:50 (2) 05:34	06:01 (3) 05:18	05:58 (3) 05:45	06:15 (3) 06:33	07:00 (2) 07:24	08:15	08:09	08:44
	17:08	18:05	18:55	20:47 14 07:04 (2) 21:35	57 07:00 (4) 22:01 68		07:07 (4) 21:42 49	07:10 (4) 20:46 6	07:06 (2) 19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	06:48 (2) 05:33	06:00 (3) 05:18	05:58 (3) 05:46	06:16 (3) 06:35	07:02 (2) 07:25	08:17	08:11	08:44
	17:10	18:07	18:56	20:49 15 07:03 (2) 21:37	58 07:00 (4) 22:01 69		07:07 (4) 21:41 46	07:09 (4) 20:44 3	07:05 (2) 19:33	18:27	16:37	16:30
25	08:29	07:34	06:31	06:22	06:46 (2) 05:32	05:59 (3) 05:19	05:58 (3) 05:48	06:26 (4) 06:37		07:27	07:18	08:45
	17:12	18:09	18:58	20:51 17 07:03 (2) 21:38	60 07:00 (4) 22:02 69		07:07 (4) 21:39 42	07:08 (4) 20:42		19:31	17:25	16:36	16:30
26	08:27	07:32	06:29	06:20	06:44 (2) 05:31	05:58 (3) 05:19	05:59 (3) 05:49	06:27 (4) 06:38		07:29	07:20	08:14	08:45
	17:13	18:11	19:00	20:53 18 07:02 (2) 21:39	62 07:01 (4) 22:02 67		07:07 (4) 21:38 41	07:08 (4) 20:40		19:29	17:23	16:35	16:31
27	08:26	07:30	06:26	06:18	06:44 (2) 05:29	05:57 (3) 05:19	05:58 (3) 05:51	06:27 (4) 06:40		07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54 18 07:02 (2) 21:41	64 07:01 (4) 22:01 68		07:07 (4) 21:37 40	07:07 (4) 20:38		19:26	17:21	16:34	16:32
28	08:25	07:27	06:24	06:16	06:45 (2) 05:28	05:56 (3) 05:20	05:59 (3) 05:52	06:28 (4) 06:41		07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56 16 07:01 (2) 21:42	65 07:01 (4) 22:01 69		07:08 (4) 21:35 38	07:06 (4) 20:36		19:24	17:19	16:33	16:32
29	08:23		07:22	06:14	06:46 (2) 05:27	05:56 (3) 05:20	05:59 (3) 05:54	06:29 (4) 06:43		07:34	07:25	08:19	08:46
	17:19		20:05	20:58 13 06:59 (2) 21:43	66 07:02 (4) 22:01 69		07:08 (4) 21:34 37	07:06 (4) 20:33		19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	06:47 (2) 05:26	05:55 (3) 05:21	05:59 (3) 05:55	06:30 (4) 06:45		07:35	07:27	08:20	08:46
	17:21		20:07	20:59 10 06:57 (2) 21:44	67 07:02 (4) 22:01 69		07:08 (4) 21:32 35	07:05 (4) 20:31		19:19	17:15	16:31	16:34
31	08:10		07:17		05:25	05:54 (3)	05:57	06:30 (4) 06:46			07:29		08:46
	17:22		20:08		21:46 68	07:02 (4)	21:30 33	07:03 (4) 20:29			17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case				150	1125	2068	1807	273				
Sun reduction				0.35	0.37	0.30	0.27	0.30				
Oper. time red.				1.00	1.00	1.00	1.00	1.00				
Wind dir. red.				0.64	0.64	0.64	0.64	0.64				
Total reduction				0.23	0.24	0.19	0.17	0.19				
Total, real				34	265	394	307	52				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** B - H2

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
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	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
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	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
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20	08:35	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
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	17:19		20:05	20:58	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
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	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com

Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** C - H3

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January		February		March	April	May	June	July	August	September	October	November		December	
1	08:46		09:41 (3)	08:19	15:18 (1)	07:25	07:15	06:10	05:24	05:21	05:58	06:48	07:37	07:31	08:27	09:27 (3)
	16:36	80	13:28 (5)	17:24	27 15:45 (1)	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31	95 15:19 (1)
2	08:46		09:42 (3)	08:17	15:19 (1)	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23	09:28 (3)
	16:37	80	13:29 (5)	17:26	26 15:45 (1)	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30	95 15:19 (1)
3	08:45		09:43 (3)	08:16	15:21 (1)	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25	09:28 (3)
	16:38	82	15:24 (1)	17:28	23 15:44 (1)	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29	94 15:18 (1)
4	08:45		09:42 (3)	08:14	15:22 (1)	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	15:00 (1)	08:26	09:28 (3)
	16:40	89	15:27 (1)	17:30	21 15:43 (1)	18:21	20:15	21:06	21:50	22:00	21:24	20:20	19:10	17:05	4 15:04 (1)	16:29	95 15:17 (1)
5	08:45		09:43 (3)	08:12	15:24 (1)	07:16	07:05	06:02	05:21	05:24	06:04	06:54	07:44	07:38	14:56 (1)	08:27	09:29 (3)
	16:41	90	15:29 (1)	17:32	17 15:41 (1)	18:23	20:17	21:08	21:51	21:59	21:22	20:18	19:08	17:04	13 15:09 (1)	16:28	93 15:17 (1)
6	08:45		09:43 (3)	08:11	15:27 (1)	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	14:53 (1)	08:29	09:29 (3)
	16:42	93	15:30 (1)	17:33	12 15:39 (1)	18:25	20:18	21:09	21:52	21:59	21:20	20:15	19:06	17:02	18 15:11 (1)	16:28	93 15:16 (1)
7	08:44		09:44 (3)	08:09		07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	14:52 (1)	08:30	09:30 (3)
	16:43	93	15:32 (1)	17:35		18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	21 15:13 (1)	16:27	90 15:16 (1)
8	08:44		09:44 (3)	08:07		07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	14:51 (1)	08:31	09:30 (3)
	16:45	95	15:33 (1)	17:37		18:28	20:22	21:13	21:54	21:57	21:17	20:11	19:01	16:59	23 15:14 (1)	16:27	89 15:15 (1)
9	08:43		09:45 (3)	08:05		07:08	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	14:50 (1)	08:32	09:31 (3)
	16:46	94	15:35 (1)	17:39		18:30	20:24	21:14	21:55	21:57	21:15	20:08	18:59	16:57	25 15:15 (1)	16:27	83 15:13 (1)
10	08:43		09:45 (3)	08:04		07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	14:49 (1)	08:33	09:31 (3)
	16:47	95	15:36 (1)	17:41		18:32	20:25	21:16	21:55	21:56	21:13	20:05	18:57	16:55	27 15:16 (1)	16:26	80 13:18 (5)
11	08:42		09:45 (3)	08:02		07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	09:38 (3)	08:35	09:31 (3)
	16:49	95	15:37 (1)	17:43		18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	36 15:17 (1)	16:26	80 13:18 (5)
12	08:42		09:45 (3)	08:00		07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:56	07:51	09:34 (3)	08:36	09:32 (3)
	16:50	94	15:38 (1)	17:45		18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	45 15:18 (1)	16:26	81 13:19 (5)
13	08:41		09:46 (3)	07:58		06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	09:32 (3)	08:37	09:32 (3)
	16:52	93	15:39 (1)	17:46		18:37	20:30	21:21	21:58	21:53	21:07	19:59	18:50	16:51	51 15:19 (1)	16:26	82 13:20 (5)
14	08:40		09:46 (3)	07:56		06:56	06:45	05:47	05:17	05:33	06:19	07:09	07:59	07:54	09:31 (3)	08:38	09:33 (3)
	16:53	92	15:39 (1)	17:48		18:39	20:32	21:22	21:58	21:53	21:05	19:57	18:48	16:49	54 15:19 (1)	16:26	81 13:20 (5)
15	08:39		09:47 (3)	07:54		06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	09:30 (3)	08:38	09:33 (3)
	16:55	89	15:40 (1)	17:50		18:41	20:34	21:24	21:59	21:52	21:03	19:54	18:46	16:48	58 15:20 (1)	16:26	82 13:21 (5)
16	08:38		09:47 (3)	07:52		06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:58	09:29 (3)	08:39	09:34 (3)
	16:56	86	15:41 (1)	17:52		18:42	20:36	21:25	21:59	21:51	21:01	19:52	18:43	16:46	60 15:20 (1)	16:26	82 13:22 (5)
17	08:38		09:48 (3)	07:50		06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	09:28 (3)	08:40	09:35 (3)
	16:58	81	15:42 (1)	17:54		18:44	20:37	21:27	22:00	21:50	20:59	19:50	18:41	16:45	63 15:20 (1)	16:26	81 13:22 (5)
18	08:37		09:48 (3)	07:48		06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	09:27 (3)	08:41	09:36 (3)
	17:00	73	15:43 (1)	17:56		18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	65 15:20 (1)	16:27	81 13:23 (5)
19	08:36		09:49 (3)	07:46		06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	09:27 (3)	08:42	09:35 (3)
	17:01	69	15:44 (1)	17:58		18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	65 15:20 (1)	16:27	82 13:23 (5)
20	08:35		09:50 (3)	07:44		06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	09:26 (3)	08:42	09:36 (3)
	17:03	68	15:45 (1)	17:59		18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	67 15:20 (1)	16:27	82 13:24 (5)
21	08:34		09:51 (3)	07:42		06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	09:26 (3)	08:43	09:36 (3)
	17:05	67	15:45 (1)	18:01		18:51	20:44	21:33	22:01	21:45	20:51	19:40	18:33	16:40	67 15:20 (1)	16:28	82 13:24 (5)
22	08:32		09:51 (3)	07:40		06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	09:26 (3)	08:43	09:37 (3)
	17:06	67	15:45 (1)	18:03		18:53	20:46	21:34	22:01	21:44	20:49	19:38	18:31	16:39	68 15:21 (1)	16:28	82 13:25 (5)
23	08:31		09:53 (3)	07:38		06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	09:26 (3)	08:44	09:37 (3)
	17:08	65	15:46 (1)	18:05		18:55	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	69 15:21 (1)	16:29	82 13:25 (5)
24	08:30		09:53 (3)	07:36		06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	09:26 (3)	08:44	09:38 (3)
	17:10	65	15:46 (1)	18:07		18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:26	16:37	71 15:20 (1)	16:29	82 13:26 (5)
25	08:29		09:54 (3)	07:34		06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	09:26 (3)	08:45	09:39 (3)
	17:12	63	15:46 (1)	18:09		18:58	20:51	21:38	22:02	21:39	20:42	19:31	17:24	16:36	81 15:20 (1)	16:30	82 13:26 (5)
26	08:27		09:56 (3)	07:32		06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	09:26 (3)	08:45	09:39 (3)
	17:13	60	15:47 (1)	18:10		19:00	20:53	21:39	22:02	21:38	20:40	19:29	17:22	16:35	86 15:20 (1)	16:31	81 13:26 (5)
27	08:26		09:57 (3)	07:30		06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	09:27 (3)	08:45	09:39 (3)
	17:15	58	15:47 (1)	18:12		19:01	20:54	21:41	22:01	21:37	20:38	19:26	17:20	16:34	89 15:20 (1)	16:31	82 13:27 (5)
28	08:25		09:59 (3)	07:27		06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	09:26 (3)	08:45	09:39 (3)
	17:17	54	15:47 (1)	18:14		19:03	20:56	21:42	22:01	21:35	20:36	19:24	17:19	16:33	93 15:20 (1)	16:32	82 13:27 (5)
29	08:23		10:01 (3)			07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	09:27 (3)	08:46	09:40 (3)
	17:19	50	15:47 (1)			20:05	20:58	21:43	22:01	21:34	20:33	19:22	17:17	16:32	94 15:20 (1)	16:33	81 13:27 (5)
30	08:22		10:03 (3)			07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	09:26 (3)	08:46	09:40 (3)
	17:20	44	15:46 (1)			20:07	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	94 15:19 (1)	16:34	81 13:27 (5)
31	08:20		10:08 (3)			07:17		05:25		05:57	06:46		07:29			08:46	09:41 (3)
	17:22	33	15:46 (1)			20:08		21:46		21:30	20:29		17:13			16:35	80 13:28 (5)
Potential sun hours	259		278			367	416	485	499	502	454	381	331	266		244	
Total, worst case		2357		126											1507		2618
Sun reduction		0.16		0.21											0.18		0.13
Oper. time red.		1.00		1.00											1.00		1.00
Wind dir. red.		0.63		0.59											0.62		0.63
Total reduction		0.10		0.12											0.12		0.09
Total, real		231		15											174		224

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** D - H4

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January		February		March		April	May	June
1	08:46		14:15 (2)	08:19		14:31 (2)	07:25	16:37 (3)	07:15	06:10	05:24
	16:36	42	14:57 (2)	17:24	31	15:02 (2)	18:16	36	17:13 (3)	20:10	21:01	21:47
2	08:46		14:15 (2)	08:17		14:33 (2)	07:23	16:36 (3)	07:12	06:08	05:24
	16:37	43	14:58 (2)	17:26	27	15:00 (2)	18:18	38	17:14 (3)	20:12	21:03	21:48
3	08:45		14:16 (2)	08:16		14:36 (2)	07:21	16:35 (3)	07:10	06:06	05:23
	16:38	43	14:59 (2)	17:28	24	15:00 (2)	18:19	39	17:14 (3)	20:13	21:04	21:49
4	08:45		14:15 (2)	08:14		14:38 (2)	07:19	16:34 (3)	07:08	06:04	05:22
	16:40	44	14:59 (2)	17:30	19	14:57 (2)	18:21	41	17:15 (3)	20:15	21:06	21:50
5	08:45		14:16 (2)	08:12		14:42 (2)	07:16	16:34 (3)	07:05	06:02	05:21
	16:41	44	15:00 (2)	17:32	12	14:54 (2)	18:23	41	17:15 (3)	20:17	21:08	21:51
6	08:45		14:16 (2)	08:11			07:14	16:32 (3)	07:03	06:00	05:21
	16:42	44	15:00 (2)	17:33			18:25	43	17:15 (3)	20:18	21:09	21:52
7	08:44		14:17 (2)	08:09			07:12	16:32 (3)	07:01	05:59	05:20
	16:43	44	15:01 (2)	17:35			18:27	43	17:15 (3)	20:20	21:11	21:53
8	08:44		14:17 (2)	08:07			07:10	16:32 (3)	06:59	05:57	05:20
	16:45	44	15:01 (2)	17:37			18:28	43	17:15 (3)	20:22	21:12	21:54
9	08:43		14:17 (2)	08:05			07:07	16:32 (3)	06:56	05:55	05:19
	16:46	44	15:01 (2)	17:39			18:30	43	17:15 (3)	20:24	21:14	21:55
10	08:43		14:18 (2)	08:04			07:05	16:32 (3)	06:54	05:53	05:19
	16:47	44	15:02 (2)	17:41			18:32	42	17:14 (3)	20:25	21:16	21:55
11	08:42		14:18 (2)	08:02			07:03	16:32 (3)	06:52	05:52	05:18
	16:49	45	15:03 (2)	17:43			18:34	42	17:14 (3)	20:27	21:17	21:56
12	08:42		14:18 (2)	08:00			07:01	16:33 (3)	06:50	05:50	05:18
	16:50	45	15:03 (2)	17:45			18:35	41	17:14 (3)	20:29	21:19	21:57
13	08:41		14:18 (2)	07:58			06:58	16:32 (3)	06:47	05:48	05:18
	16:52	45	15:03 (2)	17:46			18:37	40	17:12 (3)	20:30	21:20	21:57
14	08:40		14:18 (2)	07:56			06:56	16:33 (3)	06:45	05:47	05:17
	16:53	46	15:04 (2)	17:48			18:39	39	17:12 (3)	20:32	21:22	21:58
15	08:39		14:18 (2)	07:54			06:54	16:34 (3)	06:43	05:45	05:17
	16:55	46	15:04 (2)	17:50			18:41	37	17:11 (3)	20:34	21:24	21:59
16	08:38		14:19 (2)	07:52			06:51	16:34 (3)	06:41	05:44	05:17
	16:56	46	15:05 (2)	17:52			18:42	35	17:09 (3)	20:35	21:25	21:59
17	08:38		14:19 (2)	07:50			06:49	16:36 (3)	06:39	05:42	05:17
	16:58	46	15:05 (2)	17:54			18:44	32	17:08 (3)	20:37	21:27	22:00
18	08:37		14:20 (2)	07:48			06:47	16:37 (3)	06:36	05:41	05:17
	17:00	45	15:05 (2)	17:56			18:46	29	17:06 (3)	20:39	21:28	22:00
19	08:36		14:20 (2)	07:46			06:45	16:39 (3)	06:34	05:39	05:17
	17:01	46	15:06 (2)	17:58			18:48	25	17:04 (3)	20:41	21:30	22:00
20	08:35		14:21 (2)	07:44			06:42	16:41 (3)	06:32	05:38	05:17
	17:03	45	15:06 (2)	17:59			18:49	20	17:01 (3)	20:42	21:31	22:01
21	08:33		14:21 (2)	07:42			06:40	16:45 (3)	06:30	05:36	05:17
	17:05	45	15:06 (2)	18:01			18:51	13	16:58 (3)	20:44	21:32	22:01
22	08:32		14:22 (2)	07:40			06:38			06:28	05:35	05:17
	17:06	44	15:06 (2)	18:03			18:53			20:46	21:34	22:01
23	08:31		14:23 (2)	07:38		16:50 (3)	06:35			06:26	05:34	05:18
	17:08	43	15:06 (2)	18:05	12	17:02 (3)	18:54			20:47	21:35	22:01
24	08:30		14:23 (2)	07:36		16:46 (3)	06:33			06:24	05:33	05:18
	17:10	43	15:06 (2)	18:07	19	17:05 (3)	18:56			20:49	21:37	22:01
25	08:29		14:24 (2)	07:34		16:44 (3)	06:31			06:22	05:31	05:18
	17:11	42	15:06 (2)	18:09	24	17:08 (3)	18:58			20:51	21:38	22:01
26	08:27		14:25 (2)	07:32		16:41 (3)	06:28			06:20	05:30	05:19
	17:13	41	15:06 (2)	18:10	28	17:09 (3)	19:00			20:52	21:39	22:01
27	08:26		14:25 (2)	07:30		16:39 (3)	06:26			06:18	05:29	05:19
	17:15	40	15:05 (2)	18:12	32	17:11 (3)	19:01			20:54	21:41	22:01
28	08:25		14:26 (2)	07:27		16:38 (3)	06:24			06:16	05:28	05:20
	17:17	38	15:04 (2)	18:14	34	17:12 (3)	19:03			20:56	21:42	22:01
29	08:23		14:27 (2)				07:21			06:14	05:27	05:20
	17:19	38	15:05 (2)				20:05			20:58	21:43	22:01
30	08:22		14:28 (2)				07:19			06:12	05:26	05:21
	17:20	36	15:04 (2)				20:06			20:59	21:44	22:01
31	08:20		14:30 (2)				07:17				05:25	
	17:22	33	15:03 (2)				20:08				21:46	
Potential sun hours	259			278			367		416	485	499	
Total, worst case		1334			262			762				
Sun reduction		0.16			0.21			0.24				
Oper. time red.		1.00			1.00			1.00				
Wind dir. red.		0.60			0.62			0.64				
Total reduction		0.09			0.13			0.15				
Total, real		125			33			118				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com

Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** D - H4

Assumptions for shadow calculations

Sunshine probability (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	July	August	September			October		November			December		
1	05:21	05:58	06:48			07:37		17:12 (3)	07:31		08:22		14:00 (2)
	22:01	21:29	20:27			19:17	40	17:52 (3)	17:11		16:30	45	14:45 (2)
2	05:22	06:00	06:49			07:39		17:11 (3)	07:33		08:23		14:00 (2)
	22:00	21:27	20:24			19:15	42	17:53 (3)	17:09		16:30	45	14:45 (2)
3	05:23	06:01	06:51			07:40		17:10 (3)	07:34		08:25		14:01 (2)
	22:00	21:25	20:22			19:12	42	17:52 (3)	17:07		16:29	44	14:45 (2)
4	05:24	06:03	06:53			07:42		17:09 (3)	07:36		08:26		14:01 (2)
	22:00	21:24	20:20			19:10	43	17:52 (3)	17:05		16:29	44	14:45 (2)
5	05:24	06:04	06:54			07:44		17:09 (3)	07:38		08:27		14:02 (2)
	21:59	21:22	20:17			19:08	43	17:52 (3)	17:04		16:28	44	14:46 (2)
6	05:25	06:06	06:56			07:45		17:08 (3)	07:40	14:11 (2)	08:29		14:02 (2)
	21:59	21:20	20:15			19:06	43	17:51 (3)	17:02	14:24 (2)	16:28	44	14:46 (2)
7	05:26	06:07	06:58			07:47		17:08 (3)	07:42	14:08 (2)	08:30		14:02 (2)
	21:58	21:18	20:13			19:03	43	17:51 (3)	17:00	14:27 (2)	16:27	44	14:46 (2)
8	05:27	06:09	06:59			07:49		17:09 (3)	07:43	14:05 (2)	08:31		14:04 (2)
	21:57	21:16	20:11			19:01	41	17:50 (3)	16:58	14:30 (2)	16:27	43	14:47 (2)
9	05:28	06:11	07:01			07:50		17:09 (3)	07:45	14:03 (2)	08:32		14:04 (2)
	21:57	21:15	20:08			18:59	41	17:50 (3)	16:57	14:31 (2)	16:27	43	14:47 (2)
10	05:29	06:12	07:02			07:52		17:08 (3)	07:47	14:02 (2)	08:33		14:04 (2)
	21:56	21:13	20:06			18:57	40	17:48 (3)	16:55	14:33 (2)	16:26	43	14:47 (2)
11	05:30	06:14	07:04			07:54		17:09 (3)	07:49	14:01 (2)	08:34		14:05 (2)
	21:55	21:11	20:04			18:54	39	17:48 (3)	16:54	14:34 (2)	16:26	42	14:47 (2)
12	05:31	06:15	07:06			07:55		17:10 (3)	07:50	14:00 (2)	08:35		14:05 (2)
	21:54	21:09	20:01			18:52	37	17:47 (3)	16:52	14:35 (2)	16:26	42	14:47 (2)
13	05:32	06:17	07:07			07:57		17:11 (3)	07:52	13:59 (2)	08:36		14:06 (2)
	21:53	21:07	19:59			18:50	35	17:46 (3)	16:51	14:37 (2)	16:26	41	14:47 (2)
14	05:33	06:19	07:09			07:59		17:12 (3)	07:54	13:59 (2)	08:37		14:06 (2)
	21:52	21:05	19:57			18:48	33	17:45 (3)	16:49	14:37 (2)	16:26	42	14:48 (2)
15	05:35	06:20	07:11			08:01		17:12 (3)	07:56	13:58 (2)	08:38		14:07 (2)
	21:51	21:03	19:54			18:45	30	17:42 (3)	16:48	14:38 (2)	16:26	41	14:48 (2)
16	05:36	06:22	07:12			08:02		17:14 (3)	07:57	13:58 (2)	08:39		14:08 (2)
	21:50	21:01	19:52			18:43	27	17:41 (3)	16:46	14:39 (2)	16:26	41	14:49 (2)
17	05:37	06:23	07:14			08:04		17:16 (3)	07:59	13:57 (2)	08:40		14:09 (2)
	21:49	20:59	19:50			18:41	22	17:38 (3)	16:45	14:39 (2)	16:26	40	14:49 (2)
18	05:38	06:25	07:15			08:06		17:18 (3)	08:01	13:57 (2)	08:41		14:09 (2)
	21:48	20:57	19:47			18:39	18	17:36 (3)	16:44	14:40 (2)	16:27	41	14:50 (2)
19	05:39	06:27	07:17			08:08		17:23 (3)	08:03	13:57 (2)	08:41		14:09 (2)
	21:47	20:55	19:45			18:37	8	17:31 (3)	16:42	14:40 (2)	16:27	41	14:50 (2)
20	05:41	06:28	07:19			08:09			08:04	13:57 (2)	08:42		14:10 (2)
	21:46	20:53	19:43			18:35			16:41	14:41 (2)	16:27	41	14:51 (2)
21	05:42	06:30	07:20			08:11			08:06	13:57 (2)	08:43		14:10 (2)
	21:45	20:51	19:40			18:33			16:40	14:42 (2)	16:28	40	14:50 (2)
22	05:43	06:32	07:22		17:31 (3)	08:13			08:08	13:57 (2)	08:43		14:11 (2)
	21:43	20:48	19:38	10	17:41 (3)	18:31			16:39	14:42 (2)	16:28	40	14:51 (2)
23	05:45	06:33	07:24		17:27 (3)	08:15			08:09	13:57 (2)	08:44		14:11 (2)
	21:42	20:46	19:36	18	17:45 (3)	18:28			16:38	14:43 (2)	16:29	41	14:52 (2)
24	05:46	06:35	07:25		17:23 (3)	08:16			08:11	13:57 (2)	08:44		14:12 (2)
	21:41	20:44	19:33	24	17:47 (3)	18:26			16:37	14:42 (2)	16:29	41	14:53 (2)
25	05:48	06:36	07:27		17:21 (3)	07:18			08:13	13:57 (2)	08:45		14:12 (2)
	21:39	20:42	19:31	27	17:48 (3)	17:24			16:36	14:43 (2)	16:30	41	14:53 (2)
26	05:49	06:38	07:29		17:19 (3)	07:20			08:14	13:58 (2)	08:45		14:12 (2)
	21:38	20:40	19:29	31	17:50 (3)	17:22			16:35	14:44 (2)	16:31	41	14:53 (2)
27	05:51	06:40	07:30		17:17 (3)	07:22			08:16	13:58 (2)	08:45		14:13 (2)
	21:37	20:38	19:26	33	17:50 (3)	17:20			16:34	14:43 (2)	16:31	41	14:54 (2)
28	05:52	06:41	07:32		17:15 (3)	07:24			08:17	13:58 (2)	08:45		14:13 (2)
	21:35	20:35	19:24	36	17:51 (3)	17:18			16:33	14:44 (2)	16:32	41	14:54 (2)
29	05:53	06:43	07:34		17:14 (3)	07:25			08:19	13:59 (2)	08:46		14:13 (2)
	21:33	20:33	19:22	38	17:52 (3)	17:17			16:32	14:44 (2)	16:33	42	14:55 (2)
30	05:55	06:45	07:35		17:12 (3)	07:27			08:20	13:59 (2)	08:46		14:14 (2)
	21:32	20:31	19:19	40	17:52 (3)	17:15			16:31	14:44 (2)	16:34	41	14:55 (2)
31	05:56	06:46				07:29					08:46		14:14 (2)
	21:30	20:29				17:13					16:35	42	14:56 (2)
Potential sun hours	502	454	381			331			266		244		
Total, worst case				257			667			967		1302	
Sun reduction				0.28			0.24			0.18		0.13	
Oper. time red.				1.00			1.00			1.00		1.00	
Wind dir. red.				0.64			0.64			0.60		0.60	
Total reduction				0.18			0.15			0.11		0.08	
Total, real				46			100			107		105	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** E - H5

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April		May		June	July		August		September	October	November	December
1	08:46	08:19	07:25	07:15		06:10		20:08 (4) 05:24	05:21		05:58		20:23 (4) 06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10		21:01	22	20:30 (4) 21:47	22:01		21:29	20	20:52 (1) 20:27	19:17	17:11	16:31
2	08:45	08:17	07:23	07:12		06:08		20:08 (4) 05:24	05:22		06:00		20:21 (4) 06:49	07:39	07:32	08:23
	16:37	17:26	18:18	20:12		21:02	22	20:30 (4) 21:48	22:00		21:27	16	20:37 (4) 20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	07:10		06:06		20:08 (4) 05:23	05:23		06:01		20:21 (4) 06:51	07:40	07:34	08:25
	16:38	17:28	18:19	20:13		21:04	23	20:31 (4) 21:49	22:00		21:25	17	20:38 (4) 20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08		06:04		20:08 (4) 05:22	05:24		06:03		20:19 (4) 06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15		21:06	23	20:31 (4) 21:50	21:59		21:24	19	20:38 (4) 20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05		06:02		20:08 (4) 05:21	05:24		06:04		20:19 (4) 06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17		21:07	22	20:30 (4) 21:51	21:59		21:22	21	20:40 (4) 20:17	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03		06:00		20:08 (4) 05:21	05:25		06:06		20:18 (4) 06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18		21:09	22	20:30 (4) 21:52	21:58		21:20	21	20:39 (4) 20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01		05:59		20:09 (4) 05:20	05:26		06:07		20:18 (4) 06:58	07:47	07:41	08:30
	16:43	17:35	18:27	20:20		21:11	21	20:30 (4) 21:53	21:58		21:18	22	20:40 (4) 20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59		05:57		20:09 (4) 05:20	05:27		06:09		20:17 (4) 06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22		21:12	20	20:29 (4) 21:54	21:57		21:16	23	20:40 (4) 20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56		05:55		20:09 (4) 05:19	05:28		06:11		20:18 (4) 07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24		21:14	19	20:28 (4) 21:54	21:57		21:15	22	20:40 (4) 20:08	18:59	16:57	16:27
10	08:43	08:03	07:05	06:54		05:53		20:11 (4) 05:19	05:29		06:12		20:17 (4) 07:02	07:52	07:47	08:33
	16:47	17:41	18:32	20:25		21:16	16	20:27 (4) 21:55	21:56		21:13	23	20:40 (4) 20:06	18:57	16:55	16:26
11	08:42	08:02	07:03	06:52		05:52		20:11 (4) 05:18	05:30		06:14		20:17 (4) 07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27		21:17	15	20:26 (4) 21:56	21:55		21:11	23	20:40 (4) 20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50		05:50		20:13 (4) 05:18	05:31		06:15		20:17 (4) 07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29		21:19	20	20:42 (1) 21:57	21:54		21:09	22	20:39 (4) 20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47		05:48		20:15 (4) 05:18	05:32		06:17		20:18 (4) 07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30		21:20	18	20:43 (1) 21:57	21:53		21:07	21	20:39 (4) 19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45		05:47		20:32 (1) 05:17	05:33	20:45 (1)	06:19		20:18 (4) 07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32		21:22	13	20:45 (1) 21:58	21:52	6 20:51 (1)	21:05	18	20:36 (4) 19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43		05:45		20:30 (1) 05:17	05:35	20:44 (1)	06:20		20:19 (4) 07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34		21:24	15	20:45 (1) 21:59	21:51	8 20:52 (1)	21:03	16	20:35 (4) 19:54	18:45	16:48	16:26
16	08:38	07:52	06:51	06:41		05:44		20:30 (1) 05:17	05:36	20:43 (1)	06:22		20:20 (4) 07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35		21:25	16	20:46 (1) 21:59	21:50	10 20:53 (1)	21:01	13	20:33 (4) 19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39		05:42		20:30 (1) 05:17	05:37	20:42 (1)	06:23		20:22 (4) 07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37		21:27	16	20:46 (1) 22:00	21:49	12 20:54 (1)	20:59	9	20:31 (4) 19:50	18:41	16:45	16:27
18	08:36	07:48	06:47	06:36		05:41		20:29 (1) 05:17	05:38	20:41 (1)	06:25		20:24 (4) 07:15	08:06	08:01	08:41
	17:00	17:56	18:46	20:39		21:28	17	20:46 (1) 22:00	21:48	13 20:54 (1)	20:57	5	20:29 (4) 19:47	18:39	16:44	16:27
19	08:35	07:46	06:45	06:34		05:39		20:30 (1) 05:17	05:40	20:41 (1)	06:27		07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41		21:30	16	20:46 (1) 22:00	21:47	14 20:55 (1)	20:55		19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32		05:38		20:30 (1) 05:17	05:41	20:41 (1)	06:28		07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42		21:31	17	20:47 (1) 22:01	21:46	15 20:56 (1)	20:53		19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30		05:37		20:30 (1) 05:17	05:42	20:40 (1)	06:30		07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44		21:32	17	20:47 (1) 22:01	21:45	16 20:56 (1)	20:51		19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28		05:35		20:30 (1) 05:18	05:44	20:40 (1)	06:32		07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46		21:34	16	20:46 (1) 22:01	21:43	16 20:56 (1)	20:48		19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26		05:34		20:30 (1) 05:18	05:45	20:40 (1)	06:33		07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47		21:35	16	20:46 (1) 22:01	21:42	16 20:56 (1)	20:46		19:36	18:28	16:38	16:29
24	08:30	07:36	06:33	06:24		05:33		20:31 (1) 05:18	05:46	20:40 (1)	06:35		07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49		21:37	14	20:45 (1) 22:01	21:41	17 20:57 (1)	20:44		19:33	18:26	16:37	16:29
25	08:29	07:34	06:31	06:22		05:32		20:31 (1) 05:18	05:48	20:40 (1)	06:36		07:27	07:18	08:13	08:44
	17:11	18:09	18:58	20:51	5	20:23 (4) 21:38	14	20:45 (1) 22:01	21:39	17 20:57 (1)	20:42		19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20		20:15 (4) 05:30		20:32 (1) 05:19	05:49	20:40 (1)	06:38		07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	10	20:25 (4) 21:39	13	20:45 (1) 22:01	21:38	16 20:56 (1)	20:40		19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18		20:13 (4) 05:29		20:33 (1) 05:19	05:51	20:41 (1)	06:40		07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	13	20:26 (4) 21:41	11	20:44 (1) 22:01	21:36	16 20:57 (1)	20:38		19:26	17:20	16:34	16:31
28	08:25	07:27	06:24	06:16		20:11 (4) 05:28		20:34 (1) 05:20	05:52	20:41 (1)	06:41		07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	17	20:28 (4) 21:42	9	20:43 (1) 22:01	21:35	15 20:56 (1)	20:35		19:24	17:18	16:33	16:32
29	08:23		07:21	06:14		20:10 (4) 05:27		20:35 (1) 05:20	05:54	20:42 (1)	06:43		07:34	07:25	08:19	08:45
	17:19		20:05	20:57	19	20:29 (4) 21:43	7	20:42 (1) 22:01	21:33	14 20:56 (1)	20:33		19:22	17:17	16:32	16:33
30	08:22		07:19	06:12		20:09 (4) 05:26		20:38 (1) 05:21	05:55	20:42 (1)	06:45		07:35	07:27	08:20	08:46
	17:20		20:06	20:59	21	20:30 (4) 21:44	3	20:41 (1) 22:01	21:32	13 20:55 (1)	20:31		19:19	17:15	16:31	16:34
31	08:20		07:17			05:25			05:57	20:24 (4)	06:46			07:29		08:46
	17:22		20:08			21:46			21:30	20 20:53 (1)	20:29			17:13		16:35
Potential sun hours	259	278	367	416		485		499	502		454		381	331	266	244
Total, worst case					85		493			254		331				
Sun reduction					0,35		0,37			0,27		0,30				
Oper. time red.					1,00		1,00			1,00		1,00				
Wind dir. red.					0,68		0,68			0,68		0,68				
Total reduction					0,24		0,25			0,18		0,20				
Total, real					20		124			46		67				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** F - H6

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:14	18:07 (2) 06:10	19:21 (3) 05:24	05:21	05:58	06:48	18:18 (2) 07:37	07:31	08:22
	16:36	17:24	18:16	20:10 40	18:47 (2) 21:01 27	19:48 (3) 21:47	22:01	21:29	20:27 12	18:30 (2) 19:17	17:11	16:30
2	08:46	08:17	07:23	07:12	18:07 (2) 06:08	19:22 (3) 05:24	05:22	06:00	06:49	18:14 (2) 07:39	07:32	08:23
	16:37	17:26	18:18	20:12 39	18:46 (2) 21:02 25	19:47 (3) 21:48	22:00	21:27	20:24 18	18:32 (2) 19:15	17:09	16:30
3	08:45	08:15	07:21	07:10	18:08 (2) 06:06	19:23 (3) 05:23	05:23	06:01	06:51	18:11 (2) 07:40	07:34	08:25
	16:38	17:28	18:19	20:13 38	18:46 (2) 21:04 24	19:47 (3) 21:49	22:00	21:25	20:22 24	18:35 (2) 19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	18:08 (2) 06:04	19:24 (3) 05:22	05:24	06:03	06:53	18:09 (2) 07:42	07:36	08:26
	16:40	17:30	18:21	20:15 36	18:44 (2) 21:06 22	19:46 (3) 21:50	21:59	21:24	20:20 26	18:35 (2) 19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	18:09 (2) 06:02	19:25 (3) 05:21	05:24	06:04	19:40 (3) 06:54	18:07 (2) 07:44	07:38	08:27
	16:41	17:31	18:23	20:17 34	18:43 (2) 21:07 19	19:44 (3) 21:51	21:59	21:22 9	19:49 (3) 20:17 30	18:37 (2) 19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	18:10 (2) 06:00	19:26 (3) 05:21	05:25	06:06	19:37 (3) 06:56	18:06 (2) 07:45	07:40	08:29
	16:42	17:33	18:25	20:18 32	18:42 (2) 21:09 17	19:43 (3) 21:52	21:58	21:20 14	19:51 (3) 20:15 32	18:38 (2) 19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	18:11 (2) 05:58	19:29 (3) 05:20	05:26	06:07	19:35 (3) 06:58	18:04 (2) 07:47	07:41	08:30
	16:43	17:35	18:27	20:20 30	18:41 (2) 21:11 12	19:41 (3) 21:53	21:58	21:16 16	19:53 (3) 20:13 34	18:38 (2) 19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	18:12 (2) 05:57	19:32 (3) 05:20	05:27	06:09	19:34 (3) 06:59	18:03 (2) 07:49	07:43	08:31
	16:45	17:37	18:28	20:22 26	18:38 (2) 21:12 5	19:37 (3) 21:54	21:57	21:16 20	19:54 (3) 20:11 36	18:39 (2) 19:01	16:58	16:27
9	08:43	08:05	07:07	06:56	18:13 (2) 05:55	05:19	05:28	06:11	19:32 (3) 07:01	18:01 (2) 07:50	07:45	08:32
	16:46	17:39	18:30	20:23 24	18:37 (2) 21:14	21:54	21:57	21:15 23	19:55 (3) 20:08 38	18:39 (2) 18:59	16:57	16:27
10	08:43	08:03	07:05	06:54	18:16 (2) 05:53	05:19	05:29	06:12	19:31 (3) 07:02	18:01 (2) 07:52	07:47	08:33
	16:47	17:41	18:32	20:25 18	18:34 (2) 21:16	21:55	21:56	21:13 25	19:56 (3) 20:06 38	18:39 (2) 18:56	16:55	16:26
11	08:42	08:02	07:03	06:52	18:20 (2) 05:52	05:18	05:30	06:14	19:30 (3) 07:04	17:59 (2) 07:54	07:49	08:34
	16:49	17:43	18:34	20:27 11	18:31 (2) 21:17	21:56	21:55	21:11 26	19:56 (3) 20:04 40	18:39 (2) 18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	19:30 (3) 07:06	17:59 (2) 07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09 27	19:57 (3) 20:01 40	18:39 (2) 18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	19:29 (3) 07:07	17:59 (2) 07:57	07:52	08:36
	16:52	17:46	18:37	20:30	21:20	21:57	21:53	21:07 29	19:58 (3) 19:59 40	18:39 (2) 18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:17	05:33	06:19	19:28 (3) 07:09	17:58 (2) 07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05 30	19:58 (3) 19:57 40	18:38 (2) 18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	19:28 (3) 07:11	17:58 (2) 08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03 30	19:58 (3) 19:54 40	18:38 (2) 18:45	16:48	16:26
16	08:38	07:52	06:51	06:41 19:32 (3)	05:44	05:17	05:36	06:22	19:27 (3) 07:12	17:57 (2) 08:02	07:57	08:39
	16:56	17:52	18:42	20:35 11 19:43 (3)	21:25	21:59	21:50	21:01 30	19:57 (3) 19:52 40	18:37 (2) 18:43	16:46	16:26
17	08:37	07:50	06:49 17:26 (2)	06:39 19:29 (3)	05:42	05:17	05:37	06:23	19:28 (3) 07:14	17:57 (2) 08:04	07:59	08:40
	16:58	17:54	18:44 10 17:36 (2)	20:37 17 19:46 (3)	21:27	22:00	21:49	20:59 30	19:58 (3) 19:50 40	18:37 (2) 18:41	16:45	16:26
18	08:37	07:48	06:47 17:22 (2)	06:36 19:27 (3)	05:41	05:17	05:38	06:25	19:27 (3) 07:15	17:58 (2) 08:06	08:01	08:41
	17:00	17:56	18:46 18 17:40 (2)	20:39 21 19:48 (3)	21:28	22:00	21:48	20:57 30	19:57 (3) 19:47 38	18:36 (2) 18:39	16:44	16:27
19	08:36	07:46	06:45 17:18 (2)	06:34 19:26 (3)	05:39	05:17	05:39	06:27	19:27 (3) 07:17	17:57 (2) 08:08	08:03	08:41
	17:01	17:58	18:48 24 17:42 (2)	20:41 23 19:49 (3)	21:30	22:00	21:47	20:55 30	19:57 (3) 19:45 36	18:35 (2) 18:37	16:42	16:27
20	08:34	07:44	06:42 17:16 (2)	06:32 19:25 (3)	05:38	05:17	05:41	06:28	19:27 (3) 07:19	17:58 (2) 08:09	08:04	08:42
	17:03	17:59	18:49 28 17:44 (2)	20:42 25 19:50 (3)	21:31	22:01	21:46	20:53 29	19:56 (3) 19:43 36	18:34 (2) 18:35	16:41	16:27
21	08:33	07:42	06:40 17:15 (2)	06:30 19:23 (3)	05:36	05:17	05:42	06:30	19:28 (3) 07:20	17:58 (2) 08:11	08:06	08:43
	17:05	18:01	18:51 31 17:46 (2)	20:44 26 19:49 (3)	21:32	22:01	21:45	20:51 28	19:56 (3) 19:40 34	18:32 (2) 18:33	16:40	16:28
22	08:32	07:40	06:38 17:13 (2)	06:28 19:22 (3)	05:35	05:17	05:43	06:31	19:27 (3) 07:22	17:59 (2) 08:13	08:08	08:43
	17:06	18:03	18:53 33 17:46 (2)	20:46 28 19:50 (3)	21:34	22:01	21:43	20:48 27	19:54 (3) 19:38 32	18:31 (2) 18:31	16:39	16:28
23	08:31	07:38	06:35 17:12 (2)	06:26 19:21 (3)	05:34	05:18	05:45	06:33	19:28 (3) 07:24	18:01 (2) 08:15	08:09	08:44
	17:08	18:05	18:54 35 17:47 (2)	20:47 29 19:50 (3)	21:35	22:01	21:42	20:46 25	19:53 (3) 19:36 28	18:29 (2) 18:28	16:38	16:29
24	08:30	07:36	06:33 17:11 (2)	06:24 19:21 (3)	05:33	05:18	05:46	06:35	19:29 (3) 07:25	18:01 (2) 08:16	08:11	08:44
	17:10	18:07	18:56 37 17:48 (2)	20:49 29 19:50 (3)	21:37	22:01	21:41	20:44 22	19:51 (3) 19:33 25	18:26 (2) 18:26	16:37	16:29
25	08:29	07:34	06:31 17:09 (2)	06:22 19:20 (3)	05:31	05:18	05:48	06:36	19:30 (3) 07:27	18:04 (2) 07:18	08:13	08:45
	17:11	18:09	18:58 39 17:48 (2)	20:51 30 19:50 (3)	21:38	22:01	21:39	20:42 20	19:50 (3) 19:31 20	18:24 (2) 17:24	16:36	16:30
26	08:27	07:32	06:28 17:09 (2)	06:20 19:21 (3)	05:30	05:19	05:49	06:38	19:32 (3) 07:29	18:07 (2) 07:20	08:14	08:45
	17:13	18:10	19:00 39 17:48 (2)	20:52 30 19:51 (3)	21:39	22:01	21:38	20:40 17	19:49 (3) 19:29 14	18:21 (2) 17:22	16:35	16:31
27	08:26	07:29	06:26 17:09 (2)	06:18 19:21 (3)	05:29	05:19	05:51	06:40	19:34 (3) 07:30	07:22	08:16	08:45
	17:15	18:12	19:01 40 17:49 (2)	20:54 30 19:51 (3)	21:41	22:01	21:36	20:38 11	19:45 (3) 19:26	17:20	16:34	16:31
28	08:25	07:27	06:24 17:07 (2)	06:16 19:21 (3)	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03 41 17:48 (2)	20:56 29 19:50 (3)	21:42	22:01	21:35	20:35	19:24	17:18	16:33	16:32
29	08:23		07:21 18:07 (2)	06:14 19:21 (3)	05:27	05:20	05:53	06:43	07:34	07:25	08:19	08:45
	17:19		20:05 41 18:48 (2)	20:57 29 19:50 (3)	21:43	22:01	21:33	20:33	19:22	17:16	16:32	16:33
30	08:22		07:19 18:07 (2)	06:12 19:21 (3)	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:20		20:06 41 18:48 (2)	20:59 28 19:49 (3)	23:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17 18:07 (2)		05:25		05:56	06:46		07:29		08:46
	17:22		20:08 40 18:47 (2)		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case			497	713	151			550	833			
Sun reduction			0.24	0.35	0.37			0.30	0.28			
Oper. time red.			1.00	1.00	1.00			1.00	1.00			
Wind dir. red.			0.65	0.66	0.68			0.68	0.65			
Total reduction			0.16	0.24	0.25			0.20	0.18			
Total, real			79	168	38			110	153			

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** G - H7

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51	21:59	21:22	20:18	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:55	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:42	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
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13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:47	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:49	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:27	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
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28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:58	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** H_H8

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:25	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:39	17:28	18:20	20:13	21:04	21:49	22:00	21:25	20:22	19:13	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	22:00	21:24	20:20	19:10	17:06	16:29
5	08:45	08:12	07:16	07:05	06:02	05:22	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51	21:59	21:22	20:18	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:34	18:25	20:18	21:09	21:52	21:59	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:08	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:17	20:11	19:01	16:59	16:27
9	08:43	08:05	07:08	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
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10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:42	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:56	07:51	08:36
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:37
	16:52	17:47	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:34	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:52	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:58	08:39
	16:56	17:52	18:42	20:36	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:38	07:50	06:49	06:39	05:42	05:17	05:37	06:24	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:37	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:35	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	18:00	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:28
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:33	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:49	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:55	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:27	16:37	16:30
25	08:29	07:34	06:31	06:22	05:32	05:19	05:48	06:37	07:27	07:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:25	16:36	16:30
26	08:27	07:32	06:28	06:20	05:31	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:11	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:23	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:37	20:38	19:26	17:21	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:36	19:24	17:19	16:33	16:32
29	08:23		07:22	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:46
	17:19		20:05	20:58	21:43	22:01	21:34	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:07	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** I - H9

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:49	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:24	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:54	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:45	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
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	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
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	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
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31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

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Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** J - H10

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
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	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:39	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51	21:59	21:22	20:18	19:08	17:04	16:28
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	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
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12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:47	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:49	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:27	16:37	16:29
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26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
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27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:58	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
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	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
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Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

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Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** K - H11

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

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	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51	21:59	21:22	20:18	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:55	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:47	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:27	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** L - H12

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January			February			March			April	May	June
1	08:46			08:19		15:30 (2)	07:25		16:56 (3)	07:14	06:10	05:24
	16:36			17:24	29	15:59 (2)	18:16	28	17:24 (3)	20:10	21:01	21:47
2	08:46			08:17		15:30 (2)	07:23		16:56 (3)	07:12	06:08	05:24
	16:37			17:26	28	15:58 (2)	18:18	29	17:25 (3)	20:12	21:03	21:48
3	08:45			08:16		15:32 (2)	07:21		16:55 (3)	07:10	06:06	05:23
	16:38			17:28	26	15:58 (2)	18:19	29	17:24 (3)	20:13	21:04	21:49
4	08:45			08:14		15:33 (2)	07:19		16:55 (3)	07:08	06:04	05:22
	16:39			17:30	24	15:57 (2)	18:21	35	17:43 (5)	20:15	21:06	21:50
5	08:45			08:12		15:34 (2)	07:16		16:55 (3)	07:05	06:02	05:21
	16:41			17:31	22	15:56 (2)	18:23	41	17:46 (5)	20:17	21:08	21:51
6	08:45			08:11		15:35 (2)	07:14		16:55 (3)	07:03	06:00	05:21
	16:42			17:33	19	15:54 (2)	18:25	43	17:47 (5)	20:18	21:09	21:52
7	08:44		15:33 (2)	08:09		15:38 (2)	07:12		16:55 (3)	07:01	05:58	05:20
	16:43	7	15:40 (2)	17:35	14	15:52 (2)	18:27	46	17:50 (1)	20:20	21:11	21:53
8	08:44		15:31 (2)	08:07		15:41 (2)	07:10		16:56 (3)	06:59	05:57	05:20
	16:45	11	15:42 (2)	17:37	8	15:49 (2)	18:28	48	17:52 (1)	20:22	21:12	21:54
9	08:43		15:30 (2)	08:05			07:07		16:57 (3)	06:56	05:55	05:19
	16:46	14	15:44 (2)	17:39			18:30	47	17:53 (1)	20:24	21:14	21:55
10	08:43		15:30 (2)	08:04			07:05		16:58 (3)	06:54	05:53	05:19
	16:47	16	15:46 (2)	17:41			18:32	43	17:52 (1)	20:25	21:16	21:55
11	08:42		15:29 (2)	08:02			07:03		17:00 (3)	06:52	05:52	05:18
	16:49	18	15:47 (2)	17:43			18:34	40	17:52 (1)	20:27	21:17	21:56
12	08:42		15:28 (2)	08:00			07:01		17:03 (3)	06:50	05:50	05:18
	16:50	20	15:48 (2)	17:45			18:35	33	17:52 (1)	20:29	21:19	21:57
13	08:41		15:28 (2)	07:58			06:58		17:30 (5)	06:47	05:48	05:18
	16:52	21	15:49 (2)	17:46			18:37	20	17:50 (1)	20:30	21:20	21:57
14	08:40		15:27 (2)	07:56			06:56		17:31 (5)	06:45	05:47	05:17
	16:53	24	15:51 (2)	17:48			18:39	18	17:49 (1)	20:32	21:22	21:58
15	08:39		15:27 (2)	07:54			06:54		17:33 (5)	06:43	05:45	05:17
	16:55	25	15:52 (2)	17:50			18:41	14	17:47 (1)	20:34	21:24	21:59
16	08:38		15:27 (2)	07:52			06:51			06:41	05:44	05:17
	16:56	26	15:53 (2)	17:52			18:42			20:35	21:25	21:59
17	08:37		15:26 (2)	07:50			06:49			06:39	05:42	05:17
	16:58	28	15:54 (2)	17:54			18:44			20:37	21:27	22:00
18	08:37		15:26 (2)	07:48			06:47			06:36	05:41	05:17
	16:59	29	15:55 (2)	17:56			18:46			20:39	21:28	22:00
19	08:36		15:26 (2)	07:46			06:45			06:34	05:39	05:17
	17:01	30	15:56 (2)	17:58			18:48			20:41	21:30	22:00
20	08:34		15:27 (2)	07:44			06:42			06:32	05:38	05:17
	17:03	30	15:57 (2)	17:59			18:49			20:42	21:31	22:01
21	08:33		15:26 (2)	07:42			06:40			06:30	05:36	05:17
	17:04	30	15:56 (2)	18:01			18:51			20:44	21:32	22:01
22	08:32		15:26 (2)	07:40		17:08 (3)	06:38			06:28	05:35	05:17
	17:06	31	15:57 (2)	18:03	5	17:13 (3)	18:53			20:46	21:34	22:01
23	08:31		15:26 (2)	07:38		17:04 (3)	06:35			06:26	05:34	05:18
	17:08	32	15:58 (2)	18:05	14	17:18 (3)	18:54			20:47	21:35	22:01
24	08:30		15:26 (2)	07:36		17:02 (3)	06:33			06:24	05:33	05:18
	17:10	32	15:58 (2)	18:07	18	17:20 (3)	18:56			20:49	21:37	22:01
25	08:29		15:27 (2)	07:34		17:00 (3)	06:31			06:22	05:31	05:18
	17:11	32	15:59 (2)	18:09	22	17:22 (3)	18:58			20:51	21:38	22:01
26	08:27		15:26 (2)	07:32		16:58 (3)	06:28			06:20	05:30	05:19
	17:13	33	15:59 (2)	18:10	24	17:22 (3)	19:00			20:52	21:39	22:01
27	08:26		15:27 (2)	07:30		16:57 (3)	06:26			06:18	05:29	05:19
	17:15	32	15:59 (2)	18:12	26	17:23 (3)	19:01			20:54	21:41	22:01
28	08:25		15:27 (2)	07:27		16:57 (3)	06:24			06:16	05:28	05:20
	17:17	32	15:59 (2)	18:14	27	17:24 (3)	19:03			20:56	21:42	22:01
29	08:23		15:28 (2)				07:21			06:14	05:27	05:20
	17:19	32	16:00 (2)				20:05			20:57	21:43	22:01
30	08:22		15:28 (2)				07:19			06:12	05:26	05:21
	17:20	31	15:59 (2)				20:06			20:59	21:44	22:01
31	08:20		15:29 (2)				07:17				05:25	
	17:22	31	16:00 (2)				20:08				21:46	
Potential sun hours	259			278			367			416	485	499
Total, worst case		647			306			514				
Sun reduction		0.16			0.21			0.24				
Oper. time red.		1.00			1.00			1.00				
Wind dir. red.		0.59			0.61			0.64				
Total reduction		0.09			0.12			0.16				
Total, real		59			38			80				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** L - H12

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	July	August	September			October			November			December		
1	05:21	05:58	06:48			07:37		17:44 (3)	07:31			08:22		15:11 (2)
	22:01	21:29	20:27			19:17	29	18:31 (1)	17:11			16:30	18	15:29 (2)
2	05:22	06:00	06:49			07:39		17:40 (3)	07:33			08:23		15:12 (2)
	22:00	21:27	20:24			19:15	37	18:31 (1)	17:09			16:30	16	15:28 (2)
3	05:23	06:01	06:51			07:40		17:37 (3)	07:34		15:10 (2)	08:25		15:14 (2)
	22:00	21:25	20:22			19:12	42	18:30 (1)	17:07	9	15:19 (2)	16:29	14	15:28 (2)
4	05:24	06:03	06:53			07:42		17:35 (3)	07:36		15:07 (2)	08:26		15:15 (2)
	22:00	21:24	20:20			19:10	45	18:30 (1)	17:05	15	15:22 (2)	16:29	11	15:26 (2)
5	05:24	06:04	06:54			07:44		17:34 (3)	07:38		15:05 (2)	08:27		15:18 (2)
	21:59	21:22	20:17			19:08	46	18:29 (1)	17:04	19	15:24 (2)	16:28	7	15:25 (2)
6	05:25	06:06	06:56			07:45		17:32 (3)	07:40		15:03 (2)	08:29		
	21:58	21:20	20:15			19:06	46	18:27 (1)	17:02	23	15:26 (2)	16:28		
7	05:26	06:07	06:58			07:47		17:31 (3)	07:42		15:02 (2)	08:30		
	21:58	21:18	20:13			19:03	45	18:24 (1)	17:00	25	15:27 (2)	16:27		
8	05:27	06:09	06:59			07:49		17:31 (3)	07:43		15:01 (2)	08:31		
	21:57	21:16	20:11			19:01	41	18:22 (5)	16:58	27	15:28 (2)	16:27		
9	05:28	06:10	07:01			07:50		17:30 (3)	07:45		15:01 (2)	08:32		
	21:57	21:15	20:08			18:59	38	18:20 (5)	16:57	28	15:29 (2)	16:27		
10	05:29	06:12	07:02			07:52		17:29 (3)	07:47		15:00 (2)	08:33		
	21:56	21:13	20:06			18:56	29	17:58 (3)	16:55	30	15:30 (2)	16:26		
11	05:30	06:14	07:04			07:54		17:29 (3)	07:49		15:00 (2)	08:34		
	21:55	21:11	20:04			18:54	29	17:58 (3)	16:54	30	15:30 (2)	16:26		
12	05:31	06:15	07:06			07:55		17:29 (3)	07:50		15:00 (2)	08:35		
	21:54	21:09	20:01			18:52	29	17:58 (3)	16:52	31	15:31 (2)	16:26		
13	05:32	06:17	07:07			07:57		17:30 (3)	07:52		15:00 (2)	08:36		
	21:53	21:07	19:59			18:50	27	17:57 (3)	16:51	31	15:31 (2)	16:26		
14	05:33	06:19	07:09			07:59		17:30 (3)	07:54		15:00 (2)	08:37		
	21:52	21:05	19:57			18:48	27	17:57 (3)	16:49	32	15:32 (2)	16:26		
15	05:35	06:20	07:11			08:01		17:30 (3)	07:56		15:00 (2)	08:38		
	21:51	21:03	19:54			18:45	25	17:55 (3)	16:48	32	15:32 (2)	16:26		
16	05:36	06:22	07:12			08:02		17:31 (3)	07:57		15:00 (2)	08:39		
	21:50	21:01	19:52			18:43	23	17:54 (3)	16:46	33	15:33 (2)	16:26		
17	05:37	06:23	07:14			08:04		17:32 (3)	07:59		14:59 (2)	08:40		
	21:49	20:59	19:50			18:41	20	17:52 (3)	16:45	33	15:32 (2)	16:26		
18	05:38	06:25	07:15			08:06		17:34 (3)	08:01		15:00 (2)	08:41		
	21:48	20:57	19:47			18:39	17	17:51 (3)	16:44	32	15:32 (2)	16:27		
19	05:39	06:27	07:17			08:08		17:36 (3)	08:03		15:00 (2)	08:41		
	21:47	20:55	19:45			18:37	12	17:48 (3)	16:42	32	15:32 (2)	16:27		
20	05:41	06:28	07:19			08:09			08:04		15:01 (2)	08:42		
	21:46	20:53	19:43			18:35			16:41	31	15:32 (2)	16:27		
21	05:42	06:30	07:20			08:11			08:06		15:02 (2)	08:43		
	21:45	20:51	19:40			18:33			16:40	30	15:32 (2)	16:28		
22	05:43	06:31	07:22			08:13			08:08		15:03 (2)	08:43		
	21:43	20:48	19:38			18:31			16:39	30	15:33 (2)	16:28		
23	05:45	06:33	07:24			08:15			08:09		15:03 (2)	08:44		
	21:42	20:46	19:36			18:28			16:38	30	15:33 (2)	16:29		
24	05:46	06:35	07:25			08:16			08:11		15:03 (2)	08:44		
	21:41	20:44	19:33			18:26			16:37	29	15:32 (2)	16:29		
25	05:48	06:36	07:27			07:18			08:13		15:04 (2)	08:45		
	21:39	20:42	19:31			17:24			16:35	28	15:32 (2)	16:30		
26	05:49	06:38	07:29			07:20			08:14		15:06 (2)	08:45		
	21:38	20:40	19:29			17:22			16:35	26	15:32 (2)	16:31		
27	05:50	06:40	07:30			07:22			08:16		15:06 (2)	08:45		
	21:36	20:38	19:26			17:20			16:34	25	15:31 (2)	16:31		
28	05:52	06:41	07:32		18:15 (5)	07:24			08:17		15:07 (2)	08:45		
	21:35	20:35	19:24	8	18:23 (5)	17:18			16:33	24	15:31 (2)	16:32		
29	05:53	06:43	07:34		18:12 (5)	07:25			08:19		15:09 (2)	08:45		
	21:33	20:33	19:22	17	18:29 (1)	17:16			16:32	22	15:31 (2)	16:33		
30	05:55	06:45	07:35		18:10 (5)	07:27			08:20		15:09 (2)	08:46		
	21:32	20:31	19:19	20	18:30 (1)	17:15			16:31	21	15:30 (2)	16:34		
31	05:56	06:46				07:29						08:46		
	21:30	20:29				17:13						16:35		
Potential sun hours	502	454	381			331			266			244		
Total, worst case				45			607			758			66	
Sun reduction				0.28			0.24			0.18			0.13	
Oper. time red.				1.00			1.00			1.00			1.00	
Wind dir. red.				0.64			0.64			0.59			0.59	
Total reduction				0.18			0.15			0.11			0.08	
Total, real				8			92			81			5	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed User:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** M - H13

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51	21:59	21:22	20:18	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:55	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:47	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:49	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:27	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:58	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** N - H14

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51	21:59	21:22	20:18	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:55	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:47	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:27	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** O - H15

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:25	06:07 (2) 05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	15 06:22 (2) 22:01	21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	06:08 (2) 05:22 06:19 (2)	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	14 06:22 (2) 22:00 3	06:22 (2) 21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	06:08 (2) 05:23 06:19 (2)	06:01	06:51	07:40	07:34	08:25
	16:39	17:28	18:20	20:13	21:04	21:49	14 06:22 (2) 22:00 5	06:24 (2) 21:25	20:22	19:13	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	06:08 (2) 05:24 06:17 (2)	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	13 06:21 (2) 22:00 7	06:24 (2) 21:24	20:20	19:10	17:06	16:28
5	08:45	08:12	07:17	07:05	06:02	05:22	06:10 (2) 05:25 06:17 (2)	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51	11 06:21 (2) 21:59 8	06:25 (2) 21:22	20:18	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	06:10 (2) 05:25 06:16 (2)	06:06	06:56	07:45	07:40	08:29
	16:42	17:34	18:25	20:19	21:09	21:52	10 06:20 (2) 21:59 10	06:26 (2) 21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	06:11 (2) 05:26 06:16 (2)	06:08	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	9 06:20 (2) 21:58 11	06:27 (2) 21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	06:11 (2) 05:27 06:16 (2)	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:13	21:54	8 06:19 (2) 21:57 12	06:28 (2) 21:17	20:11	19:01	16:59	16:27
9	08:43	08:05	07:08	06:56	05:55	05:19	06:13 (2) 05:28 06:16 (2)	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:55	6 06:19 (2) 21:57 13	06:29 (2) 21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	06:15 (2) 05:29 06:16 (2)	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	3 06:18 (2) 21:56 13	06:29 (2) 21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:15 (2) 06:14	07:04	07:54	07:49	08:35
	16:49	17:43	18:34	20:27	21:17	21:56	21:55 15	06:30 (2) 21:11	20:04	18:54	16:54	16:26
12	08:42	08:00	07:01	06:50	05:50	05:18	05:31	06:15 (2) 06:15	07:06	07:56	07:51	08:36
	16:50	17:45	18:36	20:29	21:19	21:57	21:54 15	06:30 (2) 21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:15 (2) 06:17	07:07	07:57	07:52	08:37
	16:52	17:47	18:37	20:30	21:21	21:57	21:53 16	06:31 (2) 21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:34	06:15 (2) 06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:53 16	06:31 (2) 21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:15 (2) 06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:52 16	06:31 (2) 21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:15 (2) 06:22	07:12	08:02	07:58	08:39
	16:56	17:52	18:42	20:36	21:25	21:59	21:51 16	06:31 (2) 21:01	19:52	18:43	16:46	16:26
17	08:38	07:50	06:49	06:39	05:42	06:10 (2) 05:17	05:37	06:14 (2) 06:24	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	7 06:17 (2) 22:00	21:49 17	06:31 (2) 20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:37	05:41	06:08 (2) 05:17	05:38	06:14 (2) 06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	11 06:19 (2) 22:00	21:48 17	06:31 (2) 20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	06:07 (2) 05:17	05:40	06:15 (2) 06:27	07:17	08:08	08:03	08:42
	17:01	17:58	18:48	20:41	21:30	12 06:19 (2) 22:00	21:47 17	06:32 (2) 20:55	19:45	18:37	16:42	16:27
20	08:35	07:44	06:42	06:32	05:38	06:06 (2) 05:17	05:41	06:15 (2) 06:28	07:19	08:09	08:04	08:42
	17:03	18:00	18:49	20:42	21:31	14 06:20 (2) 22:01	21:46 17	06:32 (2) 20:53	19:43	18:35	16:41	16:28
21	08:33	07:42	06:40	06:30	05:37	06:06 (2) 05:17	05:42	06:15 (2) 06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:33	15 06:21 (2) 22:01	21:45 16	06:31 (2) 20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	06:06 (2) 05:18	05:44	06:15 (2) 06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	16 06:22 (2) 22:01	21:44 16	06:31 (2) 20:49	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	06:05 (2) 05:18	05:45	06:17 (2) 06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:55	20:47	21:35	16 06:21 (2) 22:01	21:42 14	06:31 (2) 20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	06:05 (2) 05:18	05:46	06:17 (2) 06:35	07:25	08:17	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	17 06:22 (2) 22:01	21:41 13	06:30 (2) 20:44	19:33	18:27	16:37	16:30
25	08:29	07:34	06:31	06:22	05:32	06:05 (2) 05:19	05:48	06:18 (2) 06:37	07:27	08:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38	17 06:22 (2) 22:01	21:39 11	06:29 (2) 20:42	19:31	17:25	16:36	16:30
26	08:27	07:32	06:29	06:20	05:31	06:05 (2) 05:19	05:49	06:19 (2) 06:38	07:29	07:20	08:14	08:45
	17:13	18:11	19:00	20:53	21:39	17 06:22 (2) 22:01	21:38 10	06:29 (2) 20:40	19:29	17:23	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	06:05 (2) 05:19	05:51	06:21 (2) 06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	17 06:22 (2) 22:01	21:37 6	06:27 (2) 20:38	19:26	17:21	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	06:05 (2) 05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	17 06:22 (2) 22:01	21:35	20:36	19:24	17:19	16:33	16:32
29	08:23		07:22	06:14	05:27	06:06 (2) 05:20	05:54	06:43	07:34	07:25	08:19	08:46
	17:19		20:05	20:58	21:43	17 06:23 (2) 22:01	21:34	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	06:06 (2) 05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:07	20:59	21:44	16 06:22 (2) 22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25	06:07 (2)	05:57	06:46		07:29		08:46
	17:22		20:08		21:46	15 06:22 (2)	21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case					224	103	330					
Sun reduction					0.37	0.30	0.27					
Oper. time red.					1.00	1.00	1.00					
Wind dir. red.					0.63	0.63	0.63					
Total reduction					0.23	0.19	0.17					
Total, real					53	20	56					

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com

Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** P - H16

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:45	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:07	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:54	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:45	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:15	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
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	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
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31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** Q - H17

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	06:34 (2) 05:25	05:53 (3) 05:22	05:53 (3) 05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01 9	06:43 (2) 21:47 31	06:24 (4) 22:01 39	06:32 (4) 21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	06:32 (2) 05:24	05:53 (3) 05:22	05:54 (3) 06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03 11	06:43 (2) 21:48 32	06:25 (4) 22:00 38	06:32 (4) 21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	06:31 (2) 05:23	05:52 (3) 05:23	05:54 (3) 06:01	06:42 (2) 06:51	07:40	07:34	08:25
	16:39	17:28	18:20	20:13	21:04 13	06:44 (2) 21:49 33	06:25 (4) 22:00 39	06:33 (4) 21:25 6	06:48 (2) 20:22	19:13	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	06:29 (2) 05:22	05:51 (3) 05:24	05:54 (3) 06:03	06:40 (2) 06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06 14	06:43 (2) 21:50 34	06:25 (4) 22:00 38	06:32 (4) 21:24 10	06:50 (2) 20:20	19:10	17:06	16:29
5	08:45	08:12	07:17	07:06	06:02	06:28 (2) 05:22	05:51 (3) 05:25	05:55 (3) 06:04	06:39 (2) 06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08 15	06:43 (2) 21:51 35	06:26 (4) 21:59 37	06:32 (4) 21:22 12	06:51 (2) 20:18	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	06:29 (2) 05:21	05:50 (3) 05:25	05:56 (3) 06:06	06:38 (2) 06:56	07:45	07:40	08:29
	16:42	17:34	18:25	20:19	21:09 14	06:43 (2) 21:52 36	06:26 (4) 21:59 37	06:33 (4) 21:20 14	06:52 (2) 20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	06:29 (2) 05:20	05:50 (3) 05:26	05:57 (3) 06:08	06:38 (2) 06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11 13	06:42 (2) 21:53 37	06:27 (4) 21:58 36	06:33 (4) 21:18 15	06:53 (2) 20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	06:29 (2) 05:20	05:49 (3) 05:27	05:58 (3) 06:09	06:37 (2) 06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:13 12	06:41 (2) 21:54 38	06:27 (4) 21:57 35	06:33 (4) 21:17 15	06:52 (2) 20:11	19:01	16:59	16:27
9	08:43	08:05	07:08	06:56	05:55	06:31 (2) 05:19	05:49 (3) 05:28	05:59 (3) 06:11	06:39 (2) 07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14 9	06:40 (2) 21:55 38	06:27 (4) 21:57 34	06:33 (4) 21:15 14	06:53 (2) 20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	06:33 (2) 05:19	05:49 (3) 05:29	06:00 (3) 06:12	06:40 (2) 07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16 4	06:37 (2) 21:55 39	06:28 (4) 21:56 33	06:33 (4) 21:13 12	06:52 (2) 20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:49 (3) 05:30	06:01 (3) 06:14	06:42 (2) 07:04	07:54	07:49	08:35
	16:49	17:43	18:34	20:27	21:17	21:56 39	06:28 (4) 21:55 31	06:32 (4) 21:11 10	06:52 (2) 20:04	18:54	16:54	16:26
12	08:42	08:00	07:01	06:50	05:50	05:18	05:49 (3) 05:31	06:02 (3) 06:16	06:43 (2) 07:06	07:56	07:51	08:36
	16:50	17:45	18:36	20:29	21:19	21:57 39	06:28 (4) 21:54 30	06:32 (4) 21:09 8	06:51 (2) 20:01	18:52	16:52	16:26
13	08:41	07:58	06:59	06:47	05:49	05:18	05:50 (3) 05:32	06:03 (3) 06:17	06:45 (2) 07:07	07:57	07:52	08:37
	16:52	17:47	18:37	20:30	21:21	21:58 39	06:29 (4) 21:53 29	06:32 (4) 21:07 6	06:51 (2) 19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:50 (3) 05:34	06:04 (3) 06:19	06:46 (2) 07:09	07:59	07:54	08:38
	16:53	17:48	18:39	20:32	21:22	21:58 39	06:29 (4) 21:53 27	06:31 (4) 21:05 3	06:49 (2) 19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:51 (3) 05:35	06:05 (3) 06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59 38	06:29 (4) 21:52 25	06:30 (4) 21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:51 (3) 05:36	06:06 (3) 06:22	07:12	08:02	07:58	08:39
	16:56	17:52	18:43	20:36	21:25	21:59 39	06:30 (4) 21:51 22	06:30 (4) 21:01	19:52	18:43	16:46	16:26
17	08:38	07:50	06:49	06:39	05:42	05:17	05:51 (3) 05:37	06:07 (3) 06:24	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00 39	06:30 (4) 21:49 18	06:29 (4) 20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:37	05:41	05:17	05:51 (3) 05:38	06:13 (4) 06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00 39	06:30 (4) 21:48 14	06:27 (4) 20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:51 (3) 05:40	06:16 (4) 06:27	07:17	08:08	08:03	08:42
	17:01	17:58	18:48	20:41	21:30	22:00 39	06:30 (4) 21:47 11	06:27 (4) 20:55	19:45	18:37	16:43	16:27
20	08:35	07:44	06:42	06:32	05:38	05:17	05:51 (3) 05:41	06:18 (4) 06:28	07:19	08:09	08:04	08:42
	17:03	18:00	18:49	20:42	21:31	22:01 39	06:30 (4) 21:46 6	06:24 (4) 20:53	19:43	18:35	16:41	16:28
21	08:34	07:42	06:40	06:30	05:37	05:17	05:51 (3) 05:42	06:30	07:21	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:33	22:01 39	06:30 (4) 21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:51 (3) 05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01 39	06:30 (4) 21:44	20:49	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:52 (3) 05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:55	20:47	21:35	22:01 39	06:31 (4) 21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33 06:06 (4)	05:18	05:52 (3) 05:46	06:35	07:25	08:17	08:11	08:44
	17:10	18:07	18:56	20:49	21:37 9 06:15 (4)	22:01 39	06:31 (4) 21:41	20:44	19:33	18:27	16:37	16:30
25	08:29	07:34	06:31	06:22	05:32 06:04 (4)	05:19	05:52 (3) 05:48	06:37	07:27	07:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38 13 06:17 (4)	22:02 39	06:31 (4) 21:39	20:42	19:31	17:25	16:36	16:30
26	08:27	07:32	06:29	06:20	05:31 06:03 (4)	05:19	05:53 (3) 05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:11	19:00	20:53	21:39 16 06:19 (4)	22:02 39	06:32 (4) 21:38	20:40	19:29	17:23	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29 05:57 (3)	05:19	05:53 (3) 05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41 20 06:20 (4)	22:01 39	06:32 (4) 21:37	20:38	19:26	17:21	16:34	16:32
28	08:25	07:28	06:24	06:16	05:28 05:56 (3)	05:20	05:53 (3) 05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42 24 06:21 (4)	22:01 39	06:32 (4) 21:35	20:36	19:24	17:19	16:33	16:32
29	08:23		07:22	06:14 06:38 (2)	05:27 05:56 (3)	05:20	05:53 (3) 05:54	06:43	07:34	07:25	08:19	08:46
	17:19		20:05	20:58 3 06:41 (2)	21:43 26 06:22 (4)	22:01 39	06:32 (4) 21:34	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12 06:36 (2)	05:26 05:55 (3)	05:21	05:54 (3) 05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:07	20:59 6 06:42 (2)	21:44 28 06:23 (4)	22:01 38	06:32 (4) 21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25 05:54 (3)		05:57	06:46		07:29		08:46
	17:22		20:08		21:46 29 06:23 (4)		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case				9	279	1131	579	125				
Sun reduction				0.35	0.37	0.30	0.27	0.30				
Oper. time red.				1.00	1.00	1.00	1.00	1.00				
Wind dir. red.				0.64	0.63	0.63	0.63	0.64				
Total reduction				0.23	0.23	0.19	0.17	0.19				
Total, real				2	65	213	97	24				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** R - H18

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	06:34 (2) 05:25	05:53 (3) 05:22	05:56 (3) 05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01 10	06:44 (2) 21:47 35	06:28 (4) 22:01 39	06:35 (4) 21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	06:32 (2) 05:24	05:53 (3) 05:22	05:57 (3) 06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03 12	06:44 (2) 21:48 36	06:29 (4) 22:00 38	06:35 (4) 21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	06:31 (2) 05:23	05:52 (3) 05:23	05:57 (3) 06:01	06:51	07:40	07:34	08:25
	16:39	17:28	18:20	20:13	21:04 13	06:44 (2) 21:49 37	06:29 (4) 22:00 39	06:36 (4) 21:25	20:22	19:13	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	06:29 (2) 05:22	05:51 (3) 05:24	05:56 (3) 06:03	06:43 (2)	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06 15	06:44 (2) 21:50 38	06:29 (4) 22:00 39	06:35 (4) 21:24 6	06:49 (2)	20:20	19:10	17:06	16:29
5	08:45	08:12	07:17	07:06	06:02	06:29 (2) 05:22	05:51 (3) 05:25	05:57 (3) 06:04	06:42 (2)	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08 14	06:43 (2) 21:51 39	06:30 (4) 21:59 39	06:36 (4) 21:22 9	06:51 (2)	20:18	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	06:31 (2) 05:21	05:51 (3) 05:25	05:57 (3) 06:06	06:40 (2)	06:56	07:45	07:40	08:29
	16:42	17:34	18:25	20:19	21:09 12	06:43 (2) 21:52 39	06:30 (4) 21:59 39	06:36 (4) 21:20 12	06:52 (2)	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	06:31 (2) 05:20	05:51 (3) 05:26	05:57 (3) 06:08	06:40 (2)	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11 11	06:42 (2) 21:53 39	06:30 (4) 21:58 39	06:36 (4) 21:18 13	06:53 (2)	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	06:32 (2) 05:20	05:51 (3) 05:27	05:58 (3) 06:09	06:39 (2)	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:13 8	06:40 (2) 21:54 39	06:30 (4) 21:57 38	06:36 (4) 21:17 14	06:53 (2)	20:11	19:01	16:59	16:27
9	08:43	08:05	07:08	06:56	05:55	06:35 (2) 05:19	05:52 (3) 05:28	05:59 (3) 06:11	06:39 (2)	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14 3	06:38 (2) 21:55 39	06:31 (4) 21:57 38	06:37 (4) 21:15 15	06:54 (2)	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:52 (3) 05:29	06:00 (3) 06:12	06:40 (2)	07:03	07:52	07:47	08:33
	16:48	17:41	18:32	20:25	21:16	21:55 39	06:31 (4) 21:56 37	06:37 (4) 21:13 13	06:53 (2)	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:52 (3) 05:30	06:01 (3) 06:14	06:42 (2)	07:04	07:54	07:49	08:35
	16:49	17:43	18:34	20:27	21:17	21:56 39	06:31 (4) 21:55 36	06:37 (4) 21:11 11	06:53 (2)	20:04	18:54	16:54	16:26
12	08:42	08:00	07:01	06:50	05:50	05:18	05:52 (3) 05:31	06:02 (3) 06:16	06:43 (2)	07:06	07:56	07:51	08:36
	16:50	17:45	18:36	20:29	21:19	21:57 39	06:31 (4) 21:54 34	06:36 (4) 21:09 9	06:52 (2)	20:01	18:52	16:52	16:26
13	08:41	07:58	06:59	06:47	05:49	05:18	05:53 (3) 05:32	06:03 (3) 06:17	06:45 (2)	07:07	07:57	07:52	08:37
	16:52	17:47	18:37	20:30	21:21	21:58 39	06:32 (4) 21:53 33	06:36 (4) 21:07 7	06:52 (2)	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:53 (3) 05:34	06:04 (3) 06:19	06:46 (2)	07:09	07:59	07:54	08:38
	16:53	17:48	18:39	20:32	21:22	21:58 39	06:32 (4) 21:53 32	06:36 (4) 21:05 4	06:50 (2)	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:54 (3) 05:35	06:05 (3) 06:20	06:48 (2)	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59 38	06:32 (4) 21:52 31	06:36 (4) 21:03 1	06:49 (2)	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:54 (3) 05:36	06:06 (3) 06:22		07:12	08:02	07:58	08:39
	16:57	17:52	18:43	20:36	21:25	21:59 39	06:33 (4) 21:51 29	06:35 (4) 21:01		19:52	18:43	16:46	16:26
17	08:38	07:50	06:49	06:39	05:42	05:17	05:54 (3) 05:37	06:07 (3) 06:24		07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00 39	06:33 (4) 21:49 28	06:35 (4) 20:59		19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:37	05:41	05:17	05:54 (3) 05:38	06:08 (3) 06:25		07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00 39	06:33 (4) 21:48 25	06:34 (4) 20:57		19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:55 (3) 05:40	06:10 (3) 06:27		07:17	08:08	08:03	08:42
	17:01	17:58	18:48	20:41	21:30	22:00 38	06:33 (4) 21:47 20	06:34 (4) 20:55		19:45	18:37	16:43	16:27
20	08:35	07:44	06:42	06:32	05:38	06:13 (4) 05:17	05:55 (3) 05:41	06:16 (4) 06:28		07:19	08:09	08:04	08:42
	17:03	18:00	18:49	20:42	21:31 2	06:15 (4) 22:01 38	06:33 (4) 21:46 17	06:33 (4) 20:53		19:43	18:35	16:41	16:28
21	08:34	07:42	06:40	06:30	05:37	06:09 (4) 05:17	05:55 (3) 05:42	06:17 (4) 06:30		07:21	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:33 10	06:19 (4) 22:01 38	06:33 (4) 21:45 15	06:32 (4) 20:51		19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	06:08 (4) 05:18	05:55 (3) 05:44	06:18 (4) 06:32		07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34 13	06:21 (4) 22:01 38	06:33 (4) 21:44 12	06:30 (4) 20:49		19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	06:07 (4) 05:18	05:56 (3) 05:45	06:21 (4) 06:33		07:24	08:15	08:09	08:44
	17:08	18:05	18:55	20:47	21:35 16	06:23 (4) 22:01 38	06:34 (4) 21:42 7	06:28 (4) 20:46		19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	06:05 (4) 05:18	05:56 (3) 05:46	06:35		07:25	08:17	08:11	08:44
	17:10	18:07	18:56	20:49	21:37 18	06:23 (4) 22:01 38	06:34 (4) 21:41	20:44		19:33	18:27	16:37	16:30
25	08:29	07:34	06:31	06:22	05:32	05:59 (3) 05:19	05:55 (3) 05:48	06:37		07:27	07:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38 22	06:24 (4) 22:02 39	06:34 (4) 21:39	20:42		19:31	17:25	16:36	16:30
26	08:27	07:32	06:29	06:20	05:31	05:58 (3) 05:19	05:56 (3) 05:49	06:38		07:29	07:20	08:14	08:45
	17:13	18:11	19:00	20:53	21:39 27	06:25 (4) 22:02 39	06:35 (4) 21:38	20:40		19:29	17:23	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:57 (3) 05:19	05:56 (3) 05:51	06:40		07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41 28	06:25 (4) 22:01 38	06:34 (4) 21:37	20:38		19:26	17:21	16:34	16:32
28	08:25	07:28	06:24	06:16 06:40 (2)	05:28	05:56 (3) 05:20	05:56 (3) 05:52	06:41		07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56 2 06:42 (2)	21:42 30	06:26 (4) 22:01 39	06:35 (4) 21:35	20:36		19:24	17:19	16:33	16:32
29	08:23		07:22	06:14 06:39 (2)	05:27	05:56 (3) 05:20	05:56 (3) 05:54	06:43		07:34	07:25	08:19	08:46
	17:19		20:05	20:58 5 06:43 (2)	21:43 31	06:27 (4) 22:01 39	06:35 (4) 21:34	20:33		19:22	17:17	16:32	16:31
30	08:22		07:19	06:12 06:36 (2)	05:26	05:55 (3) 05:21	05:57 (3) 05:55	06:45		07:35	07:27	08:20	08:46
	17:21		20:07	20:59 8 06:44 (2)	21:44 33	06:28 (4) 22:01 38	06:35 (4) 21:32	20:31		19:19	17:15	16:31	16:34
31	08:20		07:17		05:25	05:54 (3)	05:57	06:46			07:29		08:46
	17:22		20:08		21:46 34	06:28 (4)	21:30	20:29			17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case				15	362	1151	704	114				
Sun reduction				0.35	0.37	0.30	0.27	0.30				
Oper. time red.				1.00	1.00	1.00	1.00	1.00				
Wind dir. red.				0.64	0.63	0.63	0.63	0.64				
Total reduction				0.23	0.23	0.19	0.17	0.19				
Total, real				3	85	217	118	22				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** S - H19

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January		February		March	April	May	June	July	August	September	October	November		December	
1	08:46	14:55 (5)	08:19	16:03 (1)	07:25	07:15	06:10	05:24	05:21	05:58	06:48	07:37	07:31		08:22	14:46 (5)
	16:36	23 15:18 (5)	17:24	9 16:12 (1)	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11		16:30	15 15:01 (5)
2	08:46	14:56 (5)	08:17	16:07 (1)	07:23	07:12	06:08	05:24	05:22	06:00	06:49	07:39	07:33		08:23	14:46 (5)
	16:37	23 15:19 (5)	17:26	2 16:09 (1)	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09		16:30	16 15:02 (5)
3	08:45	14:57 (5)	08:16		07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34		08:25	14:45 (5)
	16:38	22 15:19 (5)	17:28		18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07		16:29	18 15:03 (5)
4	08:45	14:57 (5)	08:14		07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36		08:26	14:44 (5)
	16:40	22 15:19 (5)	17:30		18:21	20:15	21:06	21:50	22:00	21:24	20:20	19:10	17:05		16:29	19 15:03 (5)
5	08:45	14:58 (5)	08:12		07:16	07:05	06:02	05:21	05:24	06:04	06:54	07:44	07:38		08:27	14:45 (5)
	16:41	21 15:19 (5)	17:32		18:23	20:17	21:08	21:51	21:59	21:22	20:18	19:08	17:04		16:28	20 15:05 (5)
6	08:45	14:58 (5)	08:11		07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40		08:29	14:44 (5)
	16:42	21 15:19 (5)	17:33		18:25	20:18	21:09	21:52	21:59	21:20	20:15	19:06	17:02		16:28	21 15:05 (5)
7	08:44	15:00 (5)	08:09		07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42		08:30	14:45 (5)
	16:43	20 15:20 (5)	17:35		18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00		16:27	21 15:06 (5)
8	08:44	15:00 (5)	08:07		07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43		08:31	14:45 (5)
	16:45	19 15:19 (5)	17:37		18:28	20:22	21:13	21:54	21:57	21:17	20:11	19:01	16:58		16:27	22 15:07 (5)
9	08:43	15:01 (5)	08:05		07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	15:37 (1)	08:32	14:45 (5)
	16:46	18 15:19 (5)	17:39		18:30	20:24	21:14	21:55	21:57	21:15	20:08	18:59	16:57	3 15:40 (1)	16:27	22 15:07 (5)
10	08:43	15:03 (5)	08:04		07:05	06:54	05:53	05:19	05:29	06:12	07:02	07:52	07:47	15:34 (1)	08:33	14:45 (5)
	16:47	16 15:19 (5)	17:41		18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	9 15:43 (1)	16:26	23 15:08 (5)
11	08:42	15:03 (5)	08:02		07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	15:32 (1)	08:35	14:45 (5)
	16:49	16 15:19 (5)	17:43		18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	13 15:45 (1)	16:26	23 15:08 (5)
12	08:42	15:05 (5)	08:00		07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:56	07:51	15:32 (1)	08:36	14:45 (5)
	16:50	13 15:18 (5)	17:45		18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	14 15:46 (1)	16:26	24 15:09 (5)
13	08:41	15:06 (5)	07:58		06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	15:31 (1)	08:37	14:46 (5)
	16:52	11 15:17 (5)	17:46		18:37	20:30	21:21	21:58	21:53	21:07	19:59	18:50	16:51	16 15:47 (1)	16:26	23 15:09 (5)
14	08:40	15:09 (5)	07:56		06:56	06:45	05:47	05:17	05:33	06:19	07:09	07:59	07:54	15:31 (1)	08:38	14:46 (5)
	16:53	6 15:15 (5)	17:48		18:39	20:32	21:22	21:58	21:53	21:05	19:57	18:48	16:49	17 15:48 (1)	16:26	24 15:10 (5)
15	08:39		07:54		06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	15:31 (1)	08:38	14:47 (5)
	16:55		17:50		18:41	20:34	21:24	21:59	21:52	21:03	19:54	18:45	16:48	17 15:48 (1)	16:26	23 15:10 (5)
16	08:38	16:00 (1)	07:52		06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:58	15:31 (1)	08:39	14:47 (5)
	16:56	6 16:06 (1)	17:52		18:42	20:36	21:25	21:59	21:51	21:01	19:52	18:43	16:46	18 15:49 (1)	16:26	24 15:11 (5)
17	08:38	15:59 (1)	07:50		06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	15:31 (1)	08:40	14:48 (5)
	16:58	9 16:08 (1)	17:54		18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	18 15:49 (1)	16:26	24 15:12 (5)
18	08:37	15:58 (1)	07:48		06:47	06:36	05:41	05:17	05:38	06:25	07:15	08:06	08:01	15:30 (1)	08:41	14:48 (5)
	17:00	12 16:10 (1)	17:56		18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	18 15:48 (1)	16:27	24 15:12 (5)
19	08:36	15:58 (1)	07:46		06:45	06:34	05:39	05:17	05:39	06:27	07:17	08:08	08:03	15:31 (1)	08:42	14:48 (5)
	17:01	13 16:11 (1)	17:58		18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	18 15:49 (1)	16:27	24 15:12 (5)
20	08:35	15:57 (1)	07:44		06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	15:32 (1)	08:42	14:49 (5)
	17:03	16 16:13 (1)	17:59		18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	17 15:49 (1)	16:27	24 15:13 (5)
21	08:33	15:56 (1)	07:42		06:40	06:30	05:36	05:17	05:42	06:30	07:20	08:11	08:06	15:32 (1)	08:43	14:49 (5)
	17:05	17 16:13 (1)	18:01		18:51	20:44	21:33	22:01	21:45	20:51	19:40	18:33	16:40	17 15:49 (1)	16:28	24 15:13 (5)
22	08:32	15:57 (1)	07:40		06:38	06:28	05:35	05:17	05:43	06:32	07:22	08:13	08:08	15:33 (1)	08:43	14:50 (5)
	17:06	17 16:14 (1)	18:03		18:53	20:46	21:34	22:01	21:44	20:49	19:38	18:31	16:39	16 15:49 (1)	16:28	24 15:14 (5)
23	08:31	15:57 (1)	07:38		06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	15:35 (1)	08:44	14:50 (5)
	17:08	18 16:15 (1)	18:05		18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:28	16:38	13 15:48 (1)	16:29	24 15:14 (5)
24	08:30	15:56 (1)	07:36		06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	15:35 (1)	08:44	14:51 (5)
	17:10	18 16:14 (1)	18:07		18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:26	16:37	12 15:47 (1)	16:29	24 15:15 (5)
25	08:29	15:57 (1)	07:34		06:31	06:22	05:31	05:18	05:48	06:36	07:27	07:18	08:13	15:37 (1)	08:45	14:51 (5)
	17:11	18 16:15 (1)	18:09		18:58	20:51	21:38	22:02	21:39	20:42	19:31	17:24	16:36	9 15:46 (1)	16:30	24 15:15 (5)
26	08:27	15:58 (1)	07:32		06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	15:39 (1)	08:45	14:52 (5)
	17:13	18 16:16 (1)	18:10		19:00	20:52	21:39	22:02	21:38	20:40	19:29	17:22	16:35	6 15:45 (1)	16:31	24 15:16 (5)
27	08:26	15:58 (1)	07:30		06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16		08:45	14:52 (5)
	17:15	17 16:15 (1)	18:12		19:01	20:54	21:41	22:01	21:37	20:38	19:26	17:20	16:34		16:31	24 15:16 (5)
28	08:25	15:59 (1)	07:27		06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	14:49 (5)	08:45	14:52 (5)
	17:17	17 16:16 (1)	18:14		19:03	20:56	21:42	22:01	21:35	20:36	19:24	17:18	16:33	6 14:55 (5)	16:32	24 15:16 (5)
29	08:23	15:59 (1)			07:21	06:14	05:27	05:20	05:53	06:43	07:34	07:25	08:19	14:48 (5)	08:46	14:53 (5)
	17:19	16 16:15 (1)			20:05	20:58	21:43	22:01	21:34	20:33	19:22	17:17	16:32	10 14:58 (5)	16:33	24 15:17 (5)
30	08:22	16:00 (1)			07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	14:46 (5)	08:46	14:53 (5)
	17:20	14 16:14 (1)			20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	13 14:59 (5)	16:34	24 15:17 (5)
31	08:20	16:02 (1)			07:17		05:25		05:56	06:46		07:29			08:46	14:54 (5)
	17:22	12 16:14 (1)			20:08		21:46		21:30	20:29		17:13			16:35	23 15:17 (5)
Potential sun hours	259		278		367	416	485	499	502	454	381	331	266		243	
Total, worst case		489		11										280		697
Sun reduction		0.16		0.21										0.18		0.13
Oper. time red.		1.00		1.00										1.00		1.00
Wind dir. red.		0.59		0.58										0.59		0.60
Total reduction		0.09		0.12										0.11		0.08
Total, real		45		1										30		57

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) / Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker / Last time (hh:mm) with flicker	(WTG causing flicker first time) / (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** T - H20

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:39	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:54	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:47	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
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	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:27	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
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	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** U - H21

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:14	06:10	05:24	05:21	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:26	19:17	17:11	16:30
2	08:45	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:49	07:38	07:32	08:23
	16:37	17:26	18:18	20:12	21:02	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:24
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:24	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:07	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:44	08:10	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:28
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:41	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:58	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:23	21:14	21:54	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:03	07:05	06:54	05:53	05:19	05:29	06:12	07:02	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:56	16:55	16:26
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:17	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:23	21:59	21:51	21:03	19:54	18:45	16:48	16:26
16	08:38	07:52	06:51	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	21:59	21:49	20:59	19:50	18:41	16:45	16:26
18	08:36	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:15	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:35	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:40	21:29	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:17	05:43	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:28	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:26	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:44
	17:11	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:29	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:31
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:23	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:18	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:53	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:45
	17:20		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:56	06:46		07:29		08:46
	17:22		20:08		21:45		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** V - H22

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February		March		April	May	June	July	August	September	October		November		December
1	08:46	08:19		07:25		07:14	06:10	05:24	05:21	05:58	06:48	07:37	18:09 (3)	07:31	15:57 (2)	08:22
	16:36	17:24		18:16		20:10	21:01	21:47	22:01	21:29	20:27	19:17 35	18:44 (5)	17:11 25	16:22 (2)	16:30
2	08:46	08:17		07:23		07:12	06:08	05:23	05:22	05:59	06:49	07:38	18:09 (3)	07:32	15:58 (2)	08:23
	16:37	17:26		18:18		20:12	21:02	21:48	22:00	21:27	20:24	19:15 33	18:42 (5)	17:09 24	16:22 (2)	16:30
3	08:45	08:15	16:40 (2)	07:21		07:10	06:06	05:23	05:23	06:01	06:51	07:40	18:09 (3)	07:34	15:59 (2)	08:25
	16:38	17:28 1	16:41 (2)	18:19		20:13	21:04	21:49	22:00	21:25	20:22	19:12 28	18:39 (5)	17:07 22	16:21 (2)	16:29
4	08:45	08:14	16:35 (2)	07:19		07:08	06:04	05:22	05:24	06:03	06:53	07:42	18:09 (3)	07:36	16:00 (2)	08:26
	16:39	17:30 11	16:46 (2)	18:21		20:15	21:06	21:50	21:59	21:24	20:20	19:10 22	18:31 (3)	17:05 20	16:20 (2)	16:29
5	08:45	08:12	16:33 (2)	07:16	17:43 (3)	07:05	06:02	05:21	05:24	06:04	06:54	07:44	18:10 (3)	07:38	16:01 (2)	08:27
	16:41	17:31 15	16:48 (2)	18:23 2	17:45 (3)	20:17	21:07	21:51	21:59	21:22	20:17	19:08 20	18:30 (3)	17:04 18	16:19 (2)	16:28
6	08:45	08:11	16:31 (2)	07:14	17:37 (3)	07:03	06:00	05:21	05:25	06:06	06:56	07:45	18:10 (3)	07:40	16:02 (2)	08:29
	16:42	17:33 18	16:49 (2)	18:25 12	17:49 (3)	20:18	21:09	21:52	21:58	21:20	20:15	19:05 17	18:27 (3)	17:02 16	16:18 (2)	16:28
7	08:44	08:09	16:30 (2)	07:12	17:35 (3)	07:01	05:58	05:20	05:26	06:07	06:58	07:47	18:12 (3)	07:41	16:05 (2)	08:30
	16:43	17:35 21	16:51 (2)	18:27 16	17:51 (3)	20:20	21:11	21:53	21:58	21:18	20:13	19:03 14	18:26 (3)	17:00 10	16:15 (2)	16:27
8	08:44	08:07	16:29 (2)	07:10	17:34 (3)	06:58	05:57	05:20	05:27	06:09	06:59	07:49	18:14 (3)	07:43		08:31
	16:44	17:37 23	16:52 (2)	18:28 18	17:52 (3)	20:22	21:12	21:54	21:57	21:16	20:11	19:01 9	18:21 (3)	16:58		16:27
9	08:43	08:05	16:29 (2)	07:07	17:33 (3)	06:56	05:55	05:19	05:28	06:10	07:01	07:50		07:45		08:32
	16:46	17:39 24	16:53 (2)	18:30 20	17:53 (3)	20:23	21:14	21:55	21:57	21:15	20:08	18:59		16:57		16:27
10	08:43	08:03	16:28 (2)	07:05	17:31 (3)	06:54	05:53	05:19	05:29	06:12	07:02	07:52		07:47		08:33
	16:47	17:41 26	16:54 (2)	18:32 22	17:53 (3)	20:25	21:16	21:55	21:56	21:13	20:06	18:56		16:55		16:26
11	08:42	08:02	16:28 (2)	07:03	17:31 (3)	06:52	05:52	05:18	05:30	06:14	07:04	07:54		07:49		08:34
	16:49	17:43 26	16:54 (2)	18:34 31	18:03 (5)	20:27	21:17	21:56	21:55	21:11	20:04	18:54		16:54		16:26
12	08:41	08:00	16:28 (2)	07:01	17:31 (3)	06:50	05:50	05:18	05:31	06:15	07:06	07:55		07:50		08:35
	16:50	17:45 26	16:54 (2)	18:35 33	18:04 (5)	20:29	21:19	21:57	21:54	21:09	20:01	18:52		16:52		16:26
13	08:41	07:58	16:28 (2)	06:58	17:30 (3)	06:47	05:48	05:18	05:32	06:17	07:07	07:57		07:52		08:36
	16:52	17:46 26	16:54 (2)	18:37 35	18:05 (5)	20:30	21:20	21:57	21:53	21:07	19:59	18:50		16:51		16:26
14	08:40	07:56	16:28 (2)	06:56	17:30 (3)	06:45	05:47	05:17	05:33	06:18	07:09	07:59		07:54		08:37
	16:53	17:48 26	16:54 (2)	18:39 35	18:05 (5)	20:32	21:22	21:58	21:52	21:05	19:57	18:48		16:49		16:26
15	08:39	07:54	16:28 (2)	06:54	17:30 (3)	06:43	05:45	05:17	05:34	06:20	07:11	08:01	17:55 (4)	07:56		08:38
	16:55	17:50 26	16:54 (2)	18:41 36	18:06 (5)	20:34	21:24	21:59	21:51	21:03	19:54	18:45 4	17:59 (4)	16:48		16:26
16	08:38	07:52	16:28 (2)	06:51	17:30 (3)	06:41	05:44	05:17	05:36	06:22	07:12	08:02	17:52 (4)	07:57		08:39
	16:56	17:52 26	16:54 (2)	18:42 35	18:05 (5)	20:35	21:25	21:59	21:50	21:01	19:52	18:43 10	18:02 (4)	16:46		16:26
17	08:37	07:50	16:29 (2)	06:49	17:31 (3)	06:38	05:42	05:17	05:37	06:23	07:14	08:04	17:51 (4)	07:59		08:40
	16:58	17:54 27	17:27 (4)	18:44 33	18:04 (5)	20:37	21:27	22:00	21:49	20:59	19:50	18:41 12	18:03 (4)	16:45		16:26
18	08:37	07:48	16:30 (2)	06:47	17:33 (3)	06:36	05:41	05:17	05:38	06:25	07:15	08:06	17:50 (4)	08:01		08:41
	16:59	17:56 31	17:29 (4)	18:46 28	18:03 (5)	20:39	21:28	22:00	21:48	20:57	19:47	18:39 14	18:04 (4)	16:44		16:27
19	08:36	07:46	16:30 (2)	06:45	17:35 (3)	06:34	05:39	05:17	05:39	06:27	07:17	08:08	17:49 (4)	08:03		08:41
	17:01	17:58 32	17:30 (4)	18:48 21	18:01 (5)	20:41	21:30	22:00	21:47	20:55	19:45	18:37 15	18:04 (4)	16:42		16:27
20	08:34	07:44	16:31 (2)	06:42	17:52 (5)	06:32	05:38	05:17	05:41	06:28	07:19	08:09	17:47 (2)	08:04		08:42
	17:03	17:59 32	17:32 (4)	18:49 7	17:59 (5)	20:42	21:31	22:01	21:46	20:53	19:43	18:35 25	18:04 (4)	16:41		16:27
21	08:33	07:42	16:33 (2)	06:40		06:30	05:36	05:17	05:42	06:30	07:20	08:11	17:03 (2)	08:06		08:43
	17:04	18:01 30	17:33 (4)	18:51		20:44	21:32	22:01	21:45	20:51	19:40	18:33 31	18:03 (4)	16:40		16:28
22	08:32	07:40	16:37 (2)	06:38		06:28	05:35	05:17	05:43	06:31	07:22	08:13	17:01 (2)	08:08		08:43
	17:06	18:03 23	17:33 (4)	18:53		20:46	21:34	22:01	21:43	20:48	19:38	18:30 32	18:02 (4)	16:39		16:28
23	08:31	07:38	17:18 (4)	06:35		06:26	05:34	05:18	05:45	06:33	07:24 18:38 (5)	08:15	17:00 (2)	08:09		08:44
	17:08	18:05 15	17:33 (4)	18:54		20:47	21:35	22:01	21:42	20:46	19:36 4	18:42 (5)	18:28 31	18:00 (4)	16:38	16:29
24	08:30	07:36	17:19 (4)	06:33		06:24	05:33	05:18	05:46	06:35	07:25 18:20 (1)	08:16	16:59 (2)	08:11		08:44
	17:10	18:07 13	17:32 (4)	18:56		20:49	21:37	22:01	21:41	20:44	19:33 17	18:44 (5)	18:26 29	17:57 (4)	16:36	16:29
25	08:29	07:34	17:20 (4)	06:31		06:22	05:31	05:18	05:48	06:36	07:27 18:17 (3)	07:18	15:58 (2)	08:13		08:45
	17:11	18:09 11	17:31 (4)	18:58		20:51	21:38	22:01	21:39	20:42	19:31 26	18:46 (5)	17:24 25	16:23 (2)	16:35	16:30
26	08:27	07:32	17:21 (4)	06:28		06:20	05:30	05:19	05:49	06:38	07:29 18:15 (3)	07:20	15:58 (2)	08:14		08:45
	17:13	18:10 8	17:29 (4)	19:00		20:52	21:39	22:01	21:38	20:40	19:29 32	18:47 (5)	17:22 26	16:24 (2)	16:35	16:31
27	08:26	07:29		06:26		06:18	05:29	05:19	05:50	06:40	07:30 18:12 (3)	07:22	15:57 (2)	08:16		08:45
	17:15	18:12		19:01		20:54	21:41	22:01	21:36	20:38	19:26 34	18:46 (5)	17:20 27	16:24 (2)	16:34	16:31
28	08:25	07:27		06:24		06:16	05:28	05:20	05:52	06:41	07:32 18:11 (3)	07:24	15:57 (2)	08:17		08:45
	17:17	18:14		19:03		20:56	21:42	22:01	21:35	20:35	19:24 35	18:46 (5)	17:18 27	16:24 (2)	16:33	16:32
29	08:23			07:21		06:14	05:27	05:20	05:53	06:43	07:33 18:11 (3)	07:25	15:57 (2)	08:19		08:45
	17:19			20:05		20:57	21:43	22:01	21:33	20:33	19:22 35	18:46 (5)	17:16 27	16:24 (2)	16:32	16:33
30	08:22			07:19		06:12	05:26	05:21	05:55	06:45	07:35 18:09 (3)	07:27	15:57 (2)	08:20		08:46
	17:20			20:06		20:59	21:44	22:01	21:32	20:31	19:19 36	18:45 (5)	17:15 27	16:24 (2)	16:31	16:34
31	08:20			07:17			05:25		05:56	06:46			07:29	15:58 (2)		08:46
	17:22			20:08			21:46		21:30	20:29			17:13 26	16:24 (2)		16:35
Potential sun hours	259	278		367		416	485	499	502	454	381	331		266		244
Total, worst case			517		384						219		566		135	
Sun reduction			0.21		0.24						0.28		0.24		0.18	
Oper. time red.			1.00		1.00						1.00		1.00		1.00	
Wind dir. red.			0.62		0.65						0.65		0.63		0.62	
Total reduction			0.13		0.16						0.18		0.15		0.11	
Total, real			66		60						40		85		15	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** W - H23

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:45	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:07	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:54	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:47	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:26	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:44
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** X - H24

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:14	06:10	05:24	20:43 (4) 05:21	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	9 20:52 (4) 22:01	21:29	20:27	19:17	17:11	16:31
2	08:45	08:17	07:23	07:12	06:08	05:24	20:44 (4) 05:22	06:00	06:49	07:39	07:32	08:23
	16:37	17:26	18:18	20:12	21:02	21:48	7 20:51 (4) 22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	07:10	06:06	05:23	20:46 (4) 05:23	06:01	06:51	07:40	07:34	08:24
	16:38	17:28	18:19	20:13	21:04	21:49	5 20:51 (4) 22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:24	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:07	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:44	08:10	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:28
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:41	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28 20:54 (4)	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:23	21:14	21:54	3 21:56 20:57 (4)	21:15	20:08	18:59	16:57	16:27
10	08:43	08:03	07:05	06:54	05:53	05:19	05:29 20:53 (4)	06:12	07:02	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	6 21:56 20:59 (4)	21:13	20:06	18:56	16:55	16:26
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30 20:51 (4)	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	8 21:55 20:59 (4)	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31 20:51 (4)	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	10 21:54 21:01 (4)	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48 20:45 (4)	05:18	05:32 20:50 (4)	06:17	07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30	21:20 1 20:46 (4)	21:57	12 21:53 21:02 (4)	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47 20:42 (4)	05:17	05:33 20:50 (4)	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22 8 20:50 (4)	21:58	13 21:52 21:03 (4)	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45 20:40 (4)	05:17	05:35 20:49 (4)	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:23 11 20:51 (4)	21:58	14 21:51 21:03 (4)	21:03	19:54	18:45	16:48	16:26
16	08:38	07:52	06:51	06:41	05:44 20:40 (4)	05:17	05:36 20:49 (4)	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25 13 20:53 (4)	21:59	15 21:50 21:04 (4)	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42 20:39 (4)	05:17	05:37 20:48 (4)	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27 15 20:54 (4)	21:59	16 21:49 21:04 (4)	20:59	19:50	18:41	16:45	16:27
18	08:36	07:48	06:47	06:36	05:41 20:38 (4)	05:17	05:38 20:48 (4)	06:25	07:15	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28 16 20:54 (4)	22:00	16 21:48 21:04 (4)	20:57	19:47	18:39	16:44	16:27
19	08:35	07:46	06:45	06:34	05:39 20:38 (4)	05:17	05:40 20:48 (4)	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:40	21:29 16 20:54 (4)	22:00	16 21:47 21:04 (4)	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38 20:38 (4)	05:17	05:41 20:48 (4)	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31 17 20:55 (4)	22:01	17 21:46 21:05 (4)	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37 20:38 (4)	05:17	05:42 20:48 (4)	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32 17 20:55 (4)	22:01	17 21:45 21:05 (4)	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35 20:37 (4)	05:18	05:44 20:48 (4)	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34 18 20:55 (4)	22:01	17 21:43 21:05 (4)	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34 20:38 (4)	05:18	05:45 20:48 (4)	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35 17 20:55 (4)	22:01	17 21:42 21:05 (4)	20:46	19:36	18:28	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33 20:38 (4)	05:18	05:46 20:49 (4)	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37 17 20:55 (4)	22:01	16 21:41 21:05 (4)	20:44	19:33	18:26	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32 20:38 (4)	05:18	05:48 20:49 (4)	06:36	07:27	07:18	08:13	08:44
	17:11	18:09	18:58	20:51	21:38 17 20:55 (4)	22:01	16 21:39 21:05 (4)	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30 20:39 (4)	05:19	05:49 20:49 (4)	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39 16 20:55 (4)	22:01	15 21:38 21:04 (4)	20:40	19:29	17:22	16:35	16:31
27	08:26	07:29	06:26	06:18	05:29 20:39 (4)	05:19	05:51 20:50 (4)	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41 15 20:54 (4)	22:01	14 21:36 21:04 (4)	20:38	19:26	17:20	16:34	16:31
28	08:24	07:27	06:24	06:16	05:28 20:39 (4)	05:20	05:52 20:50 (4)	06:41	07:32	07:23	08:17	08:45
	17:17	18:14	19:03	20:56	21:42 15 20:54 (4)	22:01	13 21:35 21:03 (4)	20:35	19:24	17:18	16:33	16:32
29	08:23		07:21	06:14	05:27 20:40 (4)	05:20	05:54 20:52 (4)	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43 13 20:53 (4)	22:01	10 21:33 21:02 (4)	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26 20:42 (4)	05:21	05:55 20:54 (4)	06:45	07:35	07:27	08:20	08:45
	17:20		20:06	20:59	21:44 12 20:54 (4)	22:01	6 21:32 21:00 (4)	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25 20:42 (4)		05:57	06:46		07:29		08:46
	17:22		20:08		21:45 11 20:53 (4)		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case					265	21	287					
Sun reduction					0.37	0.30	0.27					
Oper. time red.					1.00	1.00	1.00					
Wind dir. red.					0.69	0.69	0.69					
Total reduction					0.25	0.21	0.18					
Total, real					67	4	53					

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** Y - H25

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:25	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:45	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:39	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:07	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:54	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:47	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:34	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:27	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** Z - H26

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:45	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:49	07:39	07:32	08:23
	16:37	17:26	18:18	20:12	21:02	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:07	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:41	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:54	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:03	07:05	06:54	05:53	05:19	05:29	06:12	07:02	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:23	21:59	21:51	21:03	19:54	18:45	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:36	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:15	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:35	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:26	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:44
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:45		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AA - H27

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:14	06:10	05:24	05:21	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	22 17:26 (2)	21:01	21:47	22:01	21:29	20:26	19:17	17:11	16:30
2	08:45	08:17	07:23	17:03 (2)	07:12	05:23	05:22	05:59	06:49	07:38	07:32	08:23
	16:37	17:26	18:18	21 17:24 (2)	20:12	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	17:04 (2)	07:10	06:06	05:23	06:01	06:51	07:40	07:34	08:25
	16:38	17:28	18:19	19 17:23 (2)	20:13	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	17:06 (2)	07:08	06:04	05:22	05:24	06:03	07:42	07:36	08:26
	16:39	17:30	18:21	16 17:22 (2)	20:15	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	17:08 (2)	07:05	06:02	05:21	05:24	06:04	07:44	07:38	08:27
	16:41	17:31	18:23	12 17:20 (2)	20:17	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:45	08:11	07:14	17:11 (2)	07:03	06:00	05:21	05:25	06:06	07:45	07:40	08:29
	16:42	17:33	18:25	5 17:16 (2)	20:18	21:52	21:58	21:20	20:15	19:05	17:02	16:28
7	08:44	08:09	07:12		07:01	05:58	05:20	05:26	06:07	07:47	07:41	08:30
	16:43	17:35	18:26		20:20	21:11	21:53	21:58	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10		06:58	05:57	05:19	05:27	06:09	07:49	17:44 (2) 07:43	08:31
	16:44	17:37	18:28		20:22	21:12	21:54	21:57	20:11	19:01	10 17:54 (2) 16:58	16:27
9	08:43	08:05	07:07		06:56	05:55	05:19	05:28	06:10	07:01	07:50 17:42 (2) 07:45	08:32
	16:46	17:39	18:30		20:23	21:14	21:54	21:57	21:15	20:08	18:59 14 17:56 (2) 16:57	16:27
10	08:43	08:03	07:05		06:54	05:53	05:19	05:29	06:12	07:02	07:52 17:39 (2) 07:47	08:33
	16:47	17:41	18:32		20:25	21:16	21:55	21:56	21:13	20:06	18:56 18 17:57 (2) 16:55	16:26
11	08:42	08:02	07:03		06:52	05:52	05:18	05:30	06:14	07:04	07:54 17:38 (2) 07:49	08:34
	16:49	17:43	18:34		20:27	21:17	21:56	21:55	21:11	20:04	18:54 20 17:58 (2) 16:54	16:26
12	08:41	08:00	07:01		06:49	05:50	05:18	05:31	06:15	07:06	07:55 17:37 (2) 07:50	08:35
	16:50	17:45	18:35		20:29	21:19	21:57	21:54	21:09	20:01	18:52 22 17:59 (2) 16:52	16:26
13	08:41	07:58	06:58		06:47	05:48	05:18	05:32	06:17	07:07	07:57 17:37 (2) 07:52	08:36
	16:52	17:46	18:37		20:30	21:20	21:57	21:53	21:07	19:59	18:50 22 17:59 (2) 16:51	16:26
14	08:40	07:56	06:56		06:45	05:47	05:17	05:33	06:18	07:09	07:59 17:36 (2) 07:54	08:37
	16:53	17:48	18:39		20:32	21:22	21:58	21:52	21:05	19:57	18:48 23 17:59 (2) 16:49	16:26
15	08:39	07:54	06:54	17:59 (3)	06:43	05:45	05:17	05:34	06:20	07:11	08:01 17:35 (2) 07:56	08:38
	16:55	17:50	18:41	9 18:03 (3)	20:34	21:24	21:59	21:51	21:03	19:54	18:45 23 17:58 (2) 16:48	16:26
16	08:38	07:52	06:51	17:56 (3)	06:41	05:44	05:17	05:36	06:22	07:12	08:02 17:35 (2) 07:57	08:39
	16:56	17:52	18:42	13 18:09 (3)	20:35	21:25	21:59	21:50	21:01	19:52	18:43 23 17:58 (2) 16:46	16:26
17	08:37	07:50	06:49	17:54 (3)	06:38	05:42	05:17	05:37	06:23	07:14	18:44 (3) 08:04 17:35 (2) 07:59	08:40
	16:58	17:54	18:44	21 18:15 (5)	20:37	21:27	22:00	21:49	20:59	19:50	9 18:53 (3) 18:41 23 17:58 (2) 16:45	16:26
18	08:36	07:48	06:47	17:53 (3)	06:36	05:41	05:17	05:38	06:25	07:15	18:42 (3) 08:06 17:36 (2) 08:01	08:41
	16:59	17:56	18:46	24 18:17 (5)	20:39	21:28	22:00	21:48	20:57	19:47	18 19:00 (5) 18:39 21 17:57 (2) 16:44	16:27
19	08:35	07:46	17:13 (2) 06:45	17:52 (3)	06:34	05:39	05:17	05:39	06:27	07:17	18:39 (3) 08:08 17:37 (2) 08:03	08:41
	17:01	17:57	4 17:17 (2) 18:48	25 18:17 (5)	20:41	21:30	22:00	21:47	20:55	19:45	22 19:01 (5) 18:37 20 17:57 (2) 16:42	16:27
20	08:34	07:44	17:09 (2) 06:42	17:52 (3)	06:32	05:38	05:17	05:41	06:28	07:19	18:38 (3) 08:09 17:38 (2) 08:04	08:42
	17:03	17:59	12 17:21 (2) 18:49	25 18:17 (5)	20:42	21:31	22:01	21:46	20:53	19:43	24 19:02 (5) 18:35 17 17:55 (2) 16:41	16:27
21	08:33	07:42	17:07 (2) 06:40	17:52 (3)	06:30	05:36	05:17	05:42	06:30	07:20	18:37 (3) 08:11 17:38 (2) 08:06	08:43
	17:04	18:01	16 17:23 (2) 18:51	26 18:18 (5)	20:44	21:32	22:01	21:45	20:51	19:40	25 19:02 (5) 18:33 15 17:53 (2) 16:40	16:28
22	08:32	07:40	17:06 (2) 06:38	17:51 (3)	06:28	05:35	05:17	05:43	06:31	07:22	18:36 (3) 08:13 17:40 (2) 08:08	08:43
	17:06	18:03	19 17:25 (2) 18:53	25 18:16 (5)	20:46	21:34	22:01	21:43	20:48	19:38	26 19:02 (5) 18:30 11 17:51 (2) 16:39	16:28
23	08:31	07:38	17:05 (2) 06:35	17:52 (3)	06:26	05:34	05:18	05:45	06:33	07:24	18:36 (3) 08:15 08:09	08:44
	17:08	18:05	21 17:26 (2) 18:54	24 18:16 (5)	20:47	21:35	22:01	21:42	20:46	19:36	26 19:02 (5) 18:28 16:38	16:29
24	08:30	07:36	17:04 (2) 06:33	17:52 (3)	06:24	05:33	05:18	05:46	06:35	07:25	18:35 (3) 08:16 08:11	08:44
	17:10	18:07	22 17:26 (2) 18:56	23 18:15 (5)	20:49	21:37	22:01	21:41	20:44	19:33	26 19:01 (5) 18:26 16:36	16:29
25	08:29	07:34	17:04 (2) 06:31	17:53 (3)	06:22	05:31	05:18	05:48	06:36	07:27	18:36 (3) 07:18 08:13	08:45
	17:11	18:08	23 17:27 (2) 18:58	19 18:12 (5)	20:51	21:38	22:01	21:39	20:42	19:31	24 19:00 (5) 17:24 16:35	16:30
26	08:27	07:32	17:03 (2) 06:28	17:55 (3)	06:20	05:30	05:19	05:49	06:38	07:29	18:37 (3) 07:20 08:14	08:45
	17:13	18:10	23 17:26 (2) 19:00	10 18:05 (3)	20:52	21:39	22:01	21:38	20:40	19:29	21 18:58 (5) 17:22 16:35	16:31
27	08:26	07:29	17:03 (2) 06:26		06:17	05:29	05:19	05:50	06:40	07:30	18:37 (3) 07:22 08:16	08:45
	17:15	18:12	23 17:26 (2) 19:01		20:54	21:41	22:01	21:36	20:38	19:26	15 18:52 (3) 17:20 16:34	16:31
28	08:25	07:27	17:03 (2) 06:24		06:15	05:28	05:20	05:52	06:41	07:32	18:38 (3) 07:23 08:17	08:45
	17:17	18:14	23 17:26 (2) 19:03		20:56	21:42	22:01	21:35	20:35	19:24	12 18:50 (3) 17:18 16:33	16:32
29	08:23		07:21		06:14	05:27	05:20	05:53	06:43	07:33	18:42 (3) 07:25 08:19	08:45
	17:19		20:05		20:57	21:43	22:01	21:33	20:33	19:22	5 18:47 (3) 17:16 16:32	16:33
30	08:22		07:19		06:12	05:26	05:21	05:55	06:44	07:35	07:27 08:20	08:46
	17:20		20:06		20:59	21:44	22:01	21:32	20:31	19:19	17:15 16:31	16:34
31	08:20		07:17			05:25		05:56	06:46		07:29		08:46
	17:22		20:08			21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case		186	339						253	282		
Sun reduction		0.21	0.24						0.28	0.24		
Oper. time red.		1.00	1.00						1.00	1.00		
Wind dir. red.		0.64	0.66						0.66	0.64		
Total reduction		0.13	0.16						0.19	0.15		
Total, real		24	54						48	43		

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AB - H28

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:25	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:45	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:37	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:39	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:07	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:24	21:14	21:54	21:57	21:15	20:08	18:59	16:57	16:27
10	08:43	08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:27
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:47	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:34	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:51	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:27	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:44
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:32
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:19	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:46		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AC - H29

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March		April		May	June	July	August	September		October		November	December
1	08:46	08:19	07:25		07:14		19:07 (3)	06:10	05:24	05:21	05:58	06:48		07:37	18:05 (2)	07:31	08:22
	16:36	17:24	18:16		20:10	14	19:21 (3)	21:01	21:47	22:01	21:29	20:26		19:17	19 18:24 (2)	17:11	16:30
2	08:45	08:17	07:23		07:12		19:09 (3)	06:08	05:23	05:22	05:59	06:49		07:38	18:04 (2)	07:32	08:23
	16:37	17:26	18:18		20:12	10	19:19 (3)	21:02	21:48	22:00	21:27	20:24		19:15	20 18:24 (2)	17:09	16:30
3	08:45	08:15	07:21	17:33 (2)	07:10		19:12 (3)	06:06	05:23	05:23	06:01	06:51		07:40	18:03 (2)	07:34	08:25
	16:38	17:28	18:19	8 17:41 (2)	20:13	3	19:15 (3)	21:04	21:49	22:00	21:25	20:22		19:12	21 18:24 (2)	17:07	16:29
4	08:45	08:14	07:19	17:30 (2)	07:08			06:04	05:22	05:24	06:03	06:53		07:42	18:02 (2)	07:36	08:26
	16:39	17:30	18:21	14 17:44 (2)	20:15			21:06	21:50	21:59	21:24	20:20		19:10	22 18:24 (2)	17:05	16:29
5	08:45	08:12	07:16	17:29 (2)	07:05			06:02	05:21	05:24	06:04	06:54		07:44	18:02 (2)	07:38	08:27
	16:41	17:31	18:23	16 17:45 (2)	20:17			21:07	21:51	21:59	21:22	20:17		19:08	22 18:24 (2)	17:04	16:28
6	08:45	08:10	07:14	17:27 (2)	07:03			06:00	05:21	05:25	06:06	06:56		07:45	18:02 (2)	07:40	08:29
	16:42	17:33	18:25	18 17:45 (2)	20:18			21:09	21:52	21:58	21:20	20:15		19:05	20 18:22 (2)	17:02	16:28
7	08:44	08:09	07:12	17:26 (2)	07:01			05:58	05:20	05:26	06:07	06:58		07:47	18:02 (2)	07:41	08:30
	16:43	17:35	18:26	20 17:46 (2)	20:20			21:11	21:53	21:58	21:18	20:13		19:03	20 18:22 (2)	17:00	16:27
8	08:44	08:07	07:10	17:26 (2)	06:58			05:57	05:19	05:27	06:09	06:59		07:49	18:03 (2)	07:43	08:31
	16:44	17:37	18:28	21 17:47 (2)	20:22			21:12	21:54	21:57	21:16	20:11		19:01	18 18:21 (2)	16:58	16:27
9	08:43	08:05	07:07	17:25 (2)	06:56			05:55	05:19	05:28	06:10	07:01		07:50	18:04 (2)	07:45	08:32
	16:46	17:39	18:30	22 17:47 (2)	20:23			21:14	21:54	21:57	21:15	20:08		18:59	16 18:20 (2)	16:57	16:27
10	08:43	08:03	07:05	17:25 (2)	06:54			05:53	05:19	05:29	06:12	07:02	19:02 (3)	07:52	18:05 (2)	07:47	08:33
	16:47	17:41	18:32	21 17:46 (2)	20:25			21:16	21:55	21:56	21:13	20:06	10 19:12 (3)	18:56	12 18:17 (2)	16:55	16:26
11	08:42	08:02	07:03	17:25 (2)	06:52			05:52	05:18	05:30	06:14	07:04	18:59 (3)	07:54	18:09 (2)	07:49	08:34
	16:49	17:43	18:34	21 17:46 (2)	20:27			21:17	21:56	21:55	21:11	20:04	14 19:13 (3)	18:54	4 18:13 (2)	16:54	16:26
12	08:41	08:00	07:01	17:26 (2)	06:49			05:50	05:18	05:31	06:15	07:06	18:58 (3)	07:55		07:50	08:35
	16:50	17:44	18:35	19 17:45 (2)	20:29			21:19	21:57	21:54	21:09	20:01	16 19:14 (3)	18:52		16:52	16:26
13	08:41	07:58	06:58	17:25 (2)	06:47			05:48	05:18	05:32	06:17	07:07	18:57 (3)	07:57		07:52	08:36
	16:52	17:46	18:37	19 17:44 (2)	20:30			21:20	21:57	21:53	21:07	19:59	18 19:15 (3)	18:50		16:51	16:26
14	08:40	07:56	06:56	17:27 (2)	06:45			05:47	05:17	05:33	06:18	07:09	18:56 (3)	07:59		07:54	08:37
	16:53	17:48	18:39	15 17:42 (2)	20:32			21:22	21:58	21:52	21:05	19:57	18 19:14 (3)	18:48		16:49	16:26
15	08:39	07:54	06:54	17:29 (2)	06:43			05:45	05:17	05:34	06:20	07:11	18:56 (3)	08:01		07:56	08:38
	16:55	17:50	18:41	12 17:41 (2)	20:34			21:23	21:59	21:51	21:03	19:54	18 19:14 (3)	18:45		16:48	16:26
16	08:38	07:52	06:51	17:31 (2)	06:41			05:44	05:17	05:36	06:22	07:12	18:55 (3)	08:02		07:57	08:39
	16:56	17:52	18:42	5 17:36 (2)	20:35			21:25	21:59	21:50	21:01	19:52	18 19:13 (3)	18:43		16:46	16:26
17	08:37	07:50	06:49		06:38			05:42	05:17	05:37	06:23	07:14	18:56 (3)	08:04		07:59	08:40
	16:58	17:54	18:44		20:37			21:27	22:00	21:49	20:59	19:50	17 19:13 (3)	18:41		16:45	16:26
18	08:36	07:48	06:47		06:36			05:41	05:17	05:38	06:25	07:15	18:56 (3)	08:06		08:01	08:41
	16:59	17:56	18:46		20:39			21:28	22:00	21:48	20:57	19:47	16 19:12 (3)	18:39		16:44	16:27
19	08:35	07:46	06:45		06:34			05:39	05:17	05:39	06:27	07:17	18:57 (3)	08:08		08:03	08:41
	17:01	17:57	18:47		20:40			21:30	22:00	21:47	20:55	19:45	13 19:10 (3)	18:37		16:42	16:27
20	08:34	07:44	06:42		06:32			05:38	05:17	05:41	06:28	07:19	18:58 (3)	08:09		08:04	08:42
	17:03	17:59	18:49		20:42			21:31	22:01	21:46	20:53	19:43	10 19:08 (3)	18:35		16:41	16:27
21	08:33	07:42	06:40		06:30			05:36	05:17	05:42	06:30	07:20		08:11		08:06	08:43
	17:04	18:01	18:51		20:44			21:32	22:01	21:45	20:51	19:40		18:33		16:40	16:28
22	08:32	07:40	06:38		06:28			05:35	05:17	05:43	06:31	07:22		08:13		08:08	08:43
	17:06	18:03	18:53		20:46			21:34	22:01	21:43	20:48	19:38		18:30		16:39	16:28
23	08:31	07:38	06:35	18:12 (3)	06:26			05:34	05:18	05:45	06:33	07:24		08:15		08:09	08:44
	17:08	18:05	18:54	9 18:21 (3)	20:47			21:35	22:01	21:42	20:46	19:36		18:28		16:38	16:29
24	08:30	07:36	06:33	18:10 (3)	06:24			05:33	05:18	05:46	06:35	07:25		08:16		08:11	08:44
	17:10	18:07	18:56	13 18:23 (3)	20:49			21:37	22:01	21:41	20:44	19:33		18:26		16:36	16:29
25	08:29	07:34	06:31	18:08 (3)	06:22			05:31	05:18	05:48	06:36	07:27		07:18		08:13	08:44
	17:11	18:08	18:58	16 18:24 (3)	20:51			21:38	22:01	21:39	20:42	19:31		17:24		16:35	16:30
26	08:27	07:32	06:28	18:07 (3)	06:20			05:30	05:19	05:49	06:38	07:29		07:20		08:14	08:45
	17:13	18:10	19:00	17 18:24 (3)	20:52			21:39	22:01	21:38	20:40	19:29		17:22		16:34	16:31
27	08:26	07:29	06:26	18:07 (3)	06:17			05:29	05:19	05:50	06:40	07:30		07:22		08:16	08:45
	17:15	18:12	19:01	18 18:25 (3)	20:54			21:41	22:01	21:36	20:38	19:26		17:20		16:34	16:31
28	08:25	07:27	06:24	18:06 (3)	06:15			05:28	05:20	05:52	06:41	07:32	18:10 (2)	07:23		08:17	08:45
	17:17	18:14	19:03	18 18:24 (3)	20:56			21:42	22:01	21:35	20:35	19:24	11 18:21 (2)	17:18		16:33	16:32
29	08:23		07:21	19:06 (3)	06:14			05:27	05:20	05:53	06:43	07:33	18:08 (2)	07:25		08:19	08:45
	17:19		20:05	18 19:24 (3)	20:57			21:43	22:01	21:33	20:33	19:22	15 18:23 (2)	17:16		16:32	16:33
30	08:22		07:19	19:06 (3)	06:12			05:26	05:21	05:55	06:44	07:35	18:06 (2)	07:27		08:20	08:46
	17:20		20:06	18 19:24 (3)	20:59			21:44	22:01	21:32	20:31	19:19	17 18:23 (2)	17:15		16:31	16:34
31	08:20		07:17	19:06 (3)				05:25		05:56	06:46			07:29			08:46
	17:22		20:08	16 19:22 (3)				21:45		21:30	20:29			17:13			16:35
Potential sun hours	259	278	367		416			485	499	502	454	381		331		266	244
Total, worst case				374		27							211		194		
Sun reduction				0.24		0.35							0.28		0.24		
Oper. time red.				1.00		1.00							1.00		1.00		
Wind dir. red.				0.65		0.67							0.67		0.64		
Total reduction				0.16		0.24							0.19		0.15		
Total, real				60		6							40		30		

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AD - H30

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:45	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:49	07:39	07:32	08:23
	16:37	17:26	18:18	20:12	21:02	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:24
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:24	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:07	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:44	08:10	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:28
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:41	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:23	21:14	21:54	21:56	21:15	20:08	18:59	16:57	16:27
10	08:43	08:03	07:05	06:54	05:53	05:19	05:29	06:12	07:02	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:26
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:17	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:23	21:58	21:51	21:03	19:54	18:45	16:48	16:26
16	08:38	07:52	06:51	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	21:59	21:49	20:59	19:50	18:41	16:45	16:27
18	08:36	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:15	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:35	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:29	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:28	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:26	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:44
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:29	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:31
28	08:24	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:23	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:18	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:45
	17:20		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:45		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com

Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AE - H31

Assumptions for shadow calculations

Sunshine probability: 5 (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:24	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:45	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:49	07:39	07:32	08:23
	16:37	17:26	18:18	20:12	21:02	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:24
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:24	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:24	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:07	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:44	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:28
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:41	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:59	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:23	21:14	21:54	21:56	21:15	20:08	18:59	16:57	16:27
10	08:43	08:03	07:05	06:54	05:53	05:19	05:29	06:12	07:02	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:57	16:55	16:26
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
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13	08:41	07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30	21:20	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:33	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:23	21:59	21:51	21:03	19:54	18:45	16:48	16:26
16	08:38	07:52	06:51	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	21:59	21:49	20:59	19:50	18:41	16:45	16:27
18	08:36	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:15	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:35	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:41
	17:01	17:58	18:48	20:41	21:29	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:43	20:48	19:38	18:31	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:26	16:37	16:29
25	08:29	07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:44
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:29	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:31
28	08:25	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:23	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:18	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:45
	17:21		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
	17:22		20:08		21:45		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AF - H32

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:15	06:10	05:25	05:22	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31
2	08:46	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23
	16:38	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25
	16:39	17:28	18:20	20:13	21:04	21:49	22:00	21:25	20:22	19:13	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	22:00	21:24	20:20	19:10	17:06	16:29
5	08:45	08:12	07:17	07:06	06:02	05:22	05:25	06:04	06:54	07:44	07:38	08:27
	16:41	17:32	18:23	20:17	21:08	21:51	21:59	21:22	20:18	19:08	17:04	16:28
6	08:45	08:11	07:14	07:03	06:01	05:21	05:25	06:06	06:56	07:45	07:40	08:29
	16:42	17:34	18:25	20:19	21:09	21:52	21:59	21:20	20:15	19:06	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:08	06:58	07:47	07:42	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:13	21:54	21:57	21:17	20:11	19:01	16:59	16:27
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	16:46	17:39	18:30	20:24	21:14	21:55	21:57	21:15	20:08	18:59	16:57	16:27
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11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:42	08:00	07:01	06:50	05:50	05:18	05:31	06:16	07:06	07:56	07:51	08:36
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13	08:41	07:58	06:59	06:47	05:49	05:18	05:32	06:17	07:07	07:57	07:52	08:37
	16:52	17:47	18:37	20:30	21:21	21:57	21:53	21:07	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	05:18	05:34	06:19	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	21:58	21:53	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:24	21:59	21:52	21:03	19:54	18:46	16:48	16:26
16	08:38	07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:58	08:39
	16:57	17:52	18:43	20:36	21:25	21:59	21:51	21:01	19:52	18:43	16:46	16:27
17	08:38	07:50	06:49	06:39	05:42	05:17	05:37	06:24	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45	16:27
18	08:37	07:48	06:47	06:37	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:36	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:42
	17:01	17:58	18:48	20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:43	16:27
20	08:35	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	18:00	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:28
21	08:33	07:42	06:40	06:30	05:37	05:18	05:42	06:30	07:21	08:11	08:06	08:43
	17:05	18:01	18:51	20:44	21:33	22:01	21:45	20:51	19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35	05:18	05:44	06:32	07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34	22:01	21:44	20:49	19:38	18:31	16:39	16:28
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	17:08	18:05	18:55	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:17	08:11	08:44
	17:10	18:07	18:56	20:49	21:37	22:01	21:41	20:44	19:33	18:27	16:37	16:30
25	08:29	07:34	06:31	06:22	05:32	05:19	05:48	06:37	07:27	07:18	08:13	08:45
	17:12	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:25	16:36	16:30
26	08:27	07:32	06:29	06:20	05:31	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:11	19:00	20:53	21:39	22:01	21:38	20:40	19:29	17:23	16:35	16:31
27	08:26	07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:37	20:38	19:26	17:21	16:34	16:32
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	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:36	19:24	17:19	16:33	16:32
29	08:23		07:22	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:46
	17:19		20:05	20:58	21:43	22:01	21:34	20:33	19:22	17:17	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46
	17:21		20:07	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:57	06:46		07:29		08:46
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Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AGTYH33

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:14	19:10 (3)	06:10	05:24	05:21	05:58	06:48	07:37	18:12 (2)	07:31	08:22
	16:36	17:24	18:16	20:10	16 19:26 (3)	21:01	21:47	22:01	21:29	20:26	19:17	20 18:32 (2)	17:11	16:30
2	08:45	08:17	07:23	07:12	19:11 (3)	06:08	05:23	05:22	05:59	06:49	07:38	18:12 (2)	07:32	08:23
	16:37	17:26	18:18	20:11	14 19:25 (3)	21:02	21:48	22:00	21:27	20:24	19:15	20 18:32 (2)	17:09	16:30
3	08:45	08:15	07:21	07:10	19:13 (3)	06:06	05:23	05:23	06:01	06:51	07:40	18:11 (2)	07:34	08:25
	16:38	17:28	18:19	20:13	10 19:23 (3)	21:04	21:49	22:00	21:25	20:22	19:12	20 18:31 (2)	17:07	16:29
4	08:45	08:14	07:19	07:08	19:14 (3)	06:04	05:22	05:24	06:03	06:53	07:42	18:12 (2)	07:36	08:26
	16:39	17:30	18:21	20:15	6 19:20 (3)	21:06	21:50	21:59	21:24	20:20	19:10	18 18:30 (2)	17:05	16:29
5	08:45	08:12	07:16	07:05		06:02	05:21	05:24	06:04	06:54	07:43	18:13 (2)	07:38	08:27
	16:41	17:31	18:23	20:17		21:07	21:51	21:59	21:22	20:17	19:08	16 18:29 (2)	17:04	16:28
6	08:45	08:10	07:14	17:41 (2)	07:03	06:00	05:21	05:25	06:06	06:56	07:45	18:13 (2)	07:40	08:28
	16:42	17:33	18:25	5 17:46 (2)	20:18	21:09	21:52	21:58	21:20	20:15	19:05	14 18:27 (2)	17:02	16:28
7	08:44	08:09	07:12	17:38 (2)	07:01	05:58	05:20	05:26	06:07	06:58	07:47	18:15 (2)	07:41	08:30
	16:43	17:35	18:26	12 17:50 (2)	20:20	21:11	21:53	21:58	21:18	20:13	19:03	9 18:24 (2)	17:00	16:27
8	08:44	08:07	07:10	17:36 (2)	06:58	05:57	05:19	05:27	06:09	06:59	07:49		07:43	08:31
	16:44	17:37	18:28	15 17:51 (2)	20:22	21:12	21:54	21:57	21:16	20:11	4 19:14 (3)	19:01		16:58	16:27
9	08:43	08:05	07:07	17:35 (2)	06:56	05:55	05:19	05:28	06:10	07:01	19:06 (3)	07:50		07:45	08:32
	16:46	17:39	18:30	18 17:53 (2)	20:23	21:14	21:54	21:57	21:15	20:08	10 19:16 (3)	18:59		16:57	16:27
10	08:43	08:03	07:05	17:34 (2)	06:54	05:53	05:19	05:29	06:12	07:02	19:04 (3)	07:52		07:47	08:33
	16:47	17:41	18:32	18 17:52 (2)	20:25	21:16	21:55	21:56	21:13	20:06	14 19:18 (3)	18:56		16:55	16:26
11	08:42	08:02	07:03	17:33 (2)	06:52	05:52	05:18	05:30	06:14	07:04	19:03 (3)	07:54		07:49	08:34
	16:49	17:43	18:34	20 17:53 (2)	20:27	21:17	21:56	21:55	21:11	20:04	15 19:18 (3)	18:54		16:54	16:26
12	08:41	08:00	07:01	17:33 (2)	06:49	05:50	05:18	05:31	06:15	07:06	19:02 (3)	07:55		07:50	08:35
	16:50	17:44	18:36	20 17:53 (2)	20:29	21:19	21:57	21:54	21:09	20:01	17 19:19 (3)	18:52		16:52	16:26
13	08:41	07:58	06:58	17:32 (2)	06:47	05:48	05:18	05:32	06:17	07:07	19:02 (3)	07:57		07:52	08:36
	16:52	17:46	18:37	20 17:52 (2)	20:30	21:20	21:57	21:53	21:07	19:59	17 19:19 (3)	18:50		16:51	16:26
14	08:40	07:56	06:56	17:33 (2)	06:45	05:47	05:17	05:33	06:18	07:09	19:01 (3)	07:59		07:54	08:37
	16:53	17:48	18:39	19 17:52 (2)	20:32	21:22	21:58	21:52	21:05	19:57	17 19:18 (3)	18:48		16:49	16:26
15	08:39	07:54	06:54	17:33 (2)	06:43	05:45	05:17	05:34	06:20	07:11	19:01 (3)	08:01		07:56	08:38
	16:55	17:50	18:41	18 17:51 (2)	20:34	21:23	21:59	21:51	21:03	19:54	17 19:18 (3)	18:45		16:48	16:26
16	08:38	07:52	06:51	17:33 (2)	06:41	05:44	05:17	05:36	06:22	07:12	19:01 (3)	08:02		07:57	08:39
	16:56	17:52	18:42	17 17:50 (2)	20:35	21:25	21:59	21:50	21:01	19:52	15 19:16 (3)	18:43		16:46	16:26
17	08:37	07:50	06:49	17:35 (2)	06:38	05:42	05:17	05:37	06:23	07:14	19:02 (3)	08:04		07:59	08:40
	16:58	17:54	18:44	13 17:48 (2)	20:37	21:27	22:00	21:49	20:59	19:50	13 19:15 (3)	18:41		16:45	16:26
18	08:36	07:48	06:47	17:37 (2)	06:36	05:41	05:17	05:38	06:25	07:15	19:03 (3)	08:06		08:01	08:41
	16:59	17:56	18:46	9 17:46 (2)	20:39	21:28	22:00	21:48	20:57	19:47	11 19:14 (3)	18:39		16:44	16:27
19	08:35	07:46	06:45	06:34		05:39	05:17	05:39	06:27	07:17	19:06 (3)	08:08		08:03	08:41
	17:01	17:57	18:47	20:40		21:30	22:00	21:47	20:55	19:45	3 19:09 (3)	18:37		16:42	16:27
20	08:34	07:44	06:42	06:32		05:38	05:17	05:41	06:28	07:19		08:09		08:04	08:42
	17:03	17:59	18:49	20:42		21:31	22:01	21:46	20:53	19:43		18:35		16:41	16:27
21	08:33	07:42	06:40	06:30		05:36	05:17	05:42	06:30	07:20		08:11		08:06	08:43
	17:04	18:01	18:51	20:44		21:32	22:01	21:45	20:51	19:40		18:33		16:40	16:28
22	08:32	07:40	06:38	06:28		05:35	05:17	05:43	06:31	07:22		08:13		08:08	08:43
	17:06	18:03	18:53	20:46		21:34	22:01	21:43	20:48	19:38		18:30		16:39	16:28
23	08:31	07:38	06:35	06:26		05:34	05:18	05:45	06:33	07:24		08:15		08:09	08:44
	17:08	18:05	18:54	20:47		21:35	22:01	21:42	20:46	19:35		18:28		16:38	16:29
24	08:30	07:36	06:33	06:24		05:33	05:18	05:46	06:35	07:25		08:16		08:11	08:44
	17:10	18:07	18:56	20:49		21:37	22:01	21:41	20:44	19:33		18:26		16:36	16:29
25	08:29	07:34	06:31	18:15 (3)	06:22	05:31	05:18	05:48	06:36	07:27	18:21 (2)	07:18		08:13	08:44
	17:11	18:08	18:58	10 18:25 (3)	20:51	21:38	22:01	21:39	20:42	19:31	6 18:27 (2)	17:24		16:35	16:30
26	08:27	07:32	06:28	18:14 (3)	06:20	05:30	05:19	05:49	06:38	07:29	18:18 (2)	07:20		08:14	08:45
	17:13	18:10	19:00	13 18:27 (3)	20:52	21:39	22:01	21:38	20:40	19:29	12 18:30 (2)	17:22		16:34	16:31
27	08:26	07:29	06:26	18:12 (3)	06:17	05:29	05:19	05:50	06:40	07:30	18:15 (2)	07:22		08:16	08:45
	17:15	18:12	19:01	16 18:28 (3)	20:54	21:41	22:01	21:36	20:38	19:26	16 18:31 (2)	17:20		16:34	16:31
28	08:25	07:27	06:24	18:11 (3)	06:15	05:28	05:20	05:52	06:41	07:32	18:14 (2)	07:23		08:17	08:45
	17:17	18:14	19:03	16 18:27 (3)	20:56	21:42	22:01	21:35	20:35	19:24	18 18:32 (2)	17:18		16:33	16:32
29	08:23		07:21	19:10 (3)	06:13	05:27	05:20	05:53	06:43	07:33	18:14 (2)	07:25		08:19	08:45
	17:19		20:05	18 19:28 (3)	20:57	21:43	22:01	21:33	20:33	19:22	19 18:33 (2)	17:16		16:32	16:33
30	08:22		07:19	19:10 (3)	06:12	05:26	05:21	05:55	06:44	07:35	18:12 (2)	07:27		08:20	08:46
	17:20		20:06	18 19:28 (3)	20:59	21:44	22:01	21:32	20:31	19:19	20 18:32 (2)	17:15		16:31	16:34
31	08:20		07:17	19:10 (3)		05:25		05:56	06:46			07:29			08:46
	17:22		20:08	16 19:26 (3)		21:45		21:30	20:29			17:13			16:35
Potential sun hours	259	278	367	416		485	499	502	454	381		331		266	244
Total, worst case			311	46						244	117				
Sun reduction			0.24	0.35						0.28	0.24				
Oper. time red.			1.00	1.00						1.00	1.00				
Wind dir. red.			0.65	0.67						0.66	0.64				
Total reduction			0.16	0.24						0.19	0.15				
Total, real			50	11						46	18				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AH - H34

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January			February	March	April	May	June	July	August	September	October	November	December		
1	08:46		09:50 (3)	08:19	07:25	07:15	06:10	05:24	05:21	05:58	06:48	07:37	07:31	08:22		
	16:36	15	10:05 (3)	17:24	18:16	20:10	21:01	21:47	22:01	21:29	20:27	19:17	17:11	16:31		
2	08:46		09:51 (3)	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:50	07:39	07:33	08:23		
	16:37	15	10:06 (3)	17:26	18:18	20:12	21:03	21:48	22:00	21:27	20:24	19:15	17:09	16:30		
3	08:46		09:52 (3)	08:16	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:25		09:43 (3)
	16:38	14	10:06 (3)	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:13	17:07	16:29	4	09:47 (3)
4	08:45		09:52 (3)	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26		09:42 (3)
	16:40	14	10:06 (3)	17:30	18:21	20:15	21:06	21:50	22:00	21:24	20:20	19:10	17:05	16:29	7	09:49 (3)
5	08:45		09:53 (3)	08:12	07:17	07:05	06:02	05:21	05:24	06:04	06:54	07:44	07:38	08:27		09:41 (3)
	16:41	13	10:06 (3)	17:32	18:23	20:17	21:08	21:51	21:59	21:22	20:18	19:08	17:04	16:28	10	09:51 (3)
6	08:45		09:54 (3)	08:11	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:29		09:40 (3)
	16:42	11	10:05 (3)	17:33	18:25	20:19	21:09	21:52	21:59	21:20	20:15	19:06	17:02	16:28	11	09:51 (3)
7	08:44		09:55 (3)	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:42	08:30		09:40 (3)
	16:43	11	10:06 (3)	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27	13	09:53 (3)
8	08:44		09:57 (3)	08:07	07:10	06:59	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31		09:40 (3)
	16:45	7	10:04 (3)	17:37	18:28	20:22	21:13	21:54	21:57	21:17	20:11	19:01	16:59	16:27	14	09:54 (3)
9	08:43		09:59 (3)	08:05	07:08	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32		09:40 (3)
	16:46	5	10:04 (3)	17:39	18:30	20:24	21:14	21:55	21:57	21:15	20:08	18:59	16:57	16:27	14	09:54 (3)
10	08:43			08:04	07:05	06:54	05:53	05:19	05:29	06:12	07:03	07:52	07:47	08:34		09:40 (3)
	16:47			17:41	18:32	20:25	21:16	21:56	21:56	21:13	20:06	18:57	16:55	16:26	15	09:55 (3)
11	08:42			08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:35		09:40 (3)
	16:49			17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26	15	09:55 (3)
12	08:42			08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:56	07:51	08:36		09:41 (3)
	16:50			17:45	18:35	20:29	21:19	21:57	21:54	21:09	20:01	18:52	16:52	16:26	16	09:57 (3)
13	08:41			07:58	06:58	06:47	05:48	05:18	05:32	06:17	07:07	07:57	07:52	08:37		09:41 (3)
	16:52			17:47	18:37	20:30	21:21	21:58	21:54	21:07	19:59	18:50	16:51	16:26	17	09:58 (3)
14	08:40			07:56	06:56	06:45	05:47	05:17	05:33	06:19	07:09	07:59	07:54	08:38		09:41 (3)
	16:53			17:48	18:39	20:32	21:22	21:58	21:53	21:05	19:57	18:48	16:49	16:26	16	09:57 (3)
15	08:39			07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:39		09:41 (3)
	16:55			17:50	18:41	20:34	21:24	21:59	21:52	21:03	19:54	18:46	16:48	16:26	17	09:58 (3)
16	08:39			07:52	06:52	06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:58	08:39		09:42 (3)
	16:56			17:52	18:42	20:36	21:25	21:59	21:51	21:01	19:52	18:43	16:46	16:26	17	09:59 (3)
17	08:38			07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40		09:42 (3)
	16:58			17:54	18:44	20:37	21:27	22:00	21:50	20:59	19:50	18:41	16:45	16:26	17	09:59 (3)
18	08:37			07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:16	08:06	08:01	08:41		09:43 (3)
	17:00			17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27	17	10:00 (3)
19	08:36			07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:08	08:03	08:42		09:43 (3)
	17:01			17:58	18:48	20:41	21:30	22:01	21:47	20:55	19:45	18:37	16:42	16:27	17	10:00 (3)
20	08:35			07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:05	08:42		09:43 (3)
	17:03			17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27	18	10:01 (3)
21	08:34			07:42	06:40	06:30	05:37	05:17	05:42	06:30	07:20	08:11	08:06	08:43		09:44 (3)
	17:05			18:01	18:51	20:44	21:33	22:01	21:45	20:51	19:40	18:33	16:40	16:28	18	10:02 (3)
22	08:32			07:40	06:38	06:28	05:35	05:17	05:44	06:32	07:22	08:13	08:08	08:43		09:44 (3)
	17:06			18:03	18:53	20:46	21:34	22:01	21:44	20:49	19:38	18:31	16:39	16:28	18	10:02 (3)
23	08:31			07:38	06:35	06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:10	08:44		09:44 (3)
	17:08			18:05	18:55	20:47	21:35	22:01	21:42	20:46	19:36	18:29	16:38	16:29	18	10:02 (3)
24	08:30			07:36	06:33	06:24	05:33	05:18	05:46	06:35	07:25	08:17	08:11	08:44		09:45 (3)
	17:10			18:07	18:56	20:49	21:37	22:02	21:41	20:44	19:33	18:27	16:37	16:29	18	10:03 (3)
25	08:29			07:34	06:31	06:22	05:32	05:18	05:48	06:36	07:27	07:18	08:13	08:45		09:46 (3)
	17:12			18:09	18:58	20:51	21:38	22:02	21:40	20:42	19:31	17:24	16:36	16:30	17	10:03 (3)
26	08:27			07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45		09:46 (3)
	17:13			18:10	19:00	20:53	21:40	22:02	21:38	20:40	19:29	17:22	16:35	16:31	17	10:03 (3)
27	08:26			07:30	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45		09:46 (3)
	17:15			18:12	19:01	20:54	21:41	22:02	21:37	20:38	19:26	17:20	16:34	16:31	18	10:04 (3)
28	08:25			07:28	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:24	08:17	08:46		09:48 (3)
	17:17			18:14	19:03	20:56	21:42	22:01	21:35	20:36	19:24	17:19	16:33	16:32	17	10:05 (3)
29	08:23				07:22	06:14	05:27	05:20	05:54	06:43	07:34	07:25	08:19	08:46		09:48 (3)
	17:19				20:05	20:58	21:43	22:01	21:34	20:33	19:22	17:17	16:32	16:33	17	10:05 (3)
30	08:22				07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:46		09:49 (3)
	17:21				20:07	20:59	21:45	22:01	21:32	20:31	19:19	17:15	16:31	16:34	17	10:06 (3)
31	08:20				07:17		05:25		05:57	06:46		07:29		08:46		09:49 (3)
	17:22				20:08		21:46		21:30	20:29		17:13		16:35	16	10:05 (3)
Potential sun hours	259			278	367	416	485	499	502	454	381	331	266	243		
Total, worst case		105													446	
Sun reduction		0.16													0.13	
Oper. time red.		1.00													1.00	
Wind dir. red.		0.66													0.66	
Total reduction		0.10													0.09	
Total, real		11													40	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AI - H35

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	07:14	06:10	20:08 (2)	05:24	05:21	05:58	20:15 (2)	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01 13	20:21 (2)	21:47	22:01	21:29 18	20:33 (2)	20:26	19:17	17:11	16:30
2	08:45	08:17	07:23	07:12	06:08	20:06 (2)	05:24	05:22	05:59	20:14 (2)	06:49	07:38	07:32	08:23
	16:37	17:26	18:18	20:11	21:02 16	20:22 (2)	21:48	22:00	21:27 19	20:33 (2)	20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	07:10	06:06	20:05 (2)	05:23	05:23	06:01	20:14 (2)	06:51	07:40	07:34	08:24
	16:38	17:28	18:19	20:13	21:04 17	20:22 (2)	21:49	22:00	21:25 20	20:34 (2)	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	20:05 (2)	05:22	05:24	06:03	20:14 (2)	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06 19	20:24 (2)	21:50	21:59	21:24 20	20:34 (2)	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	20:04 (2)	05:21	05:24	06:04	20:14 (2)	06:54	07:43	07:38	08:27
	16:41	17:31	18:23	20:17	21:07 20	20:24 (2)	21:51	21:59	21:22 20	20:34 (2)	20:17	19:08	17:04	16:28
6	08:44	08:10	07:14	07:03	06:00	20:03 (2)	05:21	05:25	06:06	20:13 (2)	06:56	07:45	07:40	08:28
	16:42	17:33	18:25	20:18	21:09 21	20:24 (2)	21:52	21:58	21:20 21	20:34 (2)	20:15	19:05	17:02	16:28
7	08:44	08:09	07:12	07:01	05:58	20:04 (2)	05:20	05:26	06:07	20:13 (2)	06:58	07:47	07:41	08:30
	16:43	17:35	18:26	20:20	21:11 20	20:24 (2)	21:53	21:58	21:18 20	20:33 (2)	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:58	05:57	20:04 (2)	05:20	05:27	06:09	20:14 (2)	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12 20	20:24 (2)	21:54	21:57	21:16 19	20:33 (2)	20:11	19:01	16:58	16:27
9	08:43	08:05	07:07	06:56	05:55	20:03 (2)	05:19	05:28	06:10	20:14 (2)	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:23	21:14 20	20:23 (2)	21:54	21:56	21:14 18	20:32 (2)	20:08	18:59	16:57	16:27
10	08:43	08:03	07:05	06:54	05:53	20:04 (2)	05:19	05:29	06:12	20:15 (2)	07:02	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16 20	20:24 (2)	21:55	21:56	21:13 17	20:32 (2)	20:06	18:56	16:55	16:26
11	08:42	08:02	07:03	06:52	05:52	20:04 (2)	05:18	05:30	06:14	20:15 (2)	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17 19	20:23 (2)	21:56	21:55	21:11 15	20:30 (2)	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:49	05:50	20:05 (2)	05:18	05:31	06:15	20:17 (2)	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19 18	20:23 (2)	21:57	21:54	21:09 12	20:29 (2)	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	20:05 (2)	05:18	05:32	06:17	20:18 (2)	07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30	21:20 16	20:21 (2)	21:57	21:53	21:07 8	20:26 (2)	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	20:07 (2)	05:17	05:33	06:18		07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22 14	20:21 (2)	21:58	21:52	21:05		19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	20:07 (2)	05:17	05:35	06:20		07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:23 12	20:19 (2)	21:58	21:51	21:03		19:54	18:45	16:48	16:26
16	08:38	07:52	06:51	06:41	05:44	20:09 (2)	05:17	05:36	06:22		07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25 9	20:18 (2)	21:59	21:50	21:01		19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:38	05:42		05:17	05:37	06:23		07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:26		21:59	21:49	20:59		19:50	18:41	16:45	16:26
18	08:36	07:48	06:47	06:36	05:41		05:17	05:38	06:25		07:15	08:06	08:01	08:41
	16:59	17:56	18:46	20:39	21:28		22:00	21:48	20:57		19:47	18:39	16:44	16:27
19	08:35	07:46	06:45	06:34	05:39		05:17	05:39	06:27		07:17	08:07	08:03	08:41
	17:01	17:57	18:47	20:40	21:29		22:00	21:47	20:55		19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38		05:17	05:41	06:28		07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31		22:01	21:46	20:53		19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:36		05:17	05:42	06:30		07:20	08:11	08:06	08:43
	17:04	18:01	18:51	20:44	21:32		22:01	21:45	20:51		19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35		05:17	05:43	06:31		07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34		22:01	21:43	20:48		19:38	18:30	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34		05:18	05:45	06:33		07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35		22:01	21:42	20:46		19:36	18:28	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33		05:18	05:46	06:35		07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37		22:01	21:41	20:44		19:33	18:26	16:37	16:29
25	08:28	07:34	06:31	06:22	05:31		05:18	05:48	06:36		07:27	07:18	08:12	08:44
	17:11	18:08	18:58	20:51	21:38		22:01	21:39	20:42		19:31	17:24	16:35	16:30
26	08:27	07:32	06:28	06:20	05:30		05:19	05:49	06:38		07:28	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39		22:01	21:38	20:40		19:29	17:22	16:35	16:31
27	08:26	07:29	06:26	06:18	05:29		05:19	05:50	20:22 (2)	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41		22:01	21:36 5	20:27 (2)	20:38	19:26	17:20	16:34	16:31
28	08:24	07:27	06:24	06:16	05:28		05:20	05:52	20:19 (2)	06:41	07:32	07:23	08:17	08:45
	17:17	18:14	19:03	20:56	21:42		22:01	21:35 10	20:29 (2)	20:35	19:24	17:18	16:33	16:32
29	08:23		07:21	06:14	05:27		05:20	05:53	20:17 (2)	06:43	07:33	07:25	08:19	08:45
	17:19		20:05	20:57	21:43		22:01	21:33 13	20:30 (2)	20:33	19:22	17:16	16:32	16:33
30	08:22		07:19	06:12	20:10 (2) 05:26		05:21	05:55	20:17 (2)	06:44	07:35	07:27	08:20	08:45
	17:20		20:06	20:59	9 20:19 (2) 21:44		22:01	21:32 15	20:32 (2)	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25			05:56	20:15 (2)	06:46		07:29		08:46
	17:22		20:08		21:45			21:30 17	20:32 (2)	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case				9	274		60	227				
Sun reduction				0.35	0.37		0.27	0.30				
Oper. time red.				1.00	1.00		1.00	1.00				
Wind dir. red.				0.68	0.68		0.68	0.68				
Total reduction				0.24	0.25		0.18	0.20				
Total, real				2	69		11	46				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AJ - H36

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April		May		June	July		August		September	October	November	December
1	08:46	08:19	07:25	07:14		06:10		20:02 (2)	05:24	05:21		05:58		20:15 (2)	06:48	07:17	07:31	08:22
	16:36	17:24	18:16	20:10		21:01	17	20:19 (2)	21:47	22:00		21:29	11	20:26 (2)	20:26	19:17	17:11	16:30
2	08:45	08:17	07:23	07:12		06:08		20:01 (2)	05:24	05:22		05:59		20:13 (2)	06:49	07:38	07:32	08:23
	16:37	17:26	18:18	20:11		21:02	19	20:20 (2)	21:48	22:00		21:27	14	20:27 (2)	20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	07:10		06:06		20:00 (2)	05:23	05:23		06:01		20:13 (2)	06:51	07:40	07:34	08:24
	16:38	17:28	18:19	20:13		21:04	20	20:20 (2)	21:49	22:00		21:25	16	20:29 (2)	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08		06:04		20:01 (2)	05:22	05:24		06:03		20:11 (2)	06:53	07:42	07:36	08:26
	16:39	17:30	18:21	20:15		21:06	20	20:21 (2)	21:50	21:59		21:24	18	20:29 (2)	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05		06:02		20:00 (2)	05:21	05:24		06:04		20:11 (2)	06:54	07:43	07:38	08:27
	16:41	17:31	18:23	20:17		21:07	20	20:20 (2)	21:51	21:59		21:22	19	20:30 (2)	20:17	19:08	17:04	16:28
6	08:44	08:10	07:14	07:03		06:00		20:00 (2)	05:21	05:25		06:06		20:10 (2)	06:56	07:45	07:40	08:28
	16:42	17:33	18:25	20:18		21:09	20	20:20 (2)	21:52	21:58		21:20	20	20:30 (2)	20:15	19:05	17:02	16:28
7	08:44	08:09	07:12	07:01		05:58		20:01 (2)	05:20	05:26		06:07		20:10 (2)	06:58	07:47	07:41	08:30
	16:43	17:35	18:26	20:20		21:11	19	20:20 (2)	21:53	21:58		21:18	19	20:29 (2)	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:58		05:57		20:01 (2)	05:20	05:27		06:09		20:10 (2)	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22		21:12	18	20:19 (2)	21:54	21:57		21:16	20	20:30 (2)	20:10	19:01	16:58	16:27
9	08:43	08:05	07:07	06:56		05:55		20:01 (2)	05:19	05:28		06:10		20:09 (2)	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:23		21:14	17	20:18 (2)	21:54	21:56		21:14	20	20:29 (2)	20:08	18:59	16:57	16:27
10	08:43	08:03	07:05	06:54		05:53		20:03 (2)	05:19	05:29		06:12		20:10 (2)	07:02	07:52	07:47	08:33
	16:47	17:41	18:32	20:25		21:16	15	20:18 (2)	21:55	21:56		21:13	19	20:29 (2)	20:06	18:56	16:55	16:26
11	08:42	08:02	07:03	06:52		05:52		20:03 (2)	05:18	05:30		06:14		20:10 (2)	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27		21:17	13	20:16 (2)	21:56	21:55		21:11	18	20:28 (2)	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:49		05:50		20:05 (2)	05:18	05:31		06:15		20:11 (2)	07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29		21:19	10	20:15 (2)	21:57	21:54		21:09	17	20:28 (2)	20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47		05:48		20:07 (2)	05:18	05:32		06:17		20:11 (2)	07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30		21:20	6	20:13 (2)	21:57	21:53		21:07	15	20:26 (2)	19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45		05:47			05:17	05:33		06:18		20:12 (2)	07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32		21:22			21:58	21:52		21:05	13	20:25 (2)	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43		05:45			05:17	05:35		06:20		20:14 (2)	07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34		21:23			21:58	21:51		21:03	10	20:24 (2)	19:54	18:45	16:48	16:26
16	08:38	07:52	06:51	06:41		05:44			05:17	05:36		06:22		20:18 (2)	07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35		21:25			21:59	21:50		21:01	1	20:19 (2)	19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:38		05:42			05:17	05:37		06:23			07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37		21:26			21:59	21:49		20:59			19:50	18:41	16:45	16:26
18	08:36	07:48	06:47	06:36		05:41			05:17	05:38		06:25			07:15	08:06	08:01	08:41
	16:59	17:56	18:46	20:39		21:28			22:00	21:48		20:57			19:47	18:39	16:44	16:27
19	08:35	07:46	06:44	06:34		05:39			05:17	05:39		06:27			07:17	08:07	08:03	08:41
	17:01	17:57	18:47	20:40		21:29			22:00	21:47		20:55			19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32		05:38			05:17	05:41		06:28			07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42		21:31			22:01	21:46		20:53			19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30		05:36			05:17	05:42		06:30			07:20	08:11	08:06	08:43
	17:04	18:01	18:51	20:44		21:32			22:01	21:45		20:51			19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28		05:35			05:17	05:43		06:31			07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46		21:34			22:01	21:43		20:48			19:38	18:30	16:39	16:28
23	08:31	07:38	06:35	06:26		05:34			05:18	05:45		06:33			07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47		21:35			22:01	21:42		20:46			19:36	18:28	16:38	16:29
24	08:30	07:36	06:33	06:24		05:33			05:18	05:46		06:35			07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49		21:37			22:01	21:41		20:44			19:33	18:26	16:37	16:29
25	08:28	07:34	06:31	06:22		05:31			05:18	05:48		06:36			07:27	07:18	08:12	08:44
	17:11	18:08	18:58	20:51		21:38			22:01	21:39		20:42			19:31	17:24	16:35	16:30
26	08:27	07:32	06:28	06:20		05:30			05:19	05:49		06:38			07:28	07:20	08:14	08:45
	17:13	18:10	19:00	20:52		21:39			22:01	21:38		20:40			19:29	17:22	16:35	16:31
27	08:26	07:29	06:26	06:18		20:09 (2)	05:29		05:19	05:50		06:40			07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	5	20:14 (2)	21:41		22:01	21:36		20:38			19:26	17:20	16:34	16:31
28	08:24	07:27	06:24	06:16		20:06 (2)	05:28		05:20	05:52		06:41			07:32	07:23	08:17	08:45
	17:17	18:14	19:03	20:56	11	20:17 (2)	21:42		22:01	21:35		20:35			19:24	17:18	16:33	16:32
29	08:23		07:21	06:14		20:04 (2)	05:27		05:20	05:53		06:43			07:33	07:25	08:19	08:45
	17:19		20:05	20:57	14	20:18 (2)	21:43		22:01	21:33		20:33			19:22	17:16	16:32	16:33
30	08:22		07:19	06:12		20:03 (2)	05:26		05:21	05:55		06:44			07:35	07:27	08:20	08:45
	17:20		20:06	20:59	16	20:19 (2)	21:44		22:01	21:32		20:31			19:19	17:15	16:31	16:34
31	08:20		07:17				05:25			05:56	20:16 (2)	06:46				07:29		08:46
	17:22		20:08				21:45			21:30	8 20:24 (2)	20:29				17:13		16:35
Potential sun hours	259	278	367	416		485		499	502		454		381	931	266	244
Total, worst case					46		214			8		250				
Sun reduction					0.35		0.37			0.27		0.30				
Oper. time red.					1.00		1.00			1.00		1.00				
Wind dir. red.					0.67		0.67			0.67		0.67				
Total reduction					0.24		0.25			0.18		0.20				
Total, real					11		53			1		50				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AK - H37

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May		June	July		August		September	October	November	December
1	08:46	08:19	07:25	07:14	06:10		05:24	05:21		05:58		20:19 (2)	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01		21:47	22:00		21:29	20	20:39 (2)	20:26	19:17	17:11	16:30
2	08:45	08:17	07:23	07:12	06:08	20:17 (2)	05:24	05:22		05:59		20:18 (2)	06:49	07:38	07:32	08:23
	16:37	17:26	18:18	20:11	21:02	3 20:20 (2)	21:48	22:00		21:27	20	20:38 (2)	20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	07:10	06:06	20:13 (2)	05:23	05:23		06:01		20:19 (2)	06:51	07:40	07:34	08:24
	16:38	17:28	18:19	20:13	21:04	10 20:23 (2)	21:49	22:00		21:25	20	20:39 (2)	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	20:12 (2)	05:22	05:24		06:03		20:18 (2)	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	13 20:25 (2)	21:50	21:59		21:24	20	20:38 (2)	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	20:11 (2)	05:21	05:24		06:04		20:19 (2)	06:54	07:43	07:38	08:27
	16:41	17:31	18:23	20:17	21:07	15 20:26 (2)	21:51	21:59		21:22	19	20:38 (2)	20:17	19:08	17:04	16:28
6	08:44	08:10	07:14	07:03	06:00	20:10 (2)	05:21	05:25		06:06		20:19 (2)	06:56	07:45	07:40	08:28
	16:42	17:33	18:25	20:18	21:09	17 20:27 (2)	21:52	21:58		21:20	18	20:37 (2)	20:15	19:05	17:02	16:28
7	08:44	08:09	07:12	07:01	05:58	20:10 (2)	05:20	05:26		06:07		20:19 (2)	06:58	07:47	07:41	08:30
	16:43	17:35	18:26	20:20	21:11	18 20:28 (2)	21:53	21:58		21:18	17	20:36 (2)	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:58	05:57	20:09 (2)	05:20	05:27		06:09		20:21 (2)	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	19 20:28 (2)	21:54	21:57		21:16	14	20:35 (2)	20:11	19:01	16:58	16:27
9	08:43	08:05	07:07	06:56	05:55	20:08 (2)	05:19	05:28		06:10		20:21 (2)	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:23	21:14	20 20:28 (2)	21:54	21:56		21:14	12	20:33 (2)	20:08	18:59	16:57	16:27
10	08:43	08:03	07:05	06:54	05:53	20:08 (2)	05:19	05:29		06:12		20:23 (2)	07:02	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	20 20:28 (2)	21:55	21:56		21:13	9	20:32 (2)	20:06	18:56	16:55	16:26
11	08:42	08:02	07:03	06:52	05:52	20:08 (2)	05:18	05:30		06:14			07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	20 20:28 (2)	21:56	21:55		21:11			20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:49	05:50	20:09 (2)	05:18	05:31		06:15			07:06	07:55	07:50	08:35
	16:50	17:45	18:35	20:29	21:19	19 20:28 (2)	21:57	21:54		21:09			20:01	18:52	16:52	16:26
13	08:41	07:58	06:58	06:47	05:48	20:08 (2)	05:18	05:32		06:17			07:07	07:57	07:52	08:36
	16:52	17:46	18:37	20:30	21:20	19 20:27 (2)	21:57	21:53		21:07			19:59	18:50	16:51	16:26
14	08:40	07:56	06:56	06:45	05:47	20:09 (2)	05:17	05:33		06:18			07:09	07:59	07:54	08:37
	16:53	17:48	18:39	20:32	21:22	18 20:27 (2)	21:58	21:52		21:05			19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	20:09 (2)	05:17	05:35		06:20			07:11	08:01	07:56	08:38
	16:55	17:50	18:41	20:34	21:23	17 20:26 (2)	21:58	21:51		21:03			19:54	18:45	16:48	16:26
16	08:38	07:52	06:51	06:41	05:44	20:10 (2)	05:17	05:36		06:22			07:12	08:02	07:57	08:39
	16:56	17:52	18:42	20:35	21:25	16 20:26 (2)	21:59	21:50		21:01			19:52	18:43	16:46	16:26
17	08:37	07:50	06:49	06:38	05:42	20:11 (2)	05:17	05:37		06:23			07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:26	15 20:26 (2)	21:59	21:49		20:59			19:50	18:41	16:45	16:26
18	08:36	07:48	06:47	06:36	05:41	20:12 (2)	05:17	05:38		06:25			07:15	08:06	08:01	08:41
	16:59	17:56	18:46	20:39	21:28	12 20:24 (2)	22:00	21:48		20:57			19:47	18:39	16:44	16:27
19	08:35	07:46	06:45	06:34	05:39	20:13 (2)	05:17	05:39		06:27			07:17	08:07	08:03	08:41
	17:01	17:57	18:47	20:40	21:29	10 20:23 (2)	22:00	21:47		20:55			19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	20:16 (2)	05:17	05:41		06:28			07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	5 20:21 (2)	22:01	21:46		20:53			19:43	18:35	16:41	16:27
21	08:33	07:42	06:40	06:30	05:36		05:17	05:42		06:30			07:20	08:11	08:06	08:43
	17:04	18:01	18:51	20:44	21:32		22:01	21:45		20:51			19:40	18:33	16:40	16:28
22	08:32	07:40	06:38	06:28	05:35		05:17	05:43		06:31			07:22	08:13	08:08	08:43
	17:06	18:03	18:53	20:46	21:34		22:01	21:43		20:48			19:38	18:30	16:39	16:28
23	08:31	07:38	06:35	06:26	05:34		05:18	05:45		06:33			07:24	08:15	08:09	08:44
	17:08	18:05	18:54	20:47	21:35		22:01	21:42		20:46			19:36	18:28	16:38	16:29
24	08:30	07:36	06:33	06:24	05:33		05:18	05:46	20:25 (2)	06:35			07:25	08:16	08:11	08:44
	17:10	18:07	18:56	20:49	21:37		22:01	21:41	8 20:33 (2)	20:44			19:33	18:26	16:37	16:29
25	08:28	07:34	06:31	06:22	05:31		05:18	05:48	20:23 (2)	06:36			07:27	07:18	08:12	08:44
	17:11	18:08	18:58	20:51	21:38		22:01	21:39	11 20:34 (2)	20:42			19:31	17:24	16:35	16:30
26	08:27	07:32	06:28	06:20	05:30		05:19	05:49	20:22 (2)	06:38			07:28	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39		22:01	21:38	13 20:35 (2)	20:40			19:29	17:22	16:35	16:31
27	08:26	07:29	06:26	06:18	05:29		05:19	05:50	20:21 (2)	06:40			07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41		22:01	21:36	16 20:37 (2)	20:38			19:26	17:20	16:34	16:31
28	08:24	07:27	06:24	06:16	05:28		05:20	05:52	20:20 (2)	06:41			07:32	07:23	08:17	08:45
	17:17	18:14	19:03	20:56	21:42		22:01	21:35	17 20:37 (2)	20:35			19:24	17:18	16:33	16:32
29	08:23		07:21	06:14	05:27		05:20	05:53	20:19 (2)	06:43			07:33	07:25	08:19	08:45
	17:19		20:05	20:57	21:43		22:01	21:33	18 20:37 (2)	20:33			19:22	17:16	16:32	16:33
30	08:22		07:19	06:12	05:26		05:21	05:55	20:19 (2)	06:44			07:35	07:27	08:20	08:45
	17:20		20:06	20:59	21:44		22:01	21:32	19 20:38 (2)	20:31			19:19	17:15	16:31	16:34
31	08:20		07:17		05:25			05:56	20:19 (2)	06:46				07:29		08:45
	17:22		20:08		21:45			21:30	19 20:38 (2)	20:29				17:13		16:35
Potential sun hours	259	278	367	416	485		499	502		454		381	331	266	244
Total, worst case						286			121		169				
Sun reduction						0.37			0.27		0.30				
Oper. time red.						1.00			1.00		1.00				
Wind dir. red.						0.68			0.68		0.68				
Total reduction						0.25			0.18		0.20				
Total, real						72			22		34				

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AL - H38

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:46	08:19	07:25	17:32 (3)	07:14	06:10	05:24	05:21	05:58	06:48	07:37	07:31	16:12 (2)	08:22
	16:36	17:24	18:16	14 17:46 (3)	20:10	21:01	21:47	22:01	21:29	20:26	19:17	17:11	20 16:32 (2)	16:30
2	08:45	08:17	07:23	17:30 (3)	07:12	06:08	05:23	05:22	05:59	06:49	07:38	07:32	16:13 (2)	08:23
	16:37	17:25	18:18	16 17:46 (3)	20:12	21:02	21:48	22:00	21:27	20:24	19:15	17:09	18 16:31 (2)	16:30
3	08:45	08:15	07:21	17:30 (3)	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	16:14 (2)	08:25
	16:38	17:28	18:19	17 17:47 (3)	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	17 16:31 (2)	16:29
4	08:45	08:14	16:50 (2) 07:19	17:30 (3)	07:08	06:04	05:22	05:23	06:03	06:53	07:42	18:12 (3) 07:36	16:14 (2)	08:26
	16:39	17:30	5 16:55 (2) 18:21	17 17:47 (3)	20:15	21:06	21:50	21:59	21:24	20:20	19:10	6 18:18 (3) 17:05	16 16:30 (2)	16:29
5	08:45	08:12	16:47 (2) 07:16	17:30 (3)	07:05	06:02	05:21	05:24	06:04	06:54	07:44	18:09 (3) 07:38	16:16 (2)	08:27
	16:41	17:31	11 16:58 (2) 18:23	17 17:47 (3)	20:17	21:07	21:51	21:59	21:22	20:17	19:08	11 18:20 (3) 17:04	13 16:29 (2)	16:28
6	08:45	08:11	16:46 (2) 07:14	17:29 (3)	07:03	06:00	05:21	05:25	06:06	06:56	07:45	18:07 (3) 07:40	16:17 (2)	08:29
	16:42	17:33	13 16:59 (2) 18:25	17 17:46 (3)	20:18	21:09	21:52	21:58	21:20	20:15	19:05	14 18:21 (3) 17:02	10 16:27 (2)	16:28
7	08:44	08:09	16:45 (2) 07:12	17:30 (3)	07:01	05:58	05:20	05:26	06:07	06:58	07:47	18:06 (3) 07:41	16:21 (2)	08:30
	16:43	17:35	15 17:00 (2) 18:26	15 17:45 (3)	20:20	21:11	21:53	21:58	21:18	20:13	19:03	15 18:21 (3) 17:00	3 16:24 (2)	16:27
8	08:44	08:07	16:44 (2) 07:10	17:31 (3)	06:58	05:57	05:19	05:27	06:09	06:59	07:49	18:05 (3) 07:43		08:31
	16:44	17:37	17 17:01 (2) 18:28	13 17:44 (3)	20:22	21:12	21:54	21:57	21:16	20:11	19:01	17 18:22 (3) 16:58		16:27
9	08:43	08:05	16:44 (2) 07:07	17:33 (3)	06:56	05:55	05:19	05:28	06:10	07:01	07:50	18:05 (3) 07:45		08:32
	16:46	17:39	19 17:03 (2) 18:30	9 17:42 (3)	20:23	21:14	21:54	21:57	21:15	20:08	18:59	17 18:22 (3) 16:57		16:27
10	08:43	08:03	16:44 (2) 07:05		06:54	05:53	05:19	05:29	06:12	07:02	07:52	18:04 (3) 07:47		08:33
	16:47	17:41	19 17:03 (2) 18:32		20:25	21:16	21:55	21:56	21:13	20:06	18:56	17 18:21 (3) 16:55		16:26
11	08:42	08:02	16:44 (2) 07:03		06:52	05:52	05:18	05:30	06:14	07:04	07:54	18:04 (3) 07:49		08:34
	16:49	17:43	19 17:03 (2) 18:34		20:27	21:17	21:56	21:55	21:11	20:04	18:54	17 18:21 (3) 16:54		16:26
12	08:41	08:00	16:44 (2) 07:01		06:49	05:50	05:18	05:31	06:15	07:06	07:55	18:05 (3) 07:50		08:35
	16:50	17:44	19 17:03 (2) 18:35		20:29	21:19	21:57	21:54	21:09	20:01	18:52	15 18:20 (3) 16:52		16:26
13	08:41	07:58	16:44 (2) 06:58		06:47	05:48	05:18	05:32	06:17	07:07	07:57	18:06 (3) 07:52		08:36
	16:52	17:46	19 17:03 (2) 18:37		20:30	21:20	21:57	21:53	21:07	19:59	18:50	13 18:19 (3) 16:51		16:26
14	08:40	07:56	16:44 (2) 06:56		06:45	05:47	05:17	05:33	06:18	07:09	07:59	18:07 (3) 07:54		08:37
	16:53	17:48	18 17:02 (2) 18:39		20:32	21:22	21:58	21:52	21:05	19:57	18:48	10 18:17 (3) 16:49		16:26
15	08:39	07:54	16:45 (2) 06:54		06:43	05:45	05:17	05:34	06:20	07:11	08:01	18:10 (3) 07:56		08:38
	16:55	17:50	16 17:01 (2) 18:41		20:34	21:24	21:59	21:51	21:03	19:54	18:45	3 18:13 (3) 16:48		16:26
16	08:38	07:52	16:46 (2) 06:51		06:41	05:44	05:17	05:36	06:22	07:12	08:02	07:57		08:39
	16:56	17:52	14 17:00 (2) 18:42		20:35	21:25	21:59	21:50	21:01	19:52	18:43	16:46		16:26
17	08:37	07:50	16:48 (2) 06:49		06:38	05:42	05:17	05:37	06:23	07:14	08:04	07:59		08:40
	16:58	17:54	11 16:59 (2) 18:44		20:37	21:27	22:00	21:49	20:59	19:50	18:41	16:45		16:26
18	08:36	07:48	16:52 (2) 06:47		06:36	05:41	05:17	05:38	06:25	07:15	08:06	08:01		08:41
	16:59	17:56	3 16:55 (2) 18:46		20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44		16:27
19	08:35	07:46	06:45		06:34	05:39	05:17	05:39	06:27	07:17	08:08	08:03		08:41
	17:01	17:57	18:47		20:41	21:30	22:00	21:47	20:55	19:45	18:37	16:42		16:27
20	08:34	07:44	06:42		06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04		08:42
	17:03	17:59	18:49		20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41		16:27
21	08:33	07:42	06:40		06:30	05:36	05:17	05:42	06:30	07:20	08:11	08:06		08:43
	17:04	18:01	18:51		20:44	21:32	22:01	21:45	20:51	19:40	18:33	16:40		16:28
22	08:32	07:40	06:38		06:28	05:35	05:17	05:43	06:31	07:22	08:13	08:08		08:43
	17:06	18:03	18:53		20:46	21:34	22:01	21:43	20:48	19:38	18:30	16:39		16:28
23	08:31	07:38	06:35		06:26	05:34	05:18	05:45	06:33	07:24	08:15	08:09		08:44
	17:08	18:05	18:54		20:47	21:35	22:01	21:42	20:46	19:36	18:28	16:38		16:29
24	08:30	07:36	06:33		06:24	05:33	05:18	05:46	06:35	07:25	08:16	17:20 (2) 08:11		08:44
	17:10	18:07	18:56		20:49	21:37	22:01	21:41	20:44	19:33	18:26	6 17:26 (2) 16:36		16:29
25	08:29	07:34	06:31		06:22	05:31	05:18	05:48	06:36	07:27	07:18	16:17 (2) 08:13		08:45
	17:11	18:08	18:58		20:51	21:38	22:01	21:39	20:42	19:31	17:24	12 16:29 (2) 16:35		16:30
26	08:27	07:32	06:28		06:19	05:30	05:19	05:49	06:38	07:29	07:20	16:16 (2) 08:14		08:45
	17:13	18:10	19:00		20:52	21:39	22:01	21:38	20:40	19:29	17:22	14 16:30 (2) 16:34		16:31
27	08:26	07:29	17:36 (3) 06:26		06:17	05:29	05:19	05:50	06:40	07:30	07:22	16:15 (2) 08:16		08:45
	17:15	18:12	6 17:42 (3) 19:01		20:54	21:41	22:01	21:36	20:38	19:26	17:20	16 16:31 (2) 16:34		16:31
28	08:25	07:27	17:33 (3) 06:24		06:15	05:28	05:20	05:52	06:41	07:32	07:23	16:14 (2) 08:17		08:45
	17:17	18:14	12 17:45 (3) 19:03		20:56	21:42	22:01	21:35	20:35	19:24	17:18	18 16:32 (2) 16:33		16:32
29	08:23		07:21		06:13	05:27	05:20	05:53	06:43	07:33	07:25	16:13 (2) 08:19		08:45
	17:19		20:05		20:57	21:43	22:01	21:33	20:33	19:22	17:16	19 16:32 (2) 16:32		16:33
30	08:22		07:19		06:12	05:26	05:21	05:55	06:44	07:35	07:27	16:13 (2) 08:20		08:46
	17:20		20:06		20:59	21:44	22:01	21:32	20:31	19:19	17:15	20 16:33 (2) 16:31		16:34
31	08:20		07:17			05:25		05:56	06:46		07:29	16:12 (2)		08:46
	17:22		20:08			21:46		21:30	20:29		17:13	20 16:32 (2)		16:35
Potential sun hours	259	278	367	416	485	459	502	454	381	331	266		244
Total, worst case		236	135							280	97		
Sun reduction		0.21	0.24							0.24	0.18		
Oper. time red.		1.00	1.00							1.00	1.00		
Wind dir. red.		0.63	0.64							0.63	0.63		
Total reduction		0.13	0.16							0.15	0.12		
Total, real		30	21							42	11		

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar

Calculation: Alternative Scenario 3 Real Case **Shadow receptor:** AM - H39

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:45	08:19	07:25	07:14	06:10	05:24	05:21	05:58	06:48	07:37	07:31	08:22
	16:36	17:24	18:16	20:10	21:01	21:47	22:00	21:29	20:26	19:17	17:11	16:30
2	08:45	08:17	07:23	07:12	06:08	05:24	05:22	06:00	06:49	07:38	07:32	08:23
	16:37	17:26	18:18	20:11	21:02	21:48	22:00	21:27	20:24	19:15	17:09	16:30
3	08:45	08:15	07:21	07:10	06:06	05:23	05:23	06:01	06:51	07:40	07:34	08:24
	16:38	17:28	18:19	20:13	21:04	21:49	22:00	21:25	20:22	19:12	17:07	16:29
4	08:45	08:14	07:19	07:08	06:04	05:22	05:24	06:03	06:53	07:42	07:36	08:26
	16:40	17:30	18:21	20:15	21:06	21:50	21:59	21:23	20:20	19:10	17:05	16:29
5	08:45	08:12	07:16	07:05	06:02	05:21	05:24	06:04	06:54	07:43	07:38	08:27
	16:41	17:31	18:23	20:17	21:07	21:51	21:59	21:22	20:17	19:08	17:04	16:28
6	08:44	08:10	07:14	07:03	06:00	05:21	05:25	06:06	06:56	07:45	07:40	08:28
	16:42	17:33	18:25	20:18	21:09	21:52	21:58	21:20	20:15	19:05	17:02	16:28
7	08:44	08:09	07:12	07:01	05:59	05:20	05:26	06:07	06:58	07:47	07:41	08:30
	16:43	17:35	18:27	20:20	21:11	21:53	21:58	21:18	20:13	19:03	17:00	16:27
8	08:44	08:07	07:10	06:58	05:57	05:20	05:27	06:09	06:59	07:49	07:43	08:31
	16:45	17:37	18:28	20:22	21:12	21:54	21:57	21:16	20:11	19:01	16:58	16:27
9	08:43	08:05	07:07	06:56	05:55	05:19	05:28	06:11	07:01	07:50	07:45	08:32
	16:46	17:39	18:30	20:23	21:14	21:54	21:56	21:14	20:08	18:59	16:57	16:27
10	08:43	08:03	07:05	06:54	05:53	05:19	05:29	06:12	07:02	07:52	07:47	08:33
	16:47	17:41	18:32	20:25	21:16	21:55	21:56	21:13	20:06	18:56	16:55	16:26
11	08:42	08:02	07:03	06:52	05:52	05:18	05:30	06:14	07:04	07:54	07:49	08:34
	16:49	17:43	18:34	20:27	21:17	21:56	21:55	21:11	20:04	18:54	16:54	16:26
12	08:41	08:00	07:01	06:50	05:50	05:18	05:31	06:15	07:06	07:55	07:50	08:35
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	16:53	17:48	18:39	20:32	21:22	21:58	21:52	21:05	19:57	18:48	16:49	16:26
15	08:39	07:54	06:54	06:43	05:45	05:17	05:35	06:20	07:11	08:01	07:56	08:38
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17	08:37	07:50	06:49	06:39	05:42	05:17	05:37	06:23	07:14	08:04	07:59	08:40
	16:58	17:54	18:44	20:37	21:26	21:59	21:49	20:59	19:50	18:41	16:45	16:26
18	08:36	07:48	06:47	06:36	05:41	05:17	05:38	06:25	07:15	08:06	08:01	08:41
	17:00	17:56	18:46	20:39	21:28	22:00	21:48	20:57	19:47	18:39	16:44	16:27
19	08:35	07:46	06:45	06:34	05:39	05:17	05:40	06:27	07:17	08:07	08:03	08:41
	17:01	17:58	18:47	20:40	21:29	22:00	21:47	20:55	19:45	18:37	16:42	16:27
20	08:34	07:44	06:42	06:32	05:38	05:17	05:41	06:28	07:19	08:09	08:04	08:42
	17:03	17:59	18:49	20:42	21:31	22:01	21:46	20:53	19:43	18:35	16:41	16:27
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	17:11	18:09	18:58	20:51	21:38	22:01	21:39	20:42	19:31	17:24	16:36	16:30
26	08:27	07:32	06:28	06:20	05:30	05:19	05:49	06:38	07:29	07:20	08:14	08:45
	17:13	18:10	19:00	20:52	21:39	22:01	21:38	20:40	19:29	17:22	16:35	16:31
27	08:26	07:29	06:26	06:18	05:29	05:19	05:51	06:40	07:30	07:22	08:16	08:45
	17:15	18:12	19:01	20:54	21:41	22:01	21:36	20:38	19:26	17:20	16:34	16:31
28	08:24	07:27	06:24	06:16	05:28	05:20	05:52	06:41	07:32	07:23	08:17	08:45
	17:17	18:14	19:03	20:56	21:42	22:01	21:35	20:35	19:24	17:18	16:33	16:32
29	08:23		07:21	06:14	05:27	05:20	05:53	06:43	07:33	07:25	08:19	08:45
	17:19		20:05	20:57	21:43	22:01	21:33	20:33	19:22	17:16	16:32	16:33
30	08:22		07:19	06:12	05:26	05:21	05:55	06:45	07:35	07:27	08:20	08:45
	17:20		20:06	20:59	21:44	22:01	21:32	20:31	19:19	17:15	16:31	16:34
31	08:20		07:17		05:25		05:56	06:46		07:29		08:45
	17:22		20:08		21:45		21:30	20:29		17:13		16:35
Potential sun hours	259	278	367	416	485	499	502	454	381	331	266	244
Total, worst case												
Sun reduction												
Oper. time red.												
Wind dir. red.												
Total reduction												
Total, real												

Table layout: For each day in each month the following matrix apply

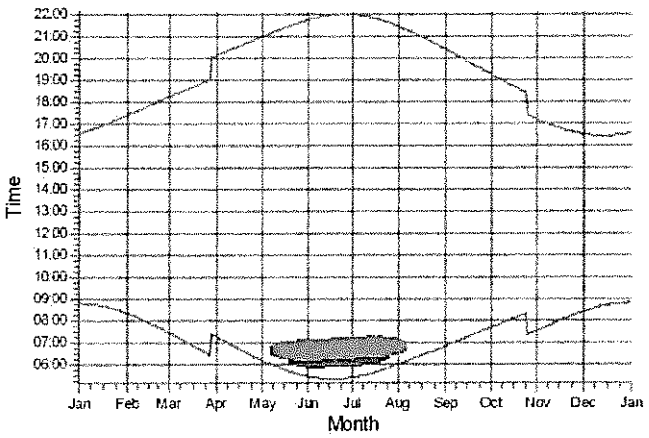
Day in month	Sun rise (hh:mm) Sun set (hh:mm)	Minutes with flicker	First time (hh:mm) with flicker Last time (hh:mm) with flicker	(WTG causing flicker first time) (WTG causing flicker last time)

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

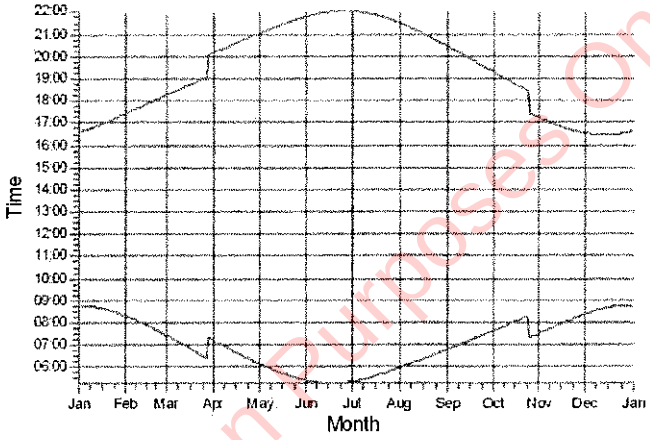
SHADOW - Calendar, graphical

Calculation: Alternative Scenario 3 Real Case

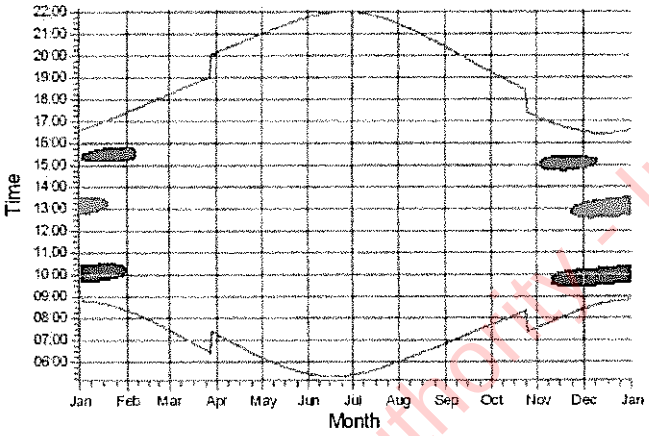
A: H1



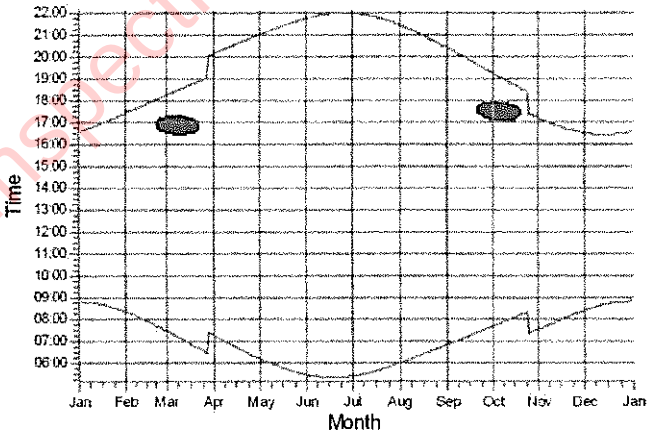
B: H2



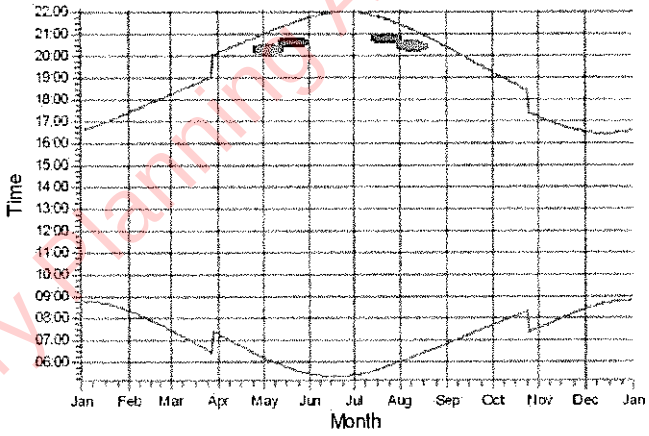
C: H3



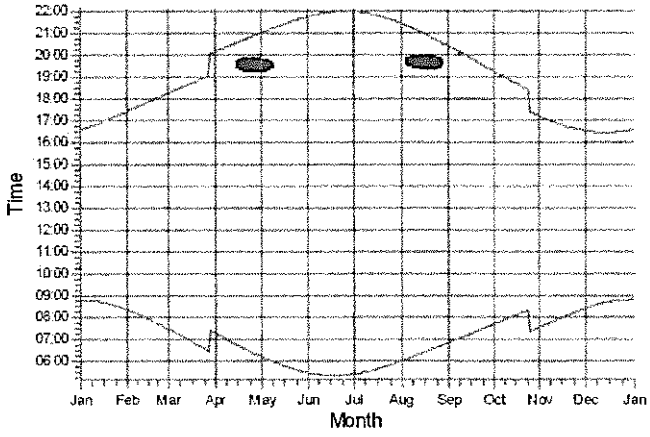
D: H4



E: H5



F: H6



WTGs

1: T1 2: T5 3: T4 4: T2 5: T3

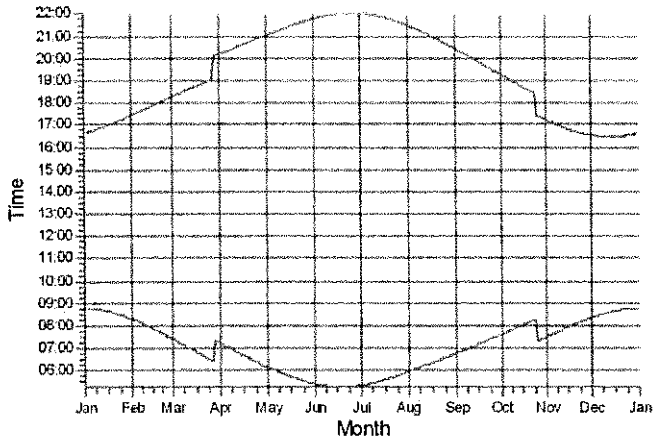
Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com

Calculated:
10/03/2023 13:04/3.6.361

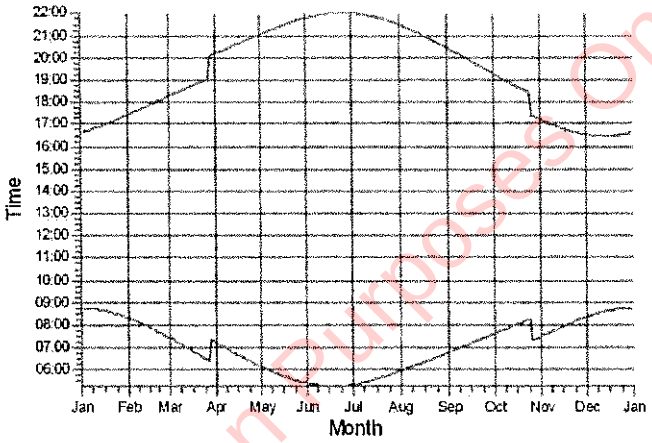
SHADOW - Calendar, graphical

Calculation: Alternative Scenario 3 Real Case

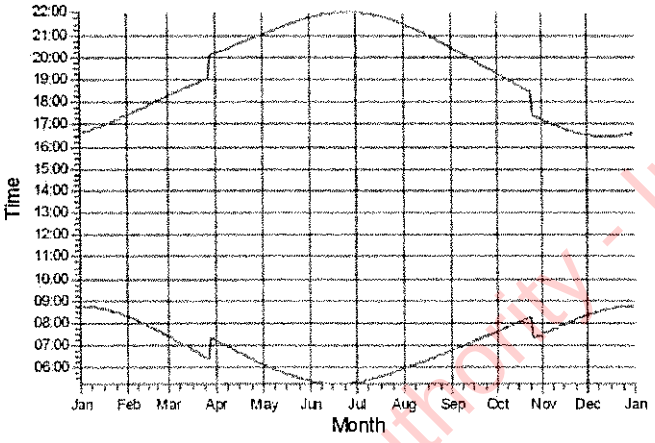
G: H7



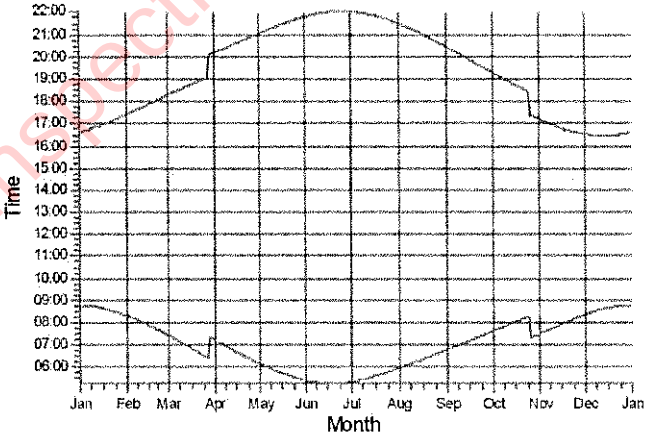
H: H8



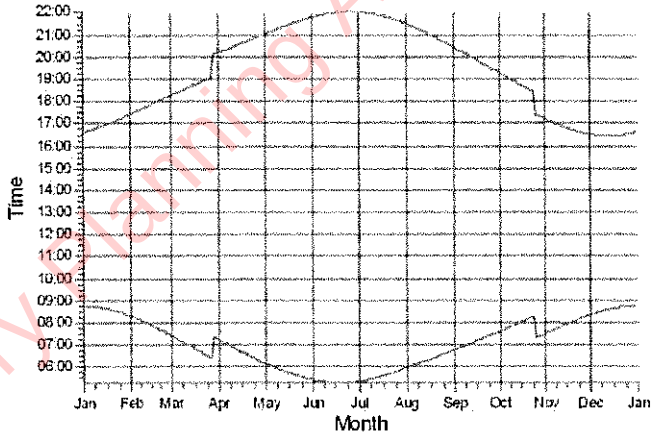
I: H9



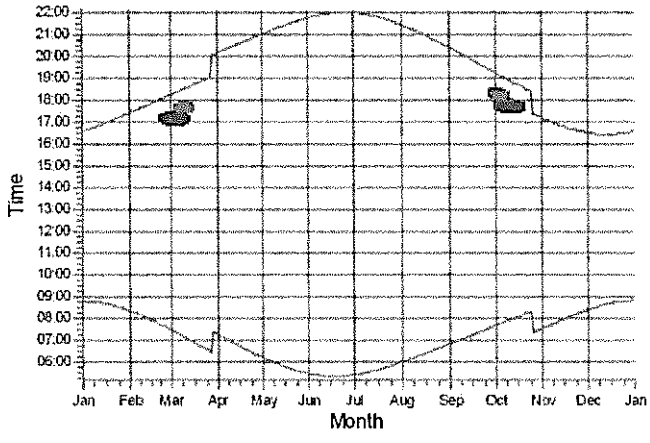
J: H10



K: H11



L: H12



WTGs

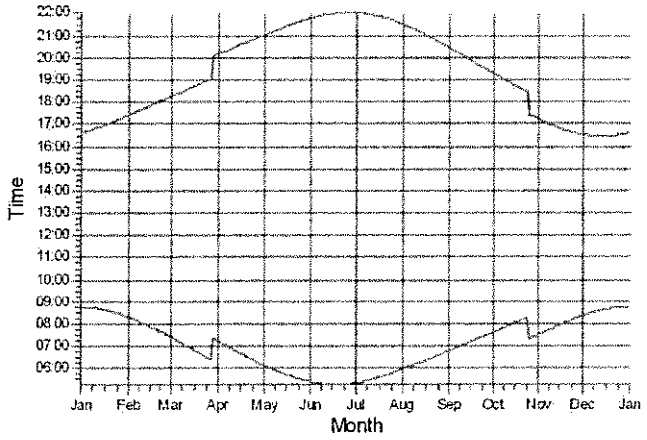
1: T1 2: T5 3: T4 5: T3

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

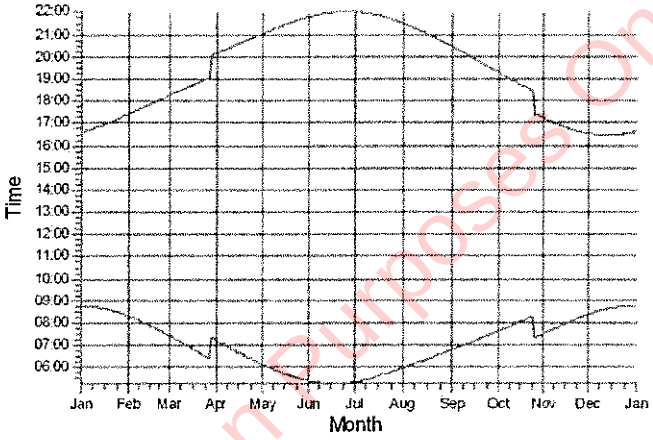
SHADOW - Calendar, graphical

Calculation: Alternative Scenario 3 Real Case

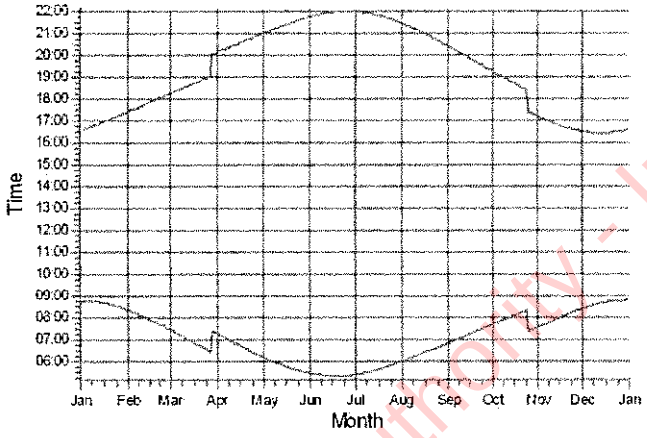
M: H13



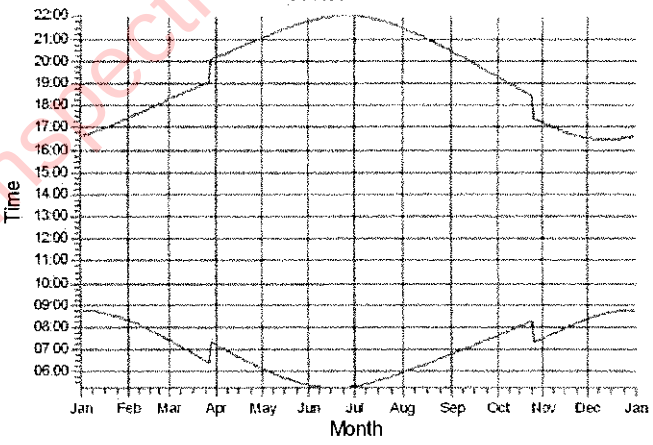
N: H14



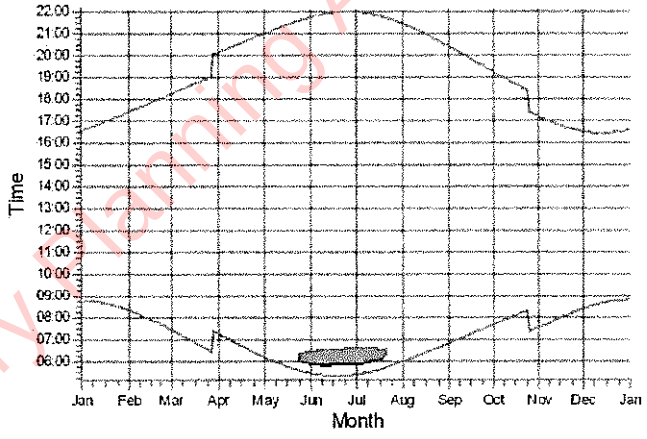
O: H15



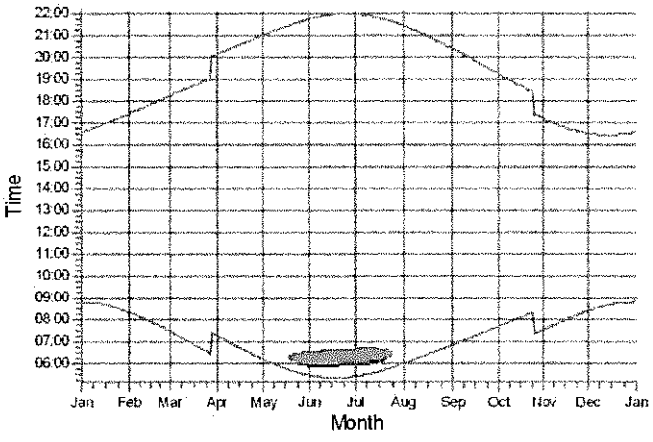
P: H16



Q: H17



R: H18



WTGs

2: T5 3: T4 4: T2

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Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
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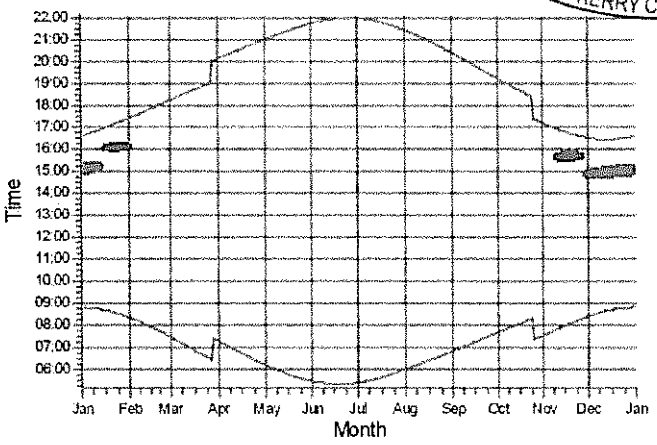
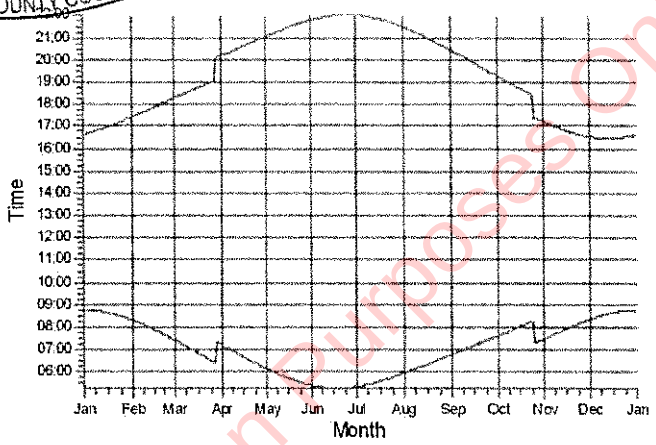
SHADOW - Calendar, graphical

Calculation: Alternative Scenario 3 Real Case

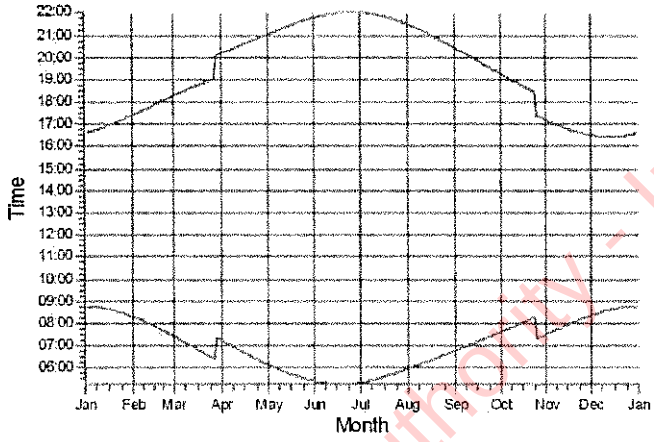
S: H19



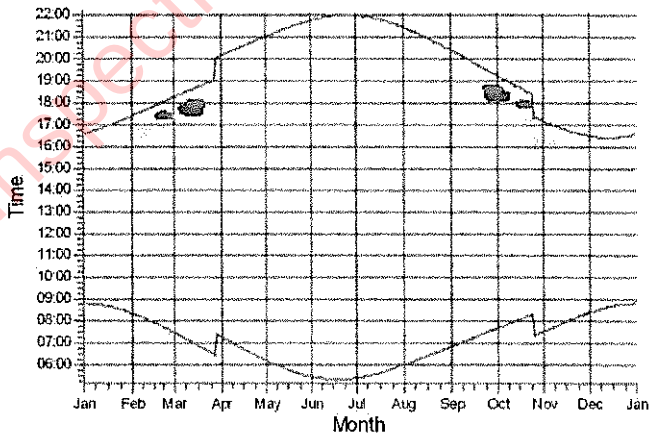
T: H20



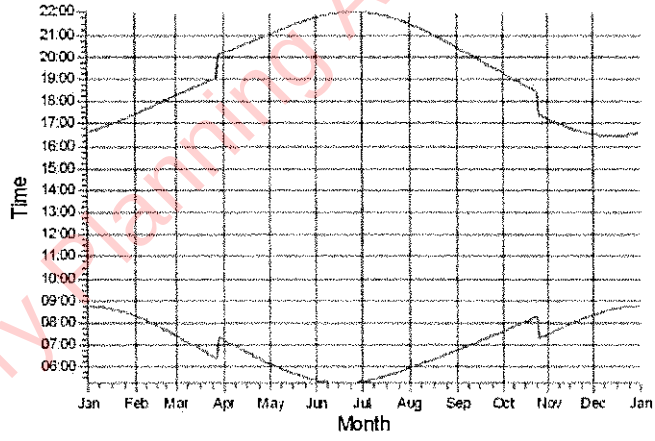
U: H21



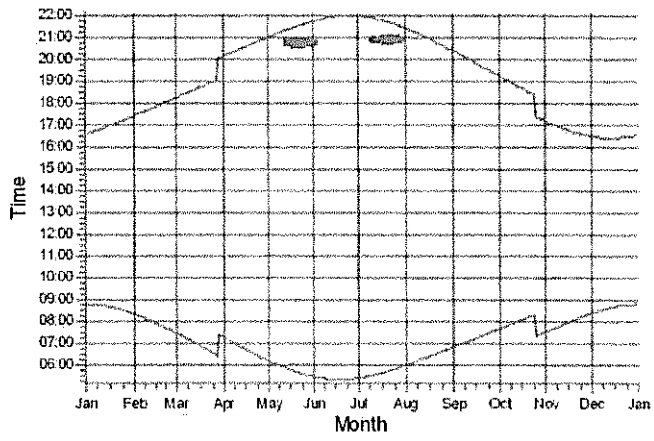
V: H22



W: H23



X: H24



WTGs

1: T1 2: T5 3: T4 4: T2 5: T3

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Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
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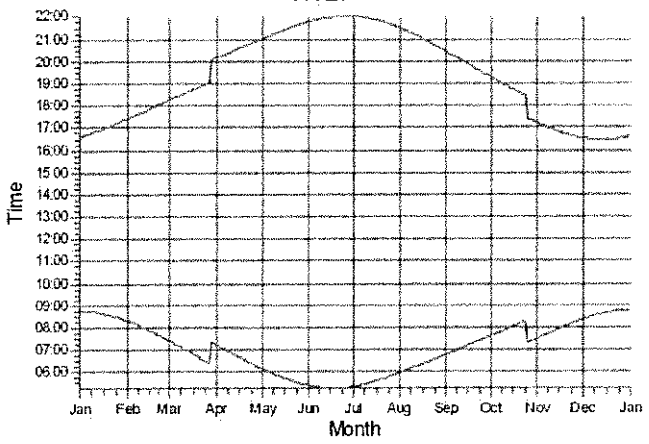
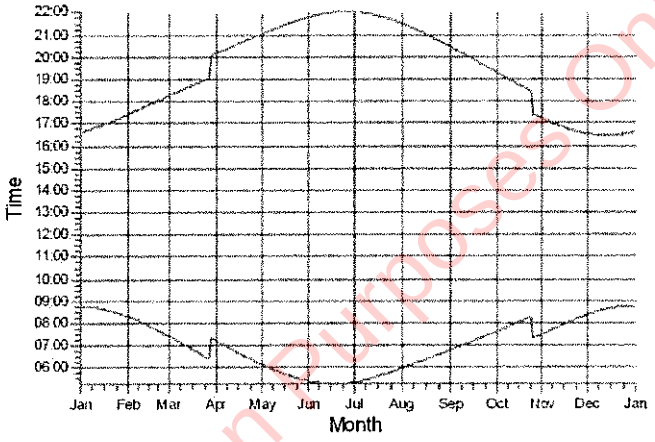
SHADOW - Calendar, graphical

Calculation: Alternative Scenario 3 Real Case

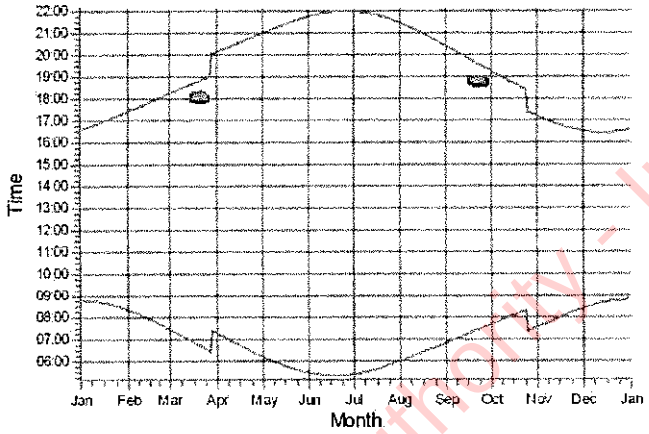
Y: H25



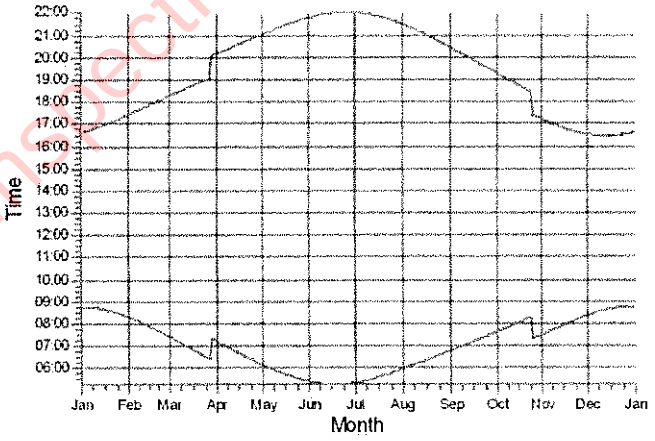
Z: H26



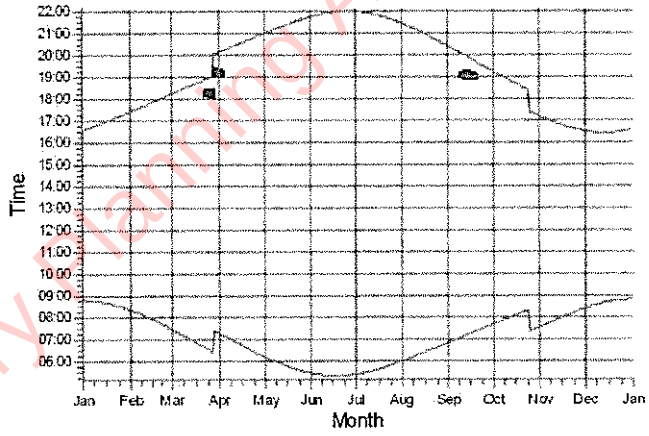
AA: H27



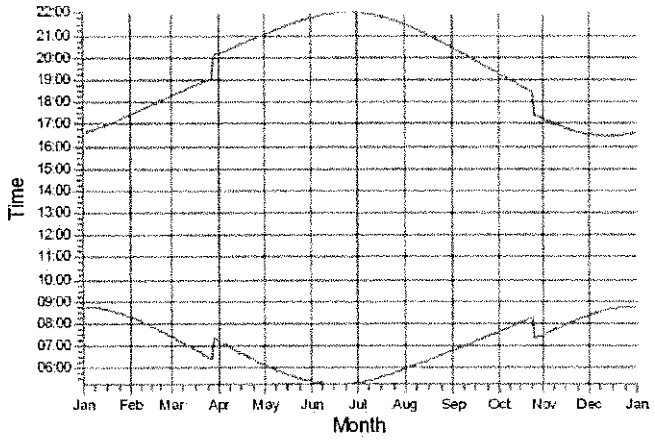
AB: H28



AC: H29



AD: H30



WTGs

2: T5 3: T4 5: T3

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Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com

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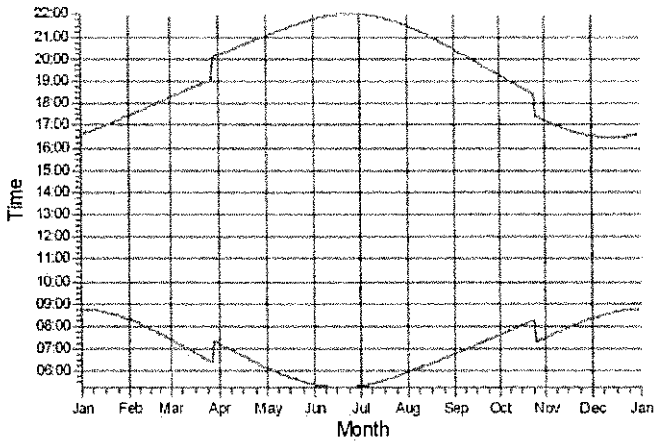
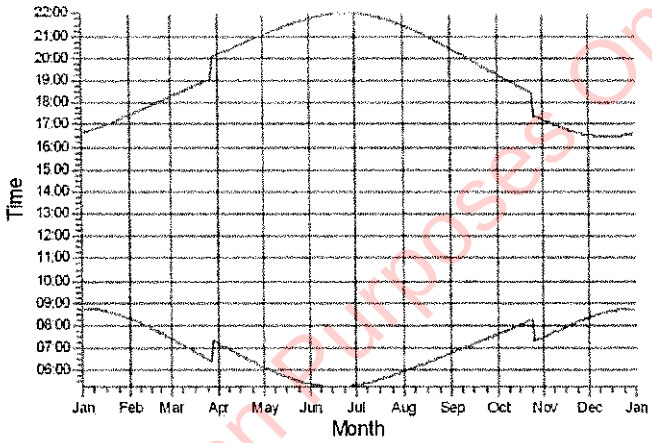
SHADOW - Calendar, graphical

Calculation: Alternative Scenario 3 Real Case

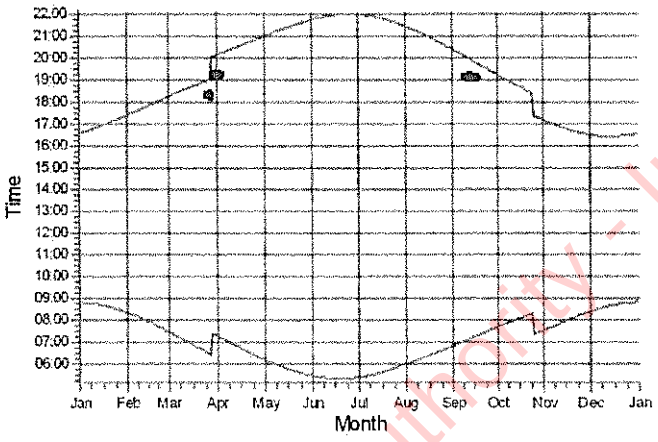
AE: H31



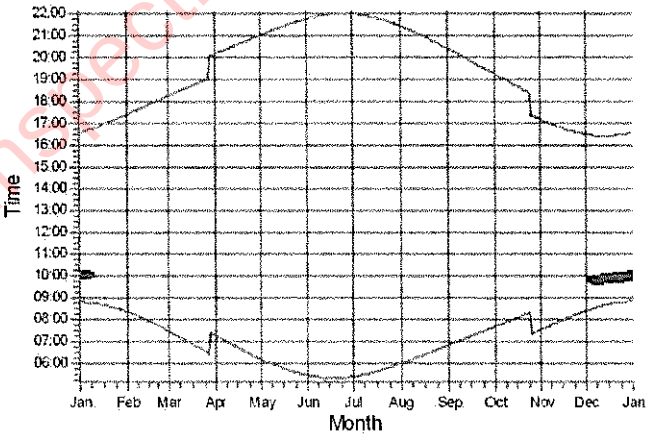
AF: H32



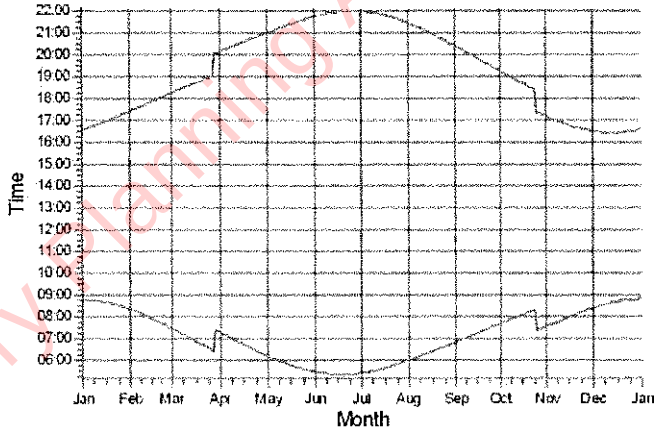
AG: H33



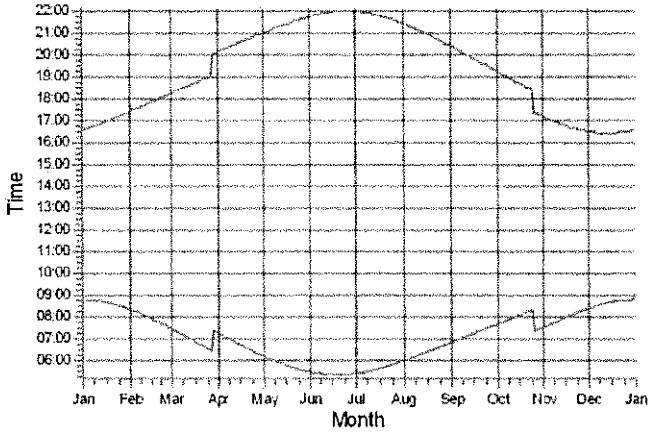
AH: H34



AI: H35



AJ: H36



WTGs

2: T5 3: T4

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Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
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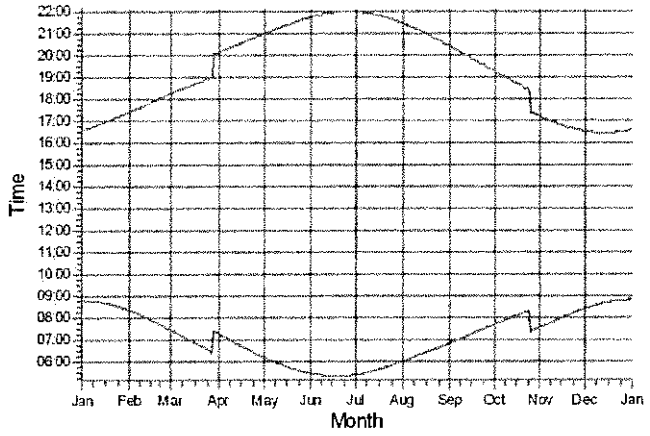
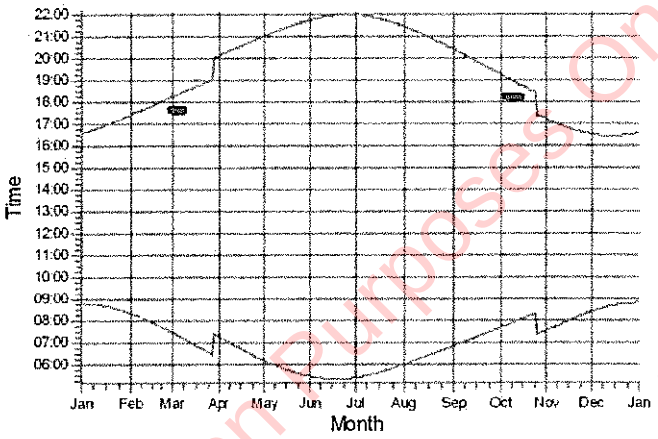
SHADOW - Calendar, graphical

Calculation: Alternative Scenario 3 Real Case

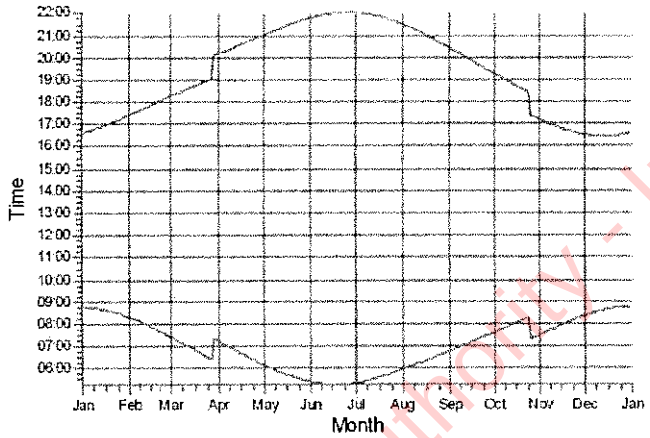
AK: H37



AL: H38



AM: H39



WTGs

2: T5 3: T4

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Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
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SHADOW - Calendar per WTG

Calculation: Alternative Scenario 3 Real Case **WTG:** 1 T1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January		February		March		April	May		June
1	08:46		08:19	16:03-16:12/9	07:25		07:15	06:10		05:24
	16:36		17:24	15:18-15:45/27	18:16		20:10	21:01		21:47
2	08:46		08:17	16:07-16:09/2	07:23		07:12	06:08		05:24
	16:37		17:26	15:19-15:45/26	18:18		20:12	21:03		21:48
3	08:45	15:21-15:24/3	08:16	15:21-15:44/23	07:21		07:10	06:06		05:23
	16:39		17:28		18:20		20:13	21:04		21:49
4	08:45	15:18-15:27/9	08:14	15:22-15:43/21	07:19		07:08	06:04		05:22
	16:40		17:30		18:21		20:15	21:06		21:50
5	08:45	15:18-15:29/11	08:12	15:24-15:41/17	07:17		07:05	06:02		05:21
	16:41		17:32		18:23		20:17	21:08		21:51
6	08:45	15:16-15:30/14	08:11	15:27-15:39/12	07:14		07:03	06:00		05:21
	16:42		17:33		18:25		20:19	21:09		21:52
7	08:44	15:16-15:32/16	08:09		07:12	17:42-17:50/8	07:01	05:59		05:20
	16:43		17:35		18:27		20:20	21:11		21:53
8	08:44	15:15-15:33/18	08:07		07:10	17:40-17:52/12	06:59	05:57		05:20
	16:45		17:37		18:28		20:22	21:13		21:54
9	08:43	15:16-15:35/19	08:05		07:08	17:39-17:53/14	06:56	05:55		05:19
	16:46		17:39		18:30		20:24	21:14		21:55
10	08:43	15:15-15:36/21	08:04		07:05	17:38-17:52/14	06:54	05:53		05:19
	16:47		17:41		18:32		20:25	21:16		21:55
11	08:42	15:14-15:37/23	08:02		07:03	17:38-17:52/14	06:52	05:52		05:18
	16:49		17:43		18:34		20:27	21:17		21:56
12	08:42	15:14-15:38/24	08:00		07:01	17:38-17:52/14	06:50	05:50	20:34-20:42/8	05:18
	16:50		17:45		18:35		20:29	21:19		21:57
13	08:41	15:14-15:39/25	07:58		06:58	17:38-17:50/12	06:47	05:48	20:32-20:43/11	05:18
	16:52		17:47		18:37		20:30	21:21		21:58
14	08:40	15:13-15:39/26	07:56		06:56	17:39-17:49/10	06:45	05:47	20:32-20:45/13	05:18
	16:53		17:48		18:39		20:32	21:22		21:58
15	08:39	15:13-15:40/27	07:54		06:54	17:42-17:47/5	06:43	05:45	20:30-20:45/15	05:17
	16:55		17:50		18:41		20:34	21:24		21:59
16	08:39	16:00-16:06/6	07:52		06:52		06:41	05:44	20:30-20:46/16	05:17
	16:56	15:13-15:41/28	17:52		18:42		20:36	21:25		21:59
17	08:38	15:59-16:08/9	07:50		06:49		06:39	05:42	20:30-20:46/16	05:17
	16:58	15:13-15:42/29	17:54		18:44		20:37	21:27		22:00
18	08:37	15:58-16:10/12	07:48		06:47		06:36	05:41	20:29-20:46/17	05:17
	17:00	15:13-15:43/30	17:56		18:46		20:39	21:28		22:00
19	08:36	15:58-16:11/13	07:46		06:45		06:34	05:39	20:30-20:46/16	05:17
	17:01	15:13-15:44/31	17:58		18:48		20:41	21:30		22:00
20	08:35	15:57-16:13/16	07:44		06:42		06:32	05:38	20:30-20:47/17	05:17
	17:03	15:14-15:45/31	18:00		18:49		20:42	21:31		22:01
21	08:34	15:56-16:13/17	07:42		06:40		06:30	05:37	20:30-20:47/17	05:17
	17:05	15:14-15:45/31	18:01		18:51		20:44	21:33		22:01
22	08:32	15:57-16:14/17	07:40		06:38		06:28	05:35	20:30-20:46/16	05:18
	17:06	15:13-15:45/32	18:03		18:53		20:46	21:34		22:01
23	08:31	15:57-16:15/18	07:38		06:35		06:26	05:34	20:30-20:46/16	05:18
	17:08	15:14-15:46/32	18:05		18:55		20:47	21:35		22:01
24	08:30	15:56-16:14/18	07:36		06:33		06:24	05:33	20:31-20:45/14	05:18
	17:10	15:13-15:46/33	18:07		18:56		20:49	21:37		22:01
25	08:29	15:57-16:15/18	07:34		06:31		06:22	05:32	20:31-20:45/14	05:18
	17:12	15:14-15:46/32	18:09		18:58		20:51	21:38		22:02
26	08:27	15:58-16:16/18	07:32		06:28		06:20	05:30	20:32-20:45/13	05:19
	17:13	15:15-15:47/32	18:10		19:00		20:53	21:39		22:02
27	08:26	15:58-16:15/17	07:30		06:26		06:18	05:29	20:33-20:44/11	05:19
	17:15	15:15-15:47/32	18:12		19:01		20:54	21:41		22:01
28	08:25	15:59-16:16/17	07:27		06:24		06:16	05:28	20:34-20:43/9	05:20
	17:17	15:16-15:47/31	18:14		19:03		20:56	21:42		22:01
29	08:23	15:59-16:15/16			07:22		06:14	05:27	20:35-20:42/7	05:20
	17:19	15:16-15:47/31			20:05		20:58	21:43		22:01
30	08:22	16:00-16:14/14			07:19		06:12	05:26	20:38-20:41/3	05:21
	17:21	15:16-15:46/30			20:07		20:59	21:44		22:01
31	08:20	16:02-16:14/12			07:17			05:25		
	17:22	15:18-15:46/28			20:08			21:46		
Potential sun hours	259		278		367		416	485		499
Sum of minutes with flicker	967		137		103		0	249		0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar per WTG

Calculation: Alternative Scenario 3 Real Case **WTG:** 1 - T1

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	July	August	September	October	November	December
1	05:22	05:58 20:45-20:52/7	06:48	07:37 18:17-18:31/14	07:31	08:22 14:56-15:19/23
	22:01	21:29	20:27	19:17	17:11	16:31
2	05:22	06:00	06:50	07:39 18:17-18:31/14	07:33	08:23 14:58-15:19/21
	22:00	21:27	20:24	19:15	17:09	16:30
3	05:23	06:01	06:51	07:40 18:16-18:30/14	07:34	08:25 14:59-15:18/19
	22:00	21:25	20:22	19:13	17:07	16:29
4	05:24	06:03	06:53	07:42 18:16-18:30/14	07:36 15:00-15:04/4	08:26 14:59-15:17/18
	22:00	21:24	20:20	19:10	17:05	16:29
5	05:25	06:04	06:54	07:44 18:17-18:29/12	07:38 14:56-15:09/13	08:27 15:01-15:17/16
	21:59	21:22	20:18	19:08	17:04	16:28
6	05:25	06:06	06:56	07:45 18:17-18:27/10	07:40 14:53-15:11/18	08:29 15:02-15:16/14
	21:59	21:20	20:15	19:06	17:02	16:28
7	05:26	06:07	06:58	07:47 18:19-18:24/5	07:42 14:52-15:13/21	08:30 15:05-15:16/11
	21:58	21:18	20:13	19:03	17:00	16:27
8	05:27	06:09	06:59	07:49	07:43 14:51-15:14/23	08:31 15:06-15:15/9
	21:57	21:17	20:11	19:01	16:59	16:27
9	05:28	06:11	07:01	07:50	07:45 15:37-15:40/3	08:32 15:09-15:13/4
	21:57	21:15	20:08	18:59	16:57 14:50-15:15/25	16:27
10	05:29	06:12	07:03	07:52	07:47 15:34-15:43/9	08:33
	21:56	21:13	20:06	18:57	16:55 14:49-15:16/27	16:27
11	05:30	06:14	07:04	07:54	07:49 15:32-15:45/13	08:35
	21:55	21:11	20:04	18:54	16:54 14:48-15:17/29	16:26
12	05:31	06:15	07:06	07:56	07:51 15:32-15:46/14	08:36
	21:54	21:09	20:01	18:52	16:52 14:48-15:18/30	16:26
13	05:32	06:17	07:07	07:57	07:52 15:31-15:47/16	08:37
	21:53	21:07	19:59	18:50	16:51 14:48-15:19/31	16:26
14	05:33 20:45-20:51/6	06:19	07:09	07:59	07:54 15:31-15:48/17	08:38
	21:53	21:05	19:57	18:48	16:49 14:48-15:19/31	16:26
15	05:35 20:44-20:52/8	06:20	07:11	08:01	07:56 15:31-15:48/17	08:38
	21:52	21:03	19:54	18:46	16:48 14:48-15:20/32	16:26
16	05:36 20:43-20:53/10	06:22	07:12	08:02	07:58 15:31-15:49/18	08:39
	21:51	21:01	19:52	18:43	16:46 14:48-15:20/32	16:26
17	05:37 20:42-20:54/12	06:24	07:14	08:04	07:59 15:31-15:49/18	08:40
	21:50	20:59	19:50	18:41	16:45 14:48-15:20/32	16:27
18	05:38 20:41-20:54/13	06:25	07:16	08:06	08:01 15:30-15:48/18	08:41
	21:48	20:57	19:47	18:39	16:44 14:47-15:20/33	16:27
19	05:40 20:41-20:55/14	06:27	07:17	08:08	08:03 15:31-15:49/18	08:42
	21:47	20:55	19:45	18:37	16:42 14:48-15:20/32	16:27
20	05:41 20:41-20:56/15	06:28	07:19	08:09	08:04 15:32-15:49/17	08:42
	21:46	20:53	19:43	18:35	16:41 14:48-15:20/32	16:27
21	05:42 20:40-20:56/16	06:30	07:20	08:11	08:06 15:32-15:49/17	08:43
	21:45	20:51	19:40	18:33	16:40 14:49-15:20/31	16:28
22	05:44 20:40-20:56/16	06:32	07:22	08:13	08:08 15:33-15:49/16	08:43
	21:44	20:49	19:38	18:31	16:39 14:50-15:21/31	16:28
23	05:45 20:40-20:56/16	06:33	07:24	08:15	08:09 15:35-15:48/13	08:44
	21:42	20:46	19:36	18:29	16:38 14:50-15:21/31	16:29
24	05:46 20:40-20:57/17	06:35	07:25	08:17	08:11 15:35-15:47/12	08:44
	21:41	20:44	19:33	18:27	16:37 14:50-15:20/30	16:29
25	05:48 20:40-20:57/17	06:37	07:27	07:18	08:13 15:37-15:46/9	08:45
	21:39	20:42	19:31	17:25	16:36 14:51-15:20/29	16:30
26	05:49 20:40-20:56/16	06:38	07:29	07:20	08:14 15:39-15:45/6	08:45
	21:38	20:40	19:29	17:23	16:35 14:52-15:20/28	16:31
27	05:51 20:41-20:57/16	06:40	07:30	07:22	08:16 14:53-15:20/27	08:45
	21:37	20:38	19:26	17:21	16:34	16:32
28	05:52 20:41-20:56/15	06:41	07:32	07:24	08:17 14:53-15:20/27	08:45
	21:35	20:36	19:24	17:19	16:33	16:32
29	05:54 20:42-20:56/14	06:43	07:34 18:21-18:29/8	07:25	08:19 14:55-15:20/25	08:46
	21:34	20:33	19:22	17:17	16:32	16:33
30	05:55 20:42-20:55/13	06:45	07:35 18:18-18:30/12	07:27	08:20 14:55-15:19/24	08:46
	21:32	20:31	19:19	17:15	16:31	16:34
31	05:57 20:43-20:53/10	06:46		07:29		08:46
	21:30	20:29		17:13		16:35
Potential sun hours	502	454	381	331	266	244
Sum of minutes with flicker	244	7	20	83	979	135

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar per WTG

Calculation: Alternative Scenario 3 Real Case **WTG:** 2 - T5

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February	March	April	May	June
1	08:46 14:15-14:57/42	08:19 15:30-15:59/29	07:25 17:04-17:26/22	07:15 18:07-18:47/40	06:10 20:02-20:21/19 06:49-06:54/5	05:24 06:07-06:22/15
	16:36	17:24 14:31-15:02/31	18:16	20:10	21:01 06:34-06:44/10	21:47
2	08:46 14:15-14:58/43	08:17 15:30-15:58/28	07:23 17:03-17:24/21	07:12 18:07-18:46/39	06:08 20:01-20:22/21	05:24 06:08-06:22/14
	16:37	17:26 14:33-15:00/27	18:18	20:12	21:03 06:32-06:44/12	21:48
3	08:45 14:16-14:59/43	08:16 16:40-16:41/1 14:36-15:00/24	07:21 17:33-17:41/8	07:10 18:08-18:46/38	06:06 20:00-20:23/23	05:23 06:08-06:22/14
	16:38	17:28 15:32-15:58/26	18:19 17:04-17:23/19	20:13	21:04 06:31-06:44/13	21:49
4	08:45 14:15-14:59/44	08:14 16:50-16:55/5 15:33-15:57/24	07:19 17:30-17:44/14	07:08 18:08-18:44/36	06:04 20:01-20:25/24	05:22 06:08-06:21/13
	16:40	17:30 16:35-16:46/11 14:38-14:57/19	18:21 17:06-17:22/16	20:15	21:06 06:29-06:44/15	21:50
5	08:45 14:16-15:00/44	08:12 16:33-16:58/25 14:42-14:54/12	07:16 17:29-17:45/16	07:05 18:09-18:43/34	06:02 20:00-20:26/26	05:21 06:10-06:21/11
	16:41	17:32 15:34-15:56/22	18:23 17:08-17:20/12	20:17	21:08 06:28-06:43/15	21:51
6	08:45 14:16-15:00/44	08:11 16:31-16:59/28	07:14 17:27-17:46/19	07:03 18:10-18:42/32	06:00 20:00-20:27/27	05:21 06:10-06:20/10
	16:42	17:33 15:35-15:54/19	18:25 17:11-17:16/5	20:18	21:09 06:29-06:43/14	21:52
7	08:44 15:33-15:40/7	08:09 16:30-17:00/30	07:12 17:26-17:50/24	07:01 18:11-18:41/30	05:59 20:01-20:28/27	05:20 06:11-06:20/9
	16:43 14:17-15:01/44	17:35 15:38-15:52/14	18:27	20:20	21:11 06:29-06:42/13	21:53
8	08:44 15:31-15:42/11	08:07 16:29-17:01/32	07:10 17:26-17:51/25	06:59 18:12-18:38/26	05:57 20:01-20:28/27	05:20 06:11-06:19/8
	16:45 14:17-15:01/44	17:37 15:41-15:49/8	18:28	20:22	21:12 06:29-06:41/12	21:54
9	08:43 15:30-15:44/14	08:05 16:29-17:03/34	07:07 17:25-17:53/28	06:56 18:13-18:37/24	05:55 20:01-20:28/27	05:19 06:13-06:19/6
	16:46 14:17-15:01/44	17:39	18:30	20:24	21:14 06:31-06:40/9	21:55
10	08:43 15:30-15:46/16	08:04 16:28-17:03/35	07:05 17:25-17:52/27	06:54 18:16-18:34/18	05:53 20:03-20:28/25	05:19 06:15-06:18/3
	16:47 14:18-15:02/44	17:41	18:32	20:25	21:16 06:33-06:37/4	21:55
11	08:42 15:29-15:47/18	08:02 16:28-17:03/35	07:03 17:25-17:53/28	06:52 18:20-18:31/11	05:52 20:03-20:28/25	05:18
	16:49 14:18-15:03/45	17:43	18:34	20:27	21:17	21:56
12	08:42 15:28-15:48/20	08:00 16:28-17:03/35	07:01 17:26-17:53/27	06:50	05:50 20:05-20:28/23	05:18
	16:50 14:18-15:03/45	17:45	18:35	20:29	21:19	21:57
13	08:41 15:28-15:49/21	07:58 16:28-17:03/35	06:58 17:25-17:52/27	06:47	05:48 20:05-20:27/22	05:18
	16:52 14:18-15:03/45	17:46	18:37	20:30	21:20	21:57
14	08:40 15:27-15:51/24	07:56 16:28-17:02/34	06:56 17:27-17:52/25	06:45	05:47 20:07-20:27/20	05:17
	16:53 14:18-15:04/46	17:48	18:39	20:32	21:22	21:58
15	08:39 15:27-15:52/25	07:54 16:28-17:01/33	06:54 17:29-17:51/22	06:43	05:45 20:07-20:26/19	05:17
	16:55 14:18-15:04/46	17:50	18:41	20:34	21:24	21:59
16	08:38 15:27-15:53/26	07:52 16:28-17:00/32	06:52 17:31-17:50/19	06:41	05:44 20:09-20:26/17	05:17
	16:56 14:19-15:05/46	17:52	18:42	20:35	21:25	21:59
17	08:37 15:26-15:54/28	07:50 16:29-16:59/30	06:49 17:26-17:48/22	06:39	05:42 20:11-20:26/15	05:17
	16:58 14:19-15:05/46	17:54	18:44	20:37	21:27 06:10-06:17/7	22:00
18	08:37 15:26-15:55/29	07:48 16:30-16:55/25	06:47 17:22-17:46/24	06:36	05:41 20:12-20:24/12	05:17
	17:00 14:20-15:05/45	17:56	18:46	20:39	21:28 06:08-06:19/11	22:00
19	08:36 15:26-15:56/30	07:46 17:13-17:17/4	06:45 17:18-17:42/24	06:34 06:58-07:01/3	05:39 20:13-20:23/10	05:17
	17:01 14:20-15:06/46	17:58 16:30-16:51/21	18:48	20:41	21:30 06:07-06:19/12	22:00
20	08:35 15:27-15:57/30	07:44 17:09-17:21/12	06:42 17:16-17:44/28	06:32 06:56-07:02/6	05:38 20:16-20:21/5	05:17
	17:03 14:21-15:06/45	17:59 16:31-16:49/18	18:49	20:42	21:31 06:06-06:20/14	22:01
21	08:33 15:26-15:56/30	07:42 17:07-17:23/16	06:40 17:15-17:46/31	06:30 06:54-07:03/9	05:37 06:06-06:21/15	05:17
	17:05 14:21-15:06/45	18:01 16:33-16:48/15	18:51	20:44	21:32	22:01
22	08:32 15:26-15:57/31	07:40 17:06-17:25/19	06:38 17:13-17:46/33	06:28 06:52-07:03/11	05:35 06:06-06:22/16	05:18
	17:06 14:22-15:06/44	18:03 16:37-16:45/8	18:53	20:46	21:34	22:01
23	08:31 15:26-15:58/32	07:38 17:05-17:26/21	06:35 17:12-17:47/35	06:26 06:50-07:04/14	05:34 06:05-06:21/16	05:18
	17:08 14:23-15:06/43	18:05	18:54	20:47	21:35	22:01
24	08:30 15:26-15:58/32	07:36 17:04-17:26/22	06:33 17:11-17:48/37	06:24 06:48-07:03/15	05:33 06:05-06:22/17	05:18
	17:10 14:23-15:06/43	18:07	18:56	20:49	21:37	22:01
25	08:29 15:27-15:59/32	07:34 17:04-17:27/23	06:31 17:09-17:48/39	06:22 06:46-07:03/17	05:32 06:05-06:22/17	05:18
	17:11 14:24-15:06/42	18:09	18:58	20:51	21:38	22:01
26	08:27 15:26-15:59/33	07:32 17:03-17:26/23	06:28 17:09-17:48/39	06:20 06:44-07:02/18	05:30 06:05-06:22/17	05:19
	17:13 14:25-15:06/41	18:10	19:00	20:52	21:39	22:01
27	08:26 15:27-15:59/32	07:30 17:03-17:26/23	06:26 17:09-17:49/40	06:18 20:09-20:14/5	05:29 06:05-06:22/17	05:19
	17:15 14:25-15:05/40	18:12	19:01	20:54 06:44-07:02/18	21:41	22:01
28	08:25 15:27-15:59/32	07:27 17:03-17:26/23	06:24 17:07-17:48/41	06:16 20:06-20:17/11 06:45-07:01/16	05:28 06:05-06:22/17	05:20
	17:17 14:26-15:04/38	18:14	19:03	20:56 06:40-06:42/2	21:42	22:01
29	08:23 15:28-16:00/32		07:21 18:07-18:48/41	06:14 20:04-20:18/14 06:46-06:59/13	05:27 06:06-06:23/17	05:20
	17:19 14:27-15:05/38		20:05	20:58 06:38-06:43/5	21:43	22:01
30	08:22 15:28-15:59/31		07:19 18:07-18:48/41	06:12 20:03-20:19/16 06:47-06:57/10	05:26 06:06-06:22/16	05:21
	17:20 14:28-15:04/36		20:06	20:59 06:36-06:44/8	21:44	22:01
31	08:20 15:29-16:00/31		07:17 18:07-18:47/40		05:25 06:07-06:22/15	
	17:22 14:30-15:03/33		20:08		21:46	
Potential sun hours	259	278	367	416	485	499
Sum of minutes with flicker	1981	991	919	539	760	103

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar per WTG

Calculation: Alternative Scenario 3 Real Case **WTG:** 2 - T5

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	July	August	September	October	November	December
1	05:21 22:01	05:58 20:15-20:39/24 21:29	06:48 18:18-18:30/12 20:27	07:37 18:05-18:32/27 19:17	07:31 15:57-16:32/35 17:11	08:22 15:11-15:29/18 16:31 14:00-14:45/45
2	05:22 06:19-06:22/3 22:00	06:00 20:13-20:38/25 21:27	06:49 18:14-18:32/18 20:24	07:39 18:04-18:32/28 19:15	07:33 15:58-16:31/33 17:09	08:23 15:12-15:28/16 16:30 14:00-14:45/45
3	05:23 06:19-06:24/5 22:00	06:01 20:13-20:39/26 21:25 06:42-06:48/6	06:51 18:11-18:35/24 20:22	07:40 18:03-18:31/28 19:12	07:34 15:59-16:31/32 17:07 15:10-15:19/9	08:25 15:14-15:28/14 16:29 14:01-14:45/44
4	05:24 06:17-06:24/7 22:00	06:03 20:11-20:38/27 21:24 06:40-06:50/10	06:53 18:09-18:35/26 20:20	07:42 18:02-18:30/28 19:10	07:36 16:00-16:30/30 17:05 15:07-15:22/15	08:26 15:15-15:26/11 16:29 14:01-14:45/44
5	05:24 06:17-06:25/8 21:59	06:04 20:11-20:38/27 21:22 06:39-06:51/12	06:54 18:07-18:37/30 20:17	07:44 18:02-18:29/27 19:08	07:38 16:01-16:29/28 17:04 15:05-15:24/19	08:27 15:18-15:25/7 16:28 14:02-14:46/44
6	05:25 06:16-06:26/10 21:58	06:06 20:10-20:37/27 21:20 06:38-06:52/14	06:56 18:06-18:38/32 20:15	07:45 18:02-18:27/25 19:06	07:40 16:02-16:22/25 14:11-14:24/13 17:02 15:03-15:26/23	08:29 14:02-14:46/44 16:28
7	05:26 06:16-06:27/11 21:58	06:07 20:10-20:36/26 21:18 06:38-06:53/15	06:58 18:04-18:38/34 20:13	07:47 18:02-18:24/22 19:03	07:42 16:21-16:24/3 15:02-15:27/25 17:00 16:05-16:15/10 14:08-14:27/19	08:30 14:02-14:46/44 16:27
8	05:27 06:16-06:28/12 21:57	06:09 20:10-20:35/25 21:16 06:37-06:53/16	06:59 18:03-18:39/36 20:11	07:49 18:03-18:21/18 19:01 17:44-17:54/10	07:43 15:01-15:28/27 16:59 14:05-14:30/25	08:31 14:04-14:47/43 16:27
9	05:28 06:16-06:29/13 21:57	06:11 20:09-20:33/24 21:15 06:39-06:54/15	07:01 18:01-18:39/38 20:08	07:50 18:04-18:20/16 18:59 17:42-17:56/14	07:45 15:01-15:29/28 16:57 14:03-14:31/28	08:32 14:04-14:47/43 16:27
10	05:29 06:16-06:29/13 21:56	06:12 20:10-20:32/22 21:13 06:40-06:53/13	07:02 18:01-18:39/38 20:06	07:52 18:05-18:17/12 18:57 17:39-17:57/18	07:47 15:00-15:30/30 16:55 14:02-14:33/31	08:33 14:04-14:47/43 16:26
11	05:30 06:15-06:30/15 21:55	06:14 20:10-20:30/20 21:11 06:42-06:53/11	07:04 17:59-18:39/40 20:04	07:54 18:09-18:13/4 18:54 17:38-17:58/20	07:49 15:00-15:30/30 16:54 14:01-14:34/33	08:34 14:05-14:47/42 16:26
12	05:31 06:15-06:30/15 21:54	06:15 20:11-20:29/18 06:57-07:04/7 21:09 06:43-06:52/9	07:06 17:59-18:39/40 20:01	07:55 17:37-17:59/22 18:52	07:50 15:00-15:31/31 16:52 14:00-14:35/35	08:35 14:05-14:47/42 16:26
13	05:32 06:15-06:31/16 21:53	06:17 20:11-20:26/15 06:55-07:06/11 21:07 06:45-06:52/7	07:07 17:59-18:39/40 19:59	07:57 17:37-17:59/22 18:50	07:52 15:00-15:31/31 16:51 13:59-14:37/38	08:36 14:06-14:47/41 16:26
14	05:33 06:15-06:31/16 21:52	06:19 20:12-20:25/13 06:53-07:07/14 21:05 06:46-06:50/4	07:09 17:58-18:38/40 19:57	07:59 17:36-17:59/23 18:48	07:54 15:00-15:32/32 16:49 13:59-14:37/38	08:37 14:06-14:48/42 16:26
15	05:35 06:15-06:31/16 21:51	06:20 20:14-20:24/10 06:52-07:08/16 21:03 06:48-06:49/1	07:11 17:58-18:38/40 19:54	08:01 17:35-17:58/23 18:45	07:56 15:00-15:32/32 16:48 13:58-14:38/40	08:38 14:07-14:48/41 16:26
16	05:36 06:15-06:31/16 21:50	06:22 20:18-20:19/1 21:01 06:51-07:08/17	07:12 17:57-18:37/40 19:52	08:02 17:35-17:58/23 18:43	07:57 15:00-15:33/33 16:46 13:58-14:39/41	08:39 14:08-14:49/41 16:26
17	05:37 06:14-06:31/17 21:49	06:23 06:51-07:09/18 20:59	07:14 17:57-18:37/40 19:50	08:04 17:35-17:58/23 18:41	07:59 14:59-15:32/33 16:45 13:57-14:39/42	08:40 14:09-14:49/40 16:26
18	05:38 06:14-06:31/17 21:48	06:25 06:52-07:09/17 20:57	07:15 17:58-18:36/38 19:47	08:06 17:36-17:57/21 18:39	08:01 15:00-15:32/32 16:44 13:57-14:40/43	08:41 14:09-14:50/41 16:27
19	05:40 06:15-06:32/17 21:47	06:27 06:54-07:09/15 20:55	07:17 17:57-18:35/38 19:45	08:08 17:37-17:57/20 18:37	08:03 15:00-15:32/32 16:42 13:57-14:40/43	08:41 14:09-14:50/41 16:27
20	05:41 06:15-06:32/17 21:46	06:28 06:55-07:08/13 20:53	07:19 17:58-18:34/36 19:43	08:09 17:38-17:55/17 18:35 17:07-17:17/10	08:04 15:01-15:32/31 16:41 13:57-14:41/44	08:42 14:10-14:51/41 16:27
21	05:42 06:15-06:31/16 21:45	06:30 06:57-07:08/11 20:51	07:20 17:58-18:32/34 19:40	08:11 17:38-17:53/15 18:33 17:03-17:19/16	08:06 15:02-15:32/30 16:40 13:57-14:42/45	08:43 14:10-14:50/40 16:28
22	05:44 06:15-06:31/16 21:43	06:32 06:58-07:07/9 20:49	07:22 17:59-18:31/32 19:38	08:13 17:40-17:51/11 18:31 17:01-17:20/19	08:08 15:03-15:33/30 16:39 13:57-14:42/45	08:43 14:11-14:51/40 16:28
23	05:45 06:17-06:31/14 21:42	06:33 07:00-07:06/6 20:46	07:24 18:01-18:29/28 19:36	08:15 17:00-17:21/21 18:29	08:09 15:03-15:33/30 16:38 13:57-14:43/46	08:44 14:11-14:52/41 16:29
24	05:46 20:25-20:33/8 21:41 06:17-06:30/13	06:35 07:02-07:05/3 20:44	07:25 18:01-18:26/25 19:33	08:16 16:59-17:26/27 18:26	08:11 15:03-15:32/29 16:37 13:57-14:42/45	08:44 14:12-14:53/41 16:29
25	05:48 20:23-20:34/11 21:39 06:18-06:29/11	06:36 20:42	07:27 18:04-18:27/23 19:31	08:18 15:58-16:29/31 17:24	08:13 15:04-15:32/28 16:36 13:57-14:43/46	08:45 14:12-14:53/41 16:30
26	05:49 20:22-20:35/13 21:38 06:19-06:29/10	06:38 20:40	07:29 18:07-18:30/23 19:29	08:20 15:58-16:30/32 17:22	08:14 15:06-15:32/26 16:35 13:58-14:44/46	08:45 14:12-14:53/41 16:31
27	05:51 20:21-20:37/16 21:37 06:21-06:27/6	06:40 20:38	07:30 18:15-18:31/16 19:26	08:22 15:57-16:31/34 17:20	08:16 15:06-15:31/25 16:34 13:58-14:43/45	08:45 14:13-14:54/41 16:31
28	05:52 20:19-20:37/18 21:35	06:41 20:35	07:32 18:10-18:32/22 19:24	08:24 15:57-16:32/35 17:18	08:17 15:07-15:31/24 16:33 13:58-14:44/46	08:45 14:13-14:54/41 16:32
29	05:54 20:17-20:37/20 21:33	06:43 20:33	07:34 18:08-18:33/25 19:22	08:25 15:57-16:32/35 17:17	08:19 15:09-15:31/22 16:32 13:59-14:44/45	08:45 14:13-14:55/42 16:33
30	05:55 20:17-20:38/21 21:32	06:45 20:31	07:35 18:06-18:32/26 19:19	08:27 15:57-16:33/36 17:15	08:20 15:09-15:30/21 16:31 13:59-14:44/45	08:46 14:14-14:55/41 16:34
31	05:57 20:15-20:38/23 21:30	06:46 20:29		07:29 15:58-16:32/34 17:13		08:46 14:14-14:56/42 16:35
Potential sun hours	502	454	391	331	266	244
Sum of minutes with flicker	460	620	934	847	1921	1368

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar per WTG

Calculation: Alternative Scenario 3 Real Case **WTG:** 3 - T4

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January		February		March		April		May		June	
1	08:46	09:41-10:20/39	08:19		07:25	17:32-17:46/14	07:15	19:07-19:26/19	06:10	19:21-19:48/27	05:24	05:53-06:14/21
	16:36		17:24		18:16	16:37-17:24/47	20:10		21:01		21:47	
2	08:45	09:42-10:21/39	08:17		07:23	17:30-17:46/16	07:12	19:09-19:25/16	06:08	19:22-19:47/25	05:24	05:52-06:14/22
	16:37		17:26		18:18	16:36-17:25/49	20:12		21:03		21:48	
3	08:45	09:43-10:22/39	08:16		07:21	17:30-17:47/17	07:10	19:12-19:23/11	06:06	19:23-19:47/24	05:23	05:52-06:15/23
	16:38		17:28		18:19	16:35-17:24/49	20:13		21:04		21:49	
4	08:45	09:42-10:22/40	08:14		07:19	17:30-17:47/17	07:08	19:14-19:20/6	06:04	19:24-19:46/22	05:22	05:51-06:15/24
	16:40		17:30		18:21	16:34-17:24/50	20:15		21:06		21:50	
5	08:45	09:43-10:23/40	08:12		07:16	17:30-17:47/17	07:05		06:02	19:25-19:44/19	05:21	05:51-06:15/24
	16:41		17:32		18:23	16:34-17:24/50	20:17		21:08		21:51	
6	08:45	09:43-10:23/40	08:11		07:14	17:29-17:49/20	07:03		06:00	19:26-19:43/17	05:21	05:50-06:15/25
	16:42		17:33		18:25	16:32-17:23/51	20:18		21:09		21:52	
7	08:44	09:44-10:24/40	08:09		07:12	17:30-17:51/21	07:01		05:59	19:29-19:41/12	05:20	05:50-06:15/25
	16:43		17:35		18:27	16:32-17:22/50	20:20		21:11		21:53	
8	08:44	09:44-10:24/40	08:07		07:10	17:31-17:52/21	06:59		05:57	19:32-19:37/5	05:20	05:49-06:15/26
	16:45		17:37		18:28	16:32-17:22/50	20:22		21:12		21:54	
9	08:43	09:45-10:25/40	08:05		07:07	17:33-17:53/20	06:56		05:55		05:19	05:49-06:15/26
	16:46		17:39		18:30	16:32-17:21/49	20:24		21:14		21:55	
10	08:43	09:45-10:25/40	08:04		07:05	17:31-17:53/22	06:54		05:53		05:19	05:49-06:16/27
	16:47		17:41		18:32	16:32-17:18/46	20:25		21:16		21:55	
11	08:42	09:45-10:25/40	08:02		07:03	17:31-17:53/22	06:52		05:52		05:18	05:49-06:15/26
	16:49		17:43		18:34	16:32-17:17/45	20:27		21:17		21:56	
12	08:42	09:45-10:25/40	08:00		07:01	17:31-17:54/23	06:50		05:50		05:18	05:49-06:15/26
	16:50		17:45		18:35	16:33-17:14/41	20:29		21:19		21:57	
13	08:41	09:46-10:25/39	07:58		06:58	17:30-17:53/23	06:47		05:48		05:18	05:50-06:16/26
	16:52		17:46		18:37	16:32-17:12/40	20:30		21:20		21:57	
14	08:40	09:46-10:26/40	07:56		06:56	17:30-17:53/23	06:45		05:47		05:17	05:50-06:16/26
	16:53		17:48		18:39	16:33-17:12/39	20:32		21:22		21:58	
15	08:39	09:47-10:26/39	07:54		06:54	17:59-18:08/9 16:34-17:11/37	06:43		05:45		05:17	05:51-06:16/25
	16:55		17:50		18:41	17:30-17:52/22	20:34		21:24		21:59	
16	08:38	09:47-10:26/39	07:52		06:52	17:56-18:09/13 16:34-17:09/35	06:41	19:32-19:43/11	05:44		05:17	05:51-06:16/25
	16:56		17:52		18:42	17:30-17:50/20	20:35		21:25		21:59	
17	08:38	09:48-10:26/38	07:50		06:49	17:54-18:11/17 16:36-17:08/32	06:39	19:29-19:46/17	05:42		05:17	05:51-06:17/26
	16:58		17:54		18:44	17:31-17:49/18	20:37		21:27		22:00	
18	08:37	09:48-10:26/38	07:48		06:47	17:53-18:12/19 16:37-17:06/29	06:36	19:27-19:48/21	05:41		05:17	05:51-06:17/26
	17:00		17:56		18:46	17:33-17:48/15	20:39		21:28		22:00	
19	08:36	09:49-10:27/38	07:46		06:45	17:52-18:11/19 16:39-17:04/25	06:34	19:26-19:49/23	05:39		05:17	05:51-06:17/26
	17:01		17:58		18:48	17:35-17:45/10	20:41		21:30		22:00	
20	08:35	09:50-10:27/37	07:44		06:42	17:52-18:12/20	06:32	19:25-19:50/25	05:38	06:05-06:08/3	05:17	05:51-06:17/26
	17:03		17:59		18:49	16:41-17:01/20	20:42		21:31		22:01	
21	08:33	09:51-10:27/36	07:42		06:40	17:52-18:12/20	06:30	19:23-19:49/26	05:37	06:04-06:10/6	05:17	05:51-06:17/26
	17:05		18:01		18:51	16:45-16:58/13	20:44		21:33		22:01	
22	08:32	09:51-10:26/35	07:40	17:08-17:13/5	06:38	17:51-18:10/19	06:28	19:22-19:50/28	05:35	06:03-06:11/8	05:18	05:51-06:17/26
	17:06		18:03		18:53		20:46		21:34		22:01	
23	08:31	09:53-10:26/33	07:38	17:04-17:18/14	06:35	18:12-18:21/9	06:26	19:21-19:50/29	05:34	06:01-06:11/10	05:18	05:52-06:18/26
	17:08		18:05	16:50-17:02/12	18:54	17:52-18:10/18	20:47		21:35		22:01	
24	08:30	09:53-10:25/32	07:36	16:46-17:20/34	06:33	18:10-18:23/13	06:24	19:21-19:50/29	05:33	06:00-06:11/11	05:18	05:52-06:18/26
	17:10		18:07		18:56	17:52-18:09/17	20:49		21:37		22:01	
25	08:29	09:54-10:25/31	07:34	16:44-17:22/38	06:31	18:08-18:25/17	06:22	19:20-19:50/30	05:32	05:59-06:12/13	05:18	05:52-06:18/26
	17:12		18:09		18:58	17:53-18:07/14	20:51		21:38		22:01	
26	08:27	09:56-10:24/28	07:32	16:41-17:22/41	06:28	18:07-18:27/20	06:20	19:21-19:51/30	05:30	05:58-06:12/14	05:19	05:53-06:18/25
	17:13		18:10		19:00	17:55-18:05/10	20:52		21:39		22:01	
27	08:26	09:57-10:23/26	07:30	17:36-17:42/6	06:26	18:07-18:28/21	06:18	19:21-19:51/30	05:29	05:57-06:13/16	05:19	05:53-06:18/25
	17:15		18:12	16:39-17:23/44	19:01		20:54		21:41		22:01	
28	08:25	09:59-10:22/23	07:27	17:33-17:45/12	06:24	18:06-18:27/21	06:16	19:21-19:50/29	05:28	05:56-06:13/17	05:20	05:53-06:19/26
	17:17		18:14	16:38-17:24/46	19:03		20:56		21:42		22:01	
29	08:23	10:01-10:20/19			07:21	19:06-19:28/22	06:14	19:21-19:50/29	05:27	05:56-06:14/18	05:20	05:53-06:19/26
	17:19				20:05		20:58		21:43		22:01	
30	08:22	10:03-10:17/14			07:19	19:06-19:28/22	06:12	19:21-19:49/28	05:26	05:55-06:14/19	05:21	05:54-06:20/26
	17:20				20:06		20:59		21:44		22:01	
31	08:20	10:08-10:13/5			07:17	19:06-19:26/20			05:25	05:54-06:14/20		
	17:22				20:08				21:46			
Potential sun hours	259		278		367		416		485		499	
Sum of minutes with flicker		1067		252		1568		437		306		759

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar per WTG

Calculation: Alternative Scenario 3 Real Case **WTG:** 3 - T4

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	July	August	September	October	November	December
1	05:21 05:53-06:19/26 22:01	05:58 21:29	06:48 20:27	07:37 18:09-18:33/24 19:17 17:12-17:52/40	07:31 17:11	08:22 09:27-10:07/40 16:31
2	05:22 05:54-06:20/26 22:00	06:00 21:27	06:49 20:24	07:39 18:09-18:32/23 19:15 17:11-17:54/43	07:33 17:09	08:23 09:28-10:08/40 16:30
3	05:23 05:54-06:21/27 22:00	06:01 21:25	06:51 20:22	07:40 18:09-18:31/22 19:12 17:10-17:56/46	07:34 17:07	08:25 09:28-10:08/40 16:29
4	05:24 05:54-06:20/26 22:00	06:03 21:24	06:53 20:20	07:42 18:09-18:31/22 19:10 17:09-17:57/48	07:36 17:05	08:26 09:28-10:08/40 16:29
5	05:24 05:55-06:21/26 21:59	06:04 19:40-19:49/9 21:22	06:54 20:18	07:44 18:09-18:30/21 19:08 17:09-17:58/49	07:38 17:04	08:27 09:29-10:09/40 16:28
6	05:25 05:56-06:21/25 21:59	06:06 19:37-19:51/14 21:20	06:56 20:15	07:45 18:07-18:27/20 19:06 17:08-17:58/50	07:40 17:02	08:29 09:29-10:09/40 16:28
7	05:26 05:57-06:22/25 21:58	06:07 19:35-19:53/18 21:18	06:58 20:13	07:47 18:06-18:26/20 19:03 17:08-17:59/51	07:42 17:00	08:30 09:30-10:10/40 16:27
8	05:27 05:58-06:22/24 21:57	06:09 19:34-19:54/20 21:16	06:59 19:10-19:14/4 20:11	07:49 18:05-18:23/18 19:01 17:09-17:59/50	07:43 16:59	08:31 09:30-10:10/40 16:27
9	05:28 05:59-06:22/23 21:57	06:11 19:32-19:55/23 21:15	07:01 19:06-19:16/10 20:08	07:50 18:05-18:22/17 18:59 17:09-17:59/50	07:45 16:57	08:32 09:31-10:10/39 16:27
10	05:29 06:00-06:22/22 21:56	06:12 19:31-19:56/25 21:13	07:02 19:02-19:18/16 20:06	07:52 18:04-18:21/17 18:57 17:08-17:58/50	07:47 16:55	08:33 09:31-10:10/39 16:26
11	05:30 06:01-06:23/22 21:55	06:14 19:30-19:56/26 21:11	07:04 18:59-19:18/19 20:04	07:54 18:04-18:21/17 18:54 17:09-17:58/49	07:49 09:38-09:45/7 16:54	08:34 09:31-10:10/39 16:26
12	05:31 06:02-06:23/21 21:54	06:15 19:30-19:57/27 21:09	07:06 18:58-19:19/21 20:01	07:55 18:05-18:20/15 18:52 17:10-17:58/48	07:50 09:34-09:49/15 16:52	08:36 09:32-10:11/39 16:26
13	05:32 06:03-06:23/20 21:53	06:17 19:29-19:58/29 21:07	07:07 18:57-19:19/22 19:59	07:57 18:06-18:19/13 18:50 17:11-17:57/46	07:52 09:32-09:52/20 16:51	08:37 09:32-10:11/39 16:26
14	05:33 06:04-06:23/19 21:52	06:19 19:28-19:58/30 21:05	07:09 18:56-19:18/22 19:57	07:59 18:07-18:17/10 18:48 17:12-17:57/45	07:54 09:31-09:54/23 16:49	08:37 09:33-10:11/38 16:26
15	05:35 06:05-06:23/18 21:52	06:20 19:28-19:58/30 21:03	07:11 18:56-19:18/22 19:54	08:01 18:10-18:13/3 18:45 17:12-17:55/43	07:56 09:30-09:56/26 16:48	08:38 09:33-10:12/39 16:26
16	05:36 06:06-06:22/16 21:50	06:22 19:27-19:57/30 21:01	07:12 18:55-19:16/21 19:52	08:02 17:14-17:54/40 18:43	07:58 09:29-09:57/28 16:46	08:39 09:34-10:12/38 16:26
17	05:37 06:07-06:22/15 21:49	06:23 19:28-19:58/30 20:59	07:14 18:56-19:15/19 19:50 18:44-18:53/9	08:04 17:16-17:52/36 18:41	07:59 09:28-09:59/31 16:45	08:40 09:35-10:13/38 16:27
18	05:38 06:08-06:22/14 21:48	06:25 19:27-19:57/30 20:57	07:16 18:56-19:14/18 19:47 18:42-18:55/13	08:06 17:18-17:51/33 18:39	08:01 09:27-09:59/32 16:44	08:41 09:36-10:14/38 16:27
19	05:40 06:10-06:22/12 21:47	06:27 19:27-19:57/30 20:55	07:17 18:57-19:10/13 19:45 18:39-18:55/16	08:08 17:36-17:48/12 18:37 17:23-17:31/8	08:03 09:27-10:00/33 16:42	08:41 09:35-10:13/38 16:27
20	05:41 06:11-06:21/10 21:46	06:28 19:27-19:56/29 20:53	07:19 18:58-19:08/10 19:43 18:38-18:56/18	08:09 18:35	08:04 09:26-10:01/35 16:41	08:42 09:36-10:14/38 16:27
21	05:42 06:12-06:21/9 21:45	06:30 19:28-19:56/28 20:51	07:20 18:37-18:56/19 19:40	08:11 18:33	08:06 09:26-10:02/36 16:40	08:43 09:36-10:14/38 16:28
22	05:44 06:13-06:20/7 21:43	06:32 19:27-19:54/27 20:49	07:22 18:36-18:56/20 19:38 17:31-17:41/10	08:13 18:31	08:08 09:26-10:03/37 16:39	08:43 09:37-10:15/38 16:28
23	05:45 06:15-06:19/4 21:42	06:33 19:28-19:53/25 20:46	07:24 18:36-18:56/20 19:36 17:27-17:45/18	08:15 18:29	08:09 09:26-10:04/38 16:38	08:44 09:37-10:15/38 16:29
24	05:46 06:16-06:18/2 21:41	06:35 19:29-19:51/22 20:44	07:25 18:35-18:55/20 17:23-17:47/24 19:33 18:20-18:27/7	08:16 18:26	08:11 09:26-10:03/37 16:37	08:44 09:38-10:16/38 16:29
25	05:48 21:39	06:36 19:30-19:50/20 20:42	07:27 18:36-18:55/19 17:21-17:48/27 19:31 18:17-18:30/13	08:18 17:24	08:13 09:26-10:04/38 16:36	08:45 09:39-10:17/38 16:30
26	05:49 21:38	06:38 19:32-19:49/17 20:40	07:29 18:37-18:54/17 17:19-17:50/31 19:29 18:15-18:32/17	08:20 17:22	08:14 09:26-10:05/39 16:35	08:45 09:39-10:17/38 16:31
27	05:51 21:37	06:40 19:34-19:45/11 20:38	07:30 18:37-18:52/15 17:17-17:50/33 19:26 18:12-18:32/20	08:22 17:20	08:16 09:27-10:06/39 16:34	08:45 09:39-10:17/38 16:31
28	05:52 21:35	06:41 20:36	07:32 18:38-18:50/12 17:15-17:51/36 19:24 18:11-18:33/22	08:24 17:18	08:17 09:26-10:06/40 16:33	08:45 09:39-10:18/39 16:32
29	05:54 21:34	06:43 20:33	07:34 18:42-18:47/5 17:14-17:52/38 19:22 18:11-18:33/22	08:25 17:17	08:19 09:27-10:07/40 16:32	08:46 09:40-10:18/38 16:33
30	05:55 21:32	06:45 20:31	07:35 18:09-18:32/23 19:19 17:12-17:52/40	08:27 17:15	08:20 09:26-10:06/40 16:31	08:46 09:40-10:19/39 16:34
31	05:57 21:30	06:46 20:29		07:29 17:13		08:46 09:41-10:19/38 16:35
Potential sun hours	502	454	381	331	266	244
Sum of minutes with flicker	439	550	801	1099	634	1202

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm) Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:
Inchamore

Description:
5 Turbine Wind Farm, Inchamore, Coolea, Co. Cork

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar per WTG

Calculation: Alternative Scenario 3 Real Case **WTG:** 4 - T2

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January	February		March	April		May		June	
1	08:46	08:19		07:25	07:15		06:10	20:08-20:30/22	05:24	20:43-20:52/9
	16:36	17:24		18:16	20:10		21:01		21:47	06:00-07:02/62
2	08:46	08:17		07:23	07:12		06:08	20:08-20:30/22	05:24	20:44-20:51/7
	16:37	17:26		18:18	20:12		21:03		21:48	06:00-07:02/62
3	08:45	08:16		07:21	07:10		06:06	20:08-20:31/23	05:23	20:46-20:51/5
	16:38	17:28		18:19	20:13		21:04		21:49	05:59-07:03/64
4	08:45	08:14		07:19	07:08		06:04	20:08-20:31/23	05:22	05:59-07:03/64
	16:40	17:30		18:21	20:15		21:06		21:50	
5	08:45	08:12		07:16	07:05		06:02	20:08-20:30/22	05:21	05:59-07:03/64
	16:41	17:32		18:23	20:17		21:08		21:51	
6	08:45	08:11		07:14	07:03		06:00	20:08-20:30/22	05:21	05:59-07:03/64
	16:42	17:33		18:25	20:18		21:09		21:52	
7	08:44	08:09		07:12	07:01		05:59	20:09-20:30/21	05:20	05:59-07:04/65
	16:43	17:35		18:27	20:20		21:11	06:34-06:41/7	21:53	
8	08:44	08:07		07:10	06:59		05:57	20:09-20:29/20	05:20	05:59-07:03/64
	16:45	17:37		18:28	20:22		21:13	06:29-06:45/16	21:54	
9	08:43	08:05		07:08	06:56		05:55	20:09-20:28/19	05:19	05:59-07:04/65
	16:46	17:39		18:30	20:24		21:14	06:27-06:48/21	21:55	
10	08:43	08:04		07:05	06:54		05:53	20:11-20:27/16	05:19	06:00-07:04/64
	16:47	17:41		18:32	20:25		21:16	06:24-06:50/26	21:55	
11	08:42	08:02		07:03	06:52		05:52	20:11-20:26/15	05:18	05:59-07:04/65
	16:49	17:43		18:34	20:27		21:17	06:22-06:51/29	21:56	
12	08:42	08:00		07:01	06:50		05:50	20:13-20:25/12	05:18	05:59-07:04/65
	16:50	17:45		18:35	20:29		21:19	06:21-06:53/32	21:57	
13	08:41	07:58		06:58	06:47		05:48	20:45-20:46/1 06:19-06:53/34	05:18	06:00-07:04/64
	16:52	17:47		18:37	20:30		21:21	20:15-20:22/7	21:57	
14	08:40	07:56		06:56	06:45		05:47	20:42-20:50/8	05:18	06:00-07:05/65
	16:53	17:48		18:39	20:32		21:22	06:19-06:55/36	21:58	
15	08:39	07:54		06:54	06:43		05:45	20:40-20:51/11	05:17	06:00-07:05/65
	16:55	17:50		18:41	20:34		21:24	06:18-06:56/38	21:59	
16	08:38	07:52		06:52	06:41		05:44	20:40-20:53/13	05:17	06:00-07:05/65
	16:56	17:52		18:42	20:36		21:25	06:17-06:56/39	21:59	
17	08:38	07:50	17:24-17:27/3	06:49	06:39		05:42	20:39-20:54/15	05:17	06:01-07:05/64
	16:58	17:54		18:44	20:37		21:27	06:17-06:57/40	22:00	
18	08:37	07:48	17:21-17:29/8	06:47	06:36		05:41	20:38-20:54/16	05:17	06:01-07:06/65
	17:00	17:56		18:46	20:39		21:28	06:15-06:57/42	22:00	
19	08:36	07:46	17:19-17:30/11	06:45	06:34		05:39	20:38-20:54/16	05:17	06:01-07:06/65
	17:01	17:58		18:48	20:41		21:30	06:15-06:58/43	22:00	
20	08:35	07:44	17:18-17:32/14	06:42	06:32		05:38	20:38-20:55/17	05:17	06:01-07:06/65
	17:03	17:59		18:49	20:42		21:31	06:13-06:59/46	22:01	
21	08:33	07:42	17:18-17:33/15	06:40	06:30		05:37	20:38-20:55/17	05:17	06:01-07:06/65
	17:05	18:01		18:51	20:44		21:33	06:09-06:59/50	22:01	
22	08:32	07:40	17:18-17:33/15	06:38	06:28		05:35	20:37-20:55/18	05:18	06:01-07:06/65
	17:06	18:03		18:53	20:46		21:34	06:08-07:00/52	22:01	
23	08:31	07:38	17:18-17:33/15	06:35	06:26		05:34	20:38-20:55/17	05:18	06:02-07:07/65
	17:08	18:05		18:55	20:47		21:35	06:07-07:00/53	22:01	
24	08:30	07:36	17:19-17:32/13	06:33	06:24		05:33	20:38-20:55/17	05:18	06:02-07:07/65
	17:10	18:07		18:56	20:49		21:37	06:05-07:00/55	22:01	
25	08:29	07:34	17:20-17:31/11	06:31	06:22	20:18-20:23/5	05:32	20:38-20:55/17	05:18	06:02-07:07/65
	17:12	18:09		18:58	20:51		21:38	06:04-07:00/56	22:01	
26	08:27	07:32	17:21-17:29/8	06:28	06:20	20:15-20:25/10	05:30	20:39-20:55/16	05:19	06:03-07:07/64
	17:13	18:10		19:00	20:53		21:39	06:03-07:01/58	22:01	
27	08:26	07:30		06:26	06:18	20:13-20:26/13	05:29	20:39-20:54/15	05:19	06:02-07:07/65
	17:15	18:12		19:01	20:54		21:41	06:02-07:01/59	22:01	
28	08:25	07:27		06:24	06:16	20:11-20:28/17	05:28	20:39-20:54/15	05:20	06:03-07:08/65
	17:17	18:14		19:03	20:56		21:42	06:01-07:01/60	22:01	
29	08:23			07:22	06:14	20:10-20:29/19	05:27	20:40-20:53/13	05:20	06:03-07:08/65
	17:19			20:05	20:58		21:43	06:01-07:02/61	22:01	
30	08:22			07:19	06:12	20:09-20:30/21	05:26	20:42-20:54/12	05:21	06:04-07:08/64
	17:21			20:07	20:59		21:44	06:01-07:02/61	22:01	
31	08:20			07:17			05:25	20:42-20:53/11		
	17:22			20:08			21:46	06:00-07:02/62		
Potential sun hours	259	278		367	416		485		499	
Sum of minutes with flicker	0	113		0	85		1585		1955	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar per WTG

Calculation: Alternative Scenario 3 Real Case **WTG:** 4 - T2

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	July	August	September	October	November	December
1	05:22 06:03-07:08/65	05:58 20:23-20:36/13	06:48	07:37	07:31	08:22
	22:01	21:29 06:32-07:02/30	20:27	19:17	17:11	16:31
2	05:22 06:04-07:08/64	06:00 20:21-20:37/16	06:50	07:39	07:33	08:23
	22:00	21:27 06:33-07:01/28	20:24	19:15	17:09	16:30
3	05:23 06:04-07:09/65	06:01 20:21-20:38/17	06:51	07:40	07:34	08:25
	22:00	21:25 06:35-06:59/24	20:22	19:12	17:07	16:29
4	05:24 06:04-07:08/64	06:03 20:19-20:38/19	06:53	07:42	07:36	08:26
	22:00	21:24 06:37-06:57/20	20:20	19:10	17:05	16:29
5	05:25 06:05-07:09/64	06:04 20:19-20:40/21	06:54	07:44	07:38	08:27
	21:59	21:22 06:40-06:54/14	20:18	19:08	17:04	16:28
6	05:25 06:05-07:09/64	06:06 20:18-20:39/21	06:56	07:45	07:40	08:29
	21:59	21:20	20:15	19:06	17:02	16:28
7	05:26 06:06-07:10/64	06:07 20:18-20:40/22	06:58	07:47	07:42	08:30
	21:58	21:18	20:13	19:03	17:00	16:27
8	05:27 06:06-07:10/64	06:09 20:17-20:40/23	06:59	07:49	07:43	08:31
	21:57	21:17	20:11	19:01	16:59	16:27
9	05:28 20:54-20:57/3	06:11 20:18-20:40/22	07:01	07:50	07:45	08:32
	21:57 06:07-07:10/63	21:15	20:08	18:59	16:57	16:27
10	05:29 20:53-20:59/6	06:12 20:17-20:40/23	07:03	07:52	07:47	08:33
	21:56 06:07-07:10/63	21:13	20:06	18:57	16:55	16:27
11	05:30 20:51-20:59/8	06:14 20:17-20:40/23	07:04	07:54	07:49	08:34
	21:55 06:08-07:11/63	21:11	20:04	18:54	16:54	16:26
12	05:31 20:51-21:01/10	06:15 20:17-20:39/22	07:06	07:56	07:51	08:36
	21:54 06:08-07:11/63	21:09	20:01	18:52	16:52	16:26
13	05:32 20:50-21:02/12	06:17 20:18-20:39/21	07:07	07:57	07:52	08:37
	21:53 06:09-07:11/62	21:07	19:59	18:50	16:51	16:26
14	05:33 20:50-21:03/13	06:19 20:18-20:36/18	07:09	07:59	07:54	08:37
	21:53 06:10-07:11/61	21:05	19:57	18:48	16:49	16:26
15	05:35 20:49-21:03/14	06:20 20:19-20:35/16	07:11	08:01 17:55-17:59/4	07:56	08:38
	21:52 06:10-07:11/61	21:03	19:54	18:46	16:48	16:26
16	05:36 20:49-21:04/15	06:22 20:20-20:33/13	07:12	08:02 17:52-18:02/10	07:58	08:39
	21:51 06:11-07:10/59	21:01	19:52	18:43	16:46	16:26
17	05:37 20:48-21:04/16	06:23 20:22-20:31/9	07:14	08:04 17:51-18:03/12	07:59	08:40
	21:49 06:12-07:10/58	20:59	19:50	18:41	16:45	16:27
18	05:38 20:48-21:04/16	06:25 20:24-20:29/5	07:16	08:06 17:50-18:04/14	08:01	08:41
	21:48 06:13-07:10/57	20:57	19:47	18:39	16:44	16:27
19	05:40 20:48-21:04/16	06:27	07:17	08:08 17:49-18:04/15	08:03	08:42
	21:47 06:15-07:11/56	20:55	19:45	18:37	16:42	16:27
20	05:41 20:48-21:05/17	06:28	07:19	08:09 17:49-18:04/15	08:04	08:42
	21:46 06:16-07:10/54	20:53	19:43	18:35	16:41	16:27
21	05:42 20:48-21:05/17	06:30	07:20	08:11 17:48-18:03/15	08:06	08:43
	21:45 06:17-07:10/53	20:51	19:40	18:33	16:40	16:28
22	05:44 20:48-21:05/17	06:32	07:22	08:13 17:49-18:02/13	08:08	08:43
	21:44 06:18-07:09/51	20:49	19:38	18:31	16:39	16:28
23	05:45 20:48-21:05/17	06:33	07:24	08:15 17:50-18:00/10	08:09	08:44
	21:42 06:21-07:10/49	20:46	19:36	18:29	16:38	16:29
24	05:46 20:49-21:05/16	06:35	07:25	08:16 17:51-17:57/6	08:11	08:44
	21:41 06:25-07:09/44	20:44	19:33	18:27	16:37	16:29
25	05:48 20:49-21:05/16	06:37	07:27	07:18	08:13	08:45
	21:39 06:26-07:08/42	20:42	19:31	17:25	16:36	16:30
26	05:49 20:49-21:04/15	06:38	07:29	07:20	08:14	08:45
	21:38 06:27-07:08/41	20:40	19:29	17:23	16:35	16:31
27	05:51 20:50-21:04/14	06:40	07:30	07:22	08:16	08:45
	21:37 06:27-07:07/40	20:38	19:26	17:21	16:34	16:32
28	05:52 20:50-21:03/13	06:41	07:32	07:24	08:17	08:45
	21:35 06:28-07:06/38	20:36	19:24	17:19	16:33	16:32
29	05:54 20:52-21:02/10	06:43	07:34	07:25	08:19	08:46
	21:34 06:29-07:06/37	20:33	19:22	17:17	16:32	16:33
30	05:55 20:54-21:00/6	06:45	07:35	07:27	08:20	08:46
	21:32 06:30-07:05/35	20:31	19:19	17:15	16:31	16:34
31	05:57 20:24-20:34/10	06:46		07:29		08:46
	21:30 06:30-07:03/33	20:29		17:13		16:35
Potential sun hours	502	454	381	331	266	244
Sum of minutes with flicker	1994	440	0	114	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar per WTG

Calculation: Alternative Scenario 3 Real Case **WTG:** 5 - T3

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	January		February	March		April	May	June
1	08:46	14:55-15:18/23	08:19	07:25		07:15	06:10	05:24
	16:36	12:47-13:28/41	17:24	18:16		20:10	21:01	21:47
2	08:46	14:56-15:19/23	08:17	07:23		07:12	06:08	05:24
	16:37	12:48-13:29/41	17:26	18:18		20:12	21:03	21:48
3	08:45	14:57-15:19/22	08:16	07:21		07:10	06:06	05:23
	16:38	12:49-13:29/40	17:28	18:19		20:13	21:04	21:49
4	08:45	14:57-15:19/22	08:14	07:19	17:37-17:43/6	07:08	06:04	05:22
	16:40	12:49-13:29/40	17:30	18:21		20:15	21:06	21:50
5	08:45	14:58-15:19/21	08:12	07:16	17:34-17:46/12	07:05	06:02	05:21
	16:41	12:50-13:29/39	17:32	18:23		20:17	21:08	21:51
6	08:45	14:58-15:19/21	08:11	07:14	17:32-17:47/15	07:03	06:00	05:21
	16:42	12:50-13:29/39	17:33	18:25		20:18	21:09	21:52
7	08:44	15:00-15:20/20	08:09	07:12	17:31-17:48/17	07:01	05:59	05:20
	16:43	12:52-13:29/37	17:35	18:27		20:20	21:11	21:53
8	08:44	15:00-15:19/19	08:07	07:10	17:30-17:49/19	06:59	05:57	05:20
	16:45	12:52-13:29/37	17:37	18:28		20:22	21:13	21:54
9	08:43	15:01-15:19/18	08:05	07:08	17:30-17:49/19	06:56	05:55	05:19
	16:46	12:54-13:29/35	17:39	18:30		20:24	21:14	21:55
10	08:43	15:03-15:19/16	08:04	07:05	17:29-17:48/19	06:54	05:53	05:19
	16:47	12:55-13:29/34	17:41	18:32		20:25	21:16	21:55
11	08:42	15:03-15:19/16	08:02	07:03	17:54-18:03/9	06:52	05:52	05:18
	16:49	12:56-13:28/32	17:43	18:34	17:29-17:48/19	20:27	21:17	21:56
12	08:42	15:05-15:18/13	08:00	07:01	17:52-18:04/12	06:50	05:50	05:18
	16:50	12:57-13:27/30	17:45	18:35	17:30-17:48/18	20:29	21:19	21:57
13	08:41	15:06-15:17/11	07:58	06:58	17:50-18:05/15	06:47	05:48	05:18
	16:52	12:58-13:27/29	17:47	18:37	17:30-17:46/16	20:30	21:21	21:58
14	08:40	15:09-15:15/6	07:56	06:56	17:49-18:05/16	06:45	05:47	05:17
	16:53	13:00-13:26/26	17:48	18:39	17:31-17:45/14	20:32	21:22	21:58
15	08:39	13:02-13:25/23	07:54	06:54	17:49-18:06/17	06:43	05:45	05:17
	16:55		17:50	18:41	17:33-17:43/10	20:34	21:24	21:59
16	08:38	13:04-13:23/19	07:52	06:52	17:48-18:05/17	06:41	05:44	05:17
	16:56		17:52	18:42		20:36	21:25	21:59
17	08:38	13:07-13:21/14	07:50	06:49	18:07-18:15/8	06:39	05:42	05:17
	16:58		17:54	18:44	17:49-18:04/15	20:37	21:27	22:00
18	08:37	13:12-13:17/5	07:48	06:47	18:06-18:17/11	06:36	05:41	05:17
	17:00		17:56	18:46	17:50-18:03/13	20:39	21:28	22:00
19	08:36		07:46	06:45	18:04-18:17/13	06:34	05:39	05:17
	17:01		17:58	18:48	17:50-18:01/11	20:41	21:30	22:00
20	08:35		07:44	06:42	18:03-18:17/14	06:32	05:38	05:17
	17:03		17:59	18:49	17:52-17:59/7	20:42	21:31	22:01
21	08:33		07:42	06:40	18:03-18:18/15	06:30	05:37	05:17
	17:05		18:01	18:51		20:44	21:33	22:01
22	08:32		07:40	06:38	18:02-18:16/14	06:28	05:35	05:18
	17:06		18:03	18:53		20:46	21:34	22:01
23	08:31		07:38	06:35	18:03-18:16/13	06:26	05:34	05:18
	17:08		18:05	18:55		20:47	21:35	22:01
24	08:30		07:36	06:33	18:04-18:15/11	06:24	05:33	05:18
	17:10		18:07	18:56		20:49	21:37	22:01
25	08:29		07:34	06:31	18:05-18:12/7	06:22	05:32	05:18
	17:12		18:09	18:58		20:51	21:38	22:02
26	08:27		07:32	06:28		06:20	05:30	05:19
	17:13		18:10	19:00		20:53	21:39	22:02
27	08:26		07:30	06:26		06:18	05:29	05:19
	17:15		18:12	19:01		20:54	21:41	22:01
28	08:25		07:27	06:24		06:16	05:28	05:20
	17:17		18:14	19:03		20:56	21:42	22:01
29	08:23			07:22		06:14	05:27	05:20
	17:19			20:05		20:58	21:43	22:01
30	08:22			07:19		06:12	05:26	05:21
	17:21			20:07		20:59	21:44	22:01
31	08:20			07:17			05:25	
	17:22			20:08			21:46	
Potential sun hours	259		278	367		416	485	499
Sum of minutes with flicker	812		0	422		0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Calendar per WTG

Calculation: Alternative Scenario 3 Real Case **WTG:** 5 - T3

Assumptions for shadow calculations

Sunshine probability S (Average daily sunshine hours) [VALENTIA OBS.]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1.30	2.04	2.89	4.92	5.79	4.99	4.32	4.35	3.60	2.54	1.64	1.06

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
357	232	194	296	505	722	799	1,057	875	1,557	847	1,319	8,760

	July	August	September	October	November	December
1	05:22	05:58	06:48	07:37 18:30-18:44/14	07:31	08:22 14:46-15:01/15
	22:01	21:29	20:27	19:17 18:09-18:26/17	17:11	16:31 12:38-13:10/32
2	05:22	06:00	06:50	07:39 18:32-18:42/10	07:33	08:23 14:46-15:02/16
	22:00	21:27	20:24	19:15 18:08-18:27/19	17:09	16:30 12:38-13:12/34
3	05:23	06:01	06:51	07:40 18:33-18:39/6	07:34	08:25 14:45-15:03/18
	22:00	21:25	20:22	19:12 18:07-18:26/19	17:07	16:29 12:37-13:12/35
4	05:24	06:03	06:53	07:42 18:07-18:26/19	07:36	08:26 14:44-15:03/19
	22:00	21:24	20:20	19:10	17:05	16:29 12:36-13:13/37
5	05:24	06:04	06:54	07:44 18:07-18:26/19	07:38	08:27 14:45-15:05/20
	21:59	21:22	20:18	19:08	17:04	16:28 12:37-13:14/37
6	05:25	06:06	06:56	07:45 18:07-18:24/17	07:40	08:29 14:44-15:05/21
	21:59	21:20	20:15	19:06	17:02	16:28 12:36-13:15/39
7	05:26	06:07	06:58	07:47 18:07-18:23/16	07:42	08:30 14:45-15:06/21
	21:58	21:18	20:13	19:03	17:00	16:27 12:37-13:16/39
8	05:27	06:09	06:59	07:49 18:09-18:22/13	07:43	08:31 14:45-15:07/22
	21:57	21:17	20:11	19:01	16:59	16:27 12:37-13:17/40
9	05:28	06:11	07:01	07:50 18:11-18:20/9	07:45	08:32 14:45-15:07/22
	21:57	21:15	20:08	18:59	16:57	16:27 12:37-13:17/40
10	05:29	06:12	07:03	07:52	07:47	08:33 14:45-15:08/23
	21:56	21:13	20:06	18:57	16:55	16:27 12:37-13:18/41
11	05:30	06:14	07:04	07:54	07:49	08:35 14:45-15:08/23
	21:55	21:11	20:04	18:54	16:54	16:26 12:37-13:18/41
12	05:31	06:15	07:06	07:56	07:51	08:36 14:45-15:09/24
	21:54	21:09	20:01	18:52	16:52	16:26 12:37-13:19/42
13	05:32	06:17	07:07	07:57	07:52	08:37 14:46-15:09/23
	21:53	21:07	19:59	18:50	16:51	16:26 12:37-13:20/43
14	05:33	06:19	07:09	07:59	07:54	08:38 14:46-15:10/24
	21:53	21:05	19:57	18:48	16:49	16:26 12:37-13:20/43
15	05:35	06:20	07:11	08:01	07:56	08:38 14:47-15:10/23
	21:52	21:03	19:54	18:46	16:48	16:26 12:38-13:21/43
16	05:36	06:22	07:12	08:02	07:58	08:39 14:47-15:11/24
	21:51	21:01	19:52	18:43	16:46	16:26 12:38-13:22/44
17	05:37	06:23	07:14	08:04	07:59	08:40 14:48-15:12/24
	21:49	20:59	19:50	18:41	16:45	16:27 12:39-13:22/43
18	05:38	06:25	07:16 18:54-19:00/6	08:06	08:01	08:41 14:48-15:12/24
	21:48	20:57	19:47	18:39	16:44	16:27 12:40-13:23/43
19	05:40	06:27	07:17 18:51-19:01/10	08:08	08:03	08:42 14:48-15:12/24
	21:47	20:55	19:45	18:37	16:42	16:27 12:39-13:23/44
20	05:41	06:28	07:19 18:49-19:02/13	08:09	08:04	08:42 14:49-15:13/24
	21:46	20:53	19:43	18:35	16:41	16:27 12:40-13:24/44
21	05:42	06:30	07:20 18:48-19:02/14	08:11	08:06	08:43 14:49-15:13/24
	21:45	20:51	19:40	18:33	16:40	16:28 12:40-13:24/44
22	05:44	06:32	07:22 18:47-19:02/15	08:13	08:08	08:43 14:50-15:14/24
	21:44	20:49	19:38	18:31	16:39	16:28 12:41-13:25/44
23	05:45	06:33	07:24 18:48-19:02/14	08:15	08:09	08:44 14:50-15:14/24
	21:42	20:46	19:36 18:38-18:42/4	18:29	16:38	16:29 12:41-13:25/44
24	05:46	06:35	07:25 18:47-19:01/14	08:16	08:11 12:50-12:54/4	08:44 14:51-15:15/24
	21:41	20:44	19:33 18:34-18:44/10	18:27	16:37	16:29 12:42-13:26/44
25	05:48	06:36	07:27 18:48-19:00/12	07:18	08:13 12:45-12:59/14	08:45 14:51-15:15/24
	21:39	20:42	19:31 18:33-18:46/13	17:24	16:36	16:30 12:42-13:26/44
26	05:49	06:38	07:29 18:49-18:58/9	07:20	08:14 12:43-13:02/19	08:45 14:52-15:16/24
	21:38	20:40	19:29 18:32-18:47/15	17:22	16:35	16:31 12:43-13:26/43
27	05:51	06:40	07:30 18:30-18:46/16	07:22	08:16 12:42-13:05/23	08:45 14:52-15:16/24
	21:37	20:38	19:26	17:20	16:34	16:31 12:43-13:27/44
28	05:52	06:41	07:32 18:30-18:46/16	07:24	08:17 14:49-14:55/6	08:45 14:52-15:16/24
	21:35	20:36	19:24 18:15-18:23/8	17:19	16:33 12:40-13:06/26	16:32 12:44-13:27/43
29	05:54	06:43	07:34 18:30-18:46/16	07:25	08:19 14:48-14:58/10	08:46 14:53-15:17/24
	21:34	20:33	19:22 18:12-18:25/13	17:17	16:32 12:39-13:08/29	16:33 12:44-13:27/43
30	05:55	06:45	07:35 18:30-18:45/15	07:27	08:20 14:46-14:59/13	08:46 14:53-15:17/24
	21:32	20:31	19:19 18:10-18:25/15	17:15	16:31 12:38-13:08/30	16:34 12:45-13:27/42
31	05:57	06:46		07:29		08:46 14:54-15:17/23
	21:30	20:29		17:13		16:35 12:46-13:28/42
Potential sun hours	502	454	381	331	266	244
Sum of minutes with flicker	0	0	248	178	174	1978

Table layout: For each day in each month the following matrix apply

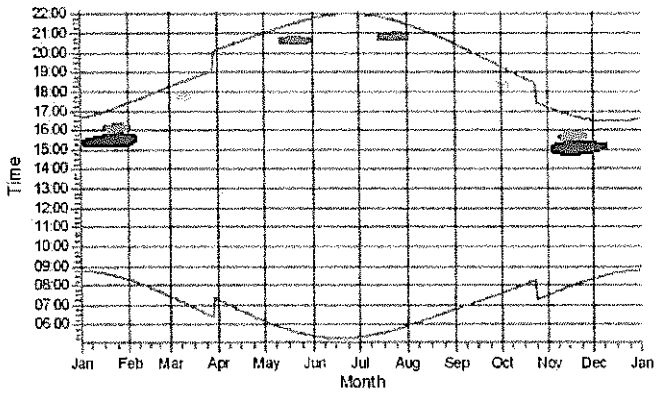
Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

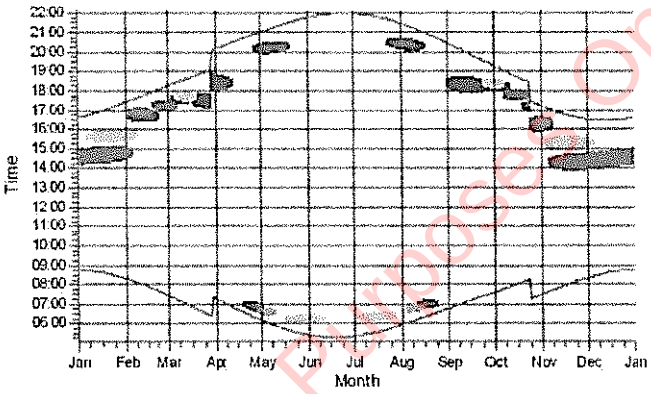
SHADOW - Calendar per WTG, graphical

Calculation: Alternative Scenario 3 Real Case

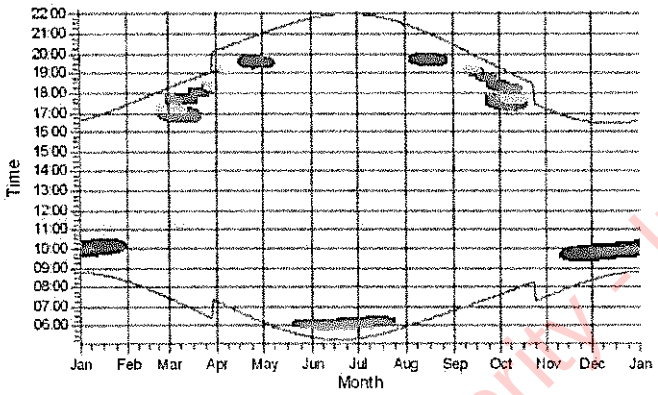
1: T1



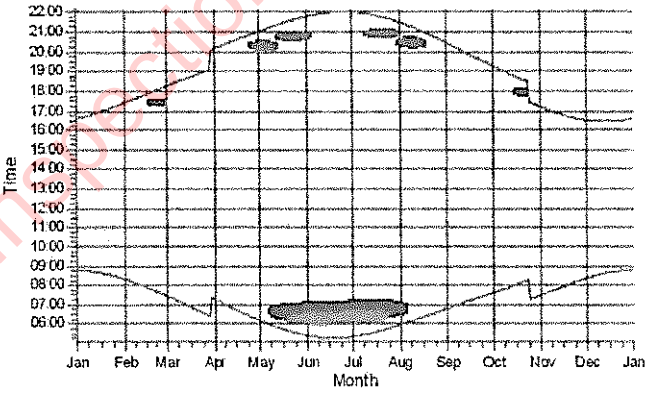
2: T5



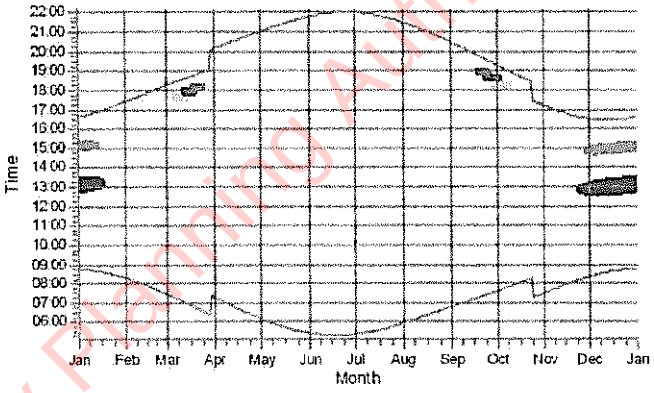
3: T4



4: T2



5: T3



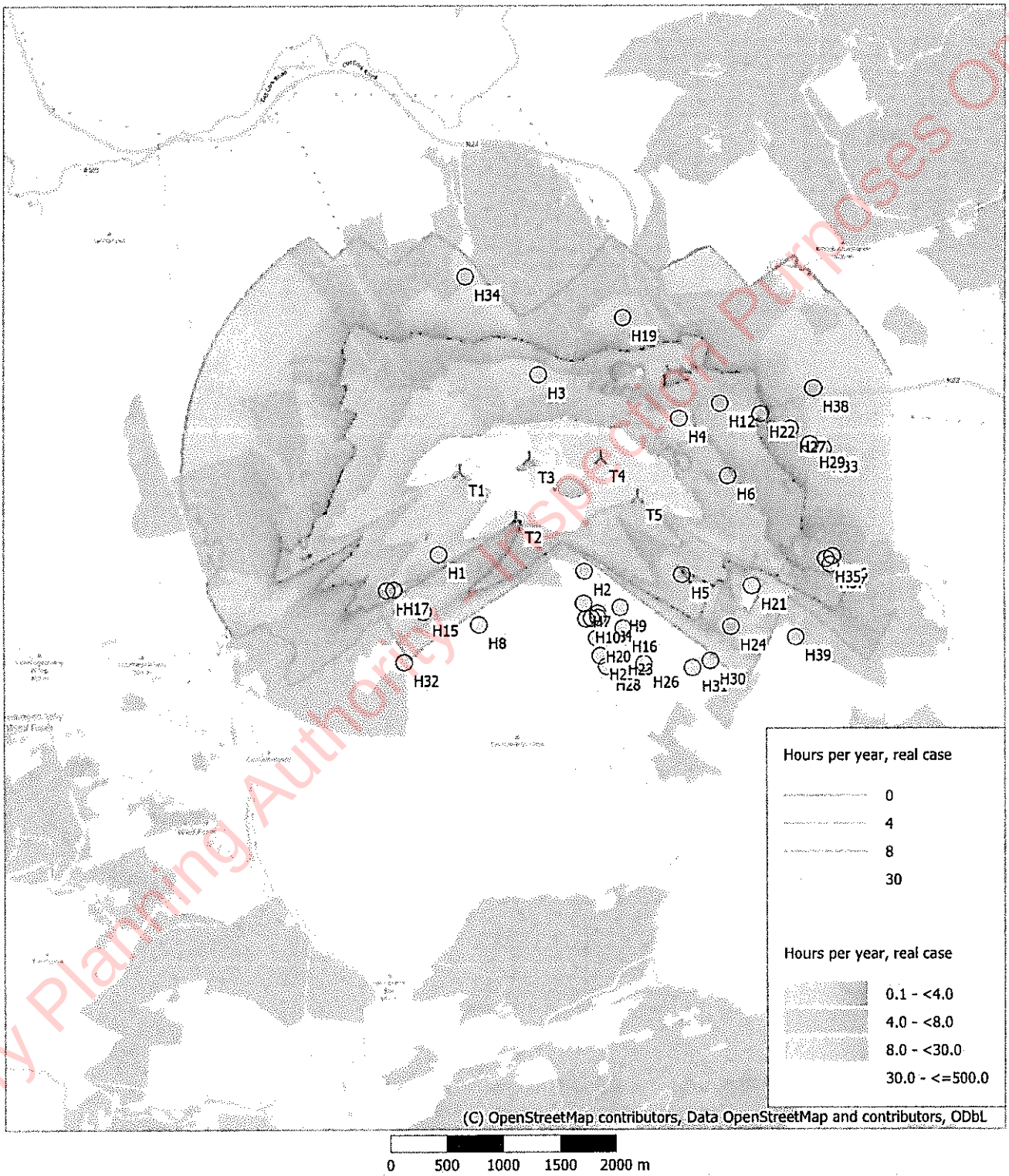
Shadow receptors

A: H1	F: H6	R: H18	AA: H27	AI: H35
C: H3	L: H12	S: H19	AC: H29	AJ: H36
D: H4	O: H15	V: H22	AG: H33	AK: H37
E: H5	Q: H17	X: H24	AH: H34	AL: H38

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com
Calculated:
10/03/2023 13:04/3.6.361

SHADOW - Map

Calculation: Alternative Scenario 3 Real Case



Map: EMD OpenStreetMap , Print scale 1:50,000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 512,720 North: 578,100

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg (3)

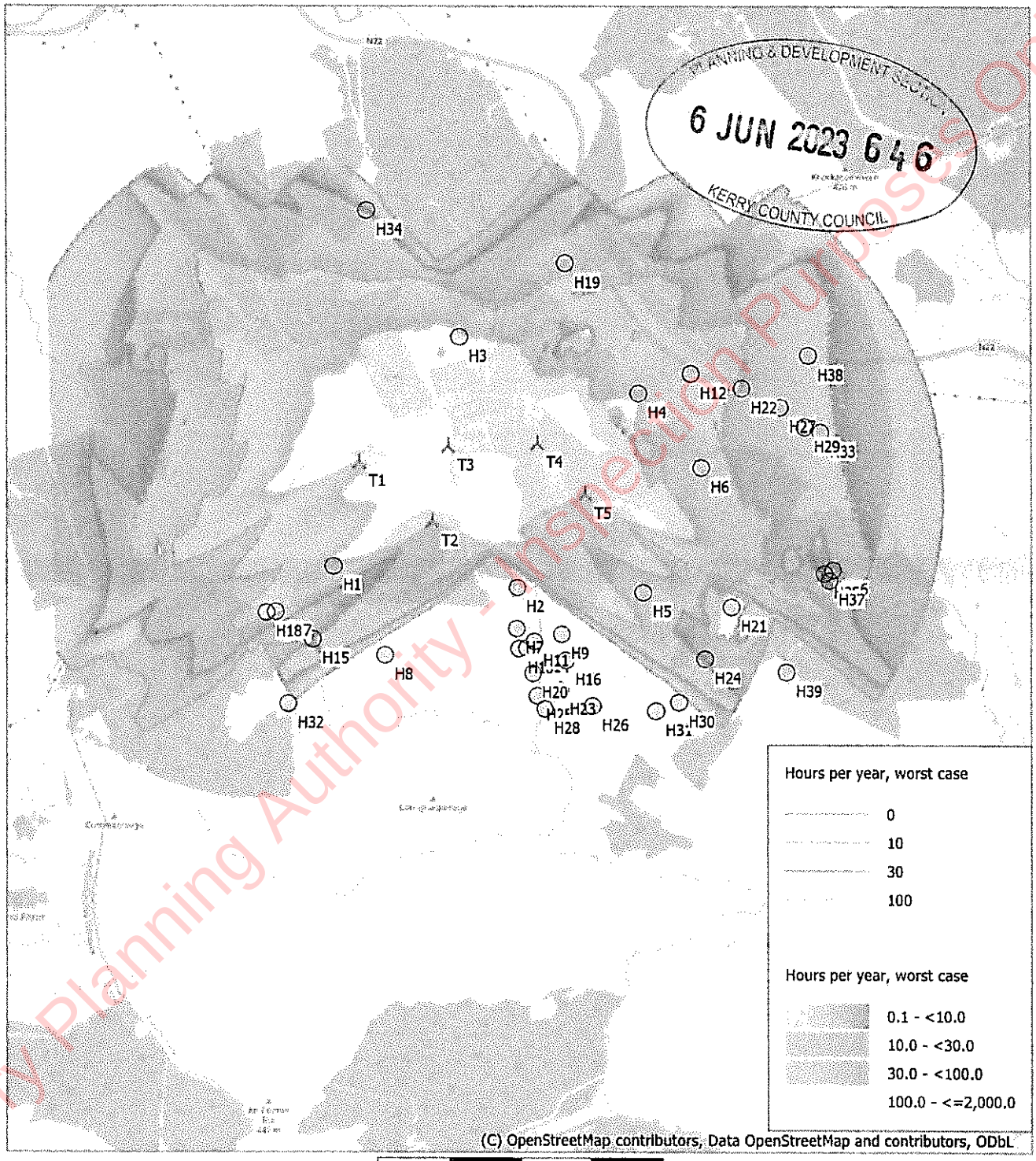
Time step: 2 minutes, Day step: 3 days, Map resolution: 10 m, Visibility resolution: 5 m, Eye height: 1.5 m

Licensed user:
Jennings O'Donovan
Finisklin Business Park
IE-F91 RHH9 Sligo
+353719161416
abyrne / abyrne@jodireland.com

Calculated:
10/03/2023 12:51/3.6.361

SHADOW - Map

Calculation: Alternative Scenario 3 Worst Case



0 500 1000 1500 2000 m

Map: EMD OpenStreetMap , Print scale 1:40,000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 513,470 North: 578,100

New WTG Shadow receptor

Flicker map level: Elevation Grid Data Object: Inchamore_EMDGrid_3.wpg (3)

Time step: 2 minutes, Day step: 3 days, Map resolution: 10 m, Visibility resolution: 5 m, Eye height: 1.5 m