Shadow Flicker Assessment
Updated Layouts

Scatec 200 MW Wind Farm in Egypt

ECO Consult

REV-1

13 February 2025

Report Approval and Revision Record

Template Code		J-UK-50783	Template Revision No.	REV-1
Version	**Date**	**Description**	**Prepared By**	**Approved By**
REV 0	27/11/2024	Scatec Egypt Wind Farm	ECO Consult	
REV 1	13/2/2025	Scatec Egypt Wind Farm	ECO Consult	

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ACRONYMS

GFRP	Glass Fiber Reinforced Polymer
kW	Kilowatt
m	Metre(s)
MW	Megawatt
SR	Sensitive Receiver
WTG	Wind Turbine Generator
UTM	Universal Transverse Mercator
ZVI	Zone of Visual Interest

1. INTRODUCTION

1.1 Introduction

This document aims to outline the Wind Turbine Generator (WTG) shadow flicker effects on potential receptors by assessing shadow flicker predictions. The results of the prediction have been evaluated according to international best practices for shadow flicker.

1.1.1 Shadow Flicker

Shadow flicker is defined as the optical flickering effect caused when rotating wind turbine blades periodically cast shadows through constrained openings (such as windows) on properties neighbouring the WTG sites.

There are three conditions which must be met in order for shadow flicker to occur:

- The sun must be shining without cloud cover;
- The wind turbine must be between the sun and the observer; and,
- The observer must be within the shadow of the wind turbine.

The shadow length of an object is dependent on the angle of the sun, which in turn varies depending on the time of the year and time of the day. An illustration of the shadow flicker on a receptor is presented in Figure 1.

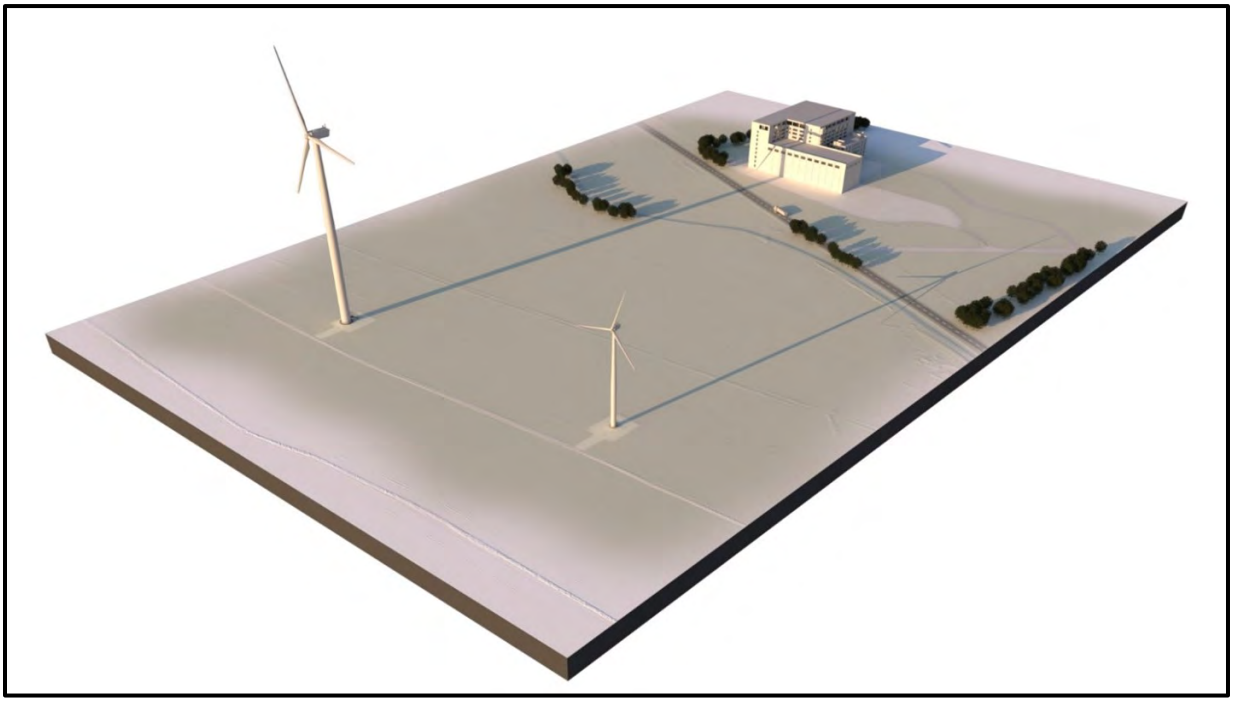

Figure 1: Visual Description of Shadow Flicker

1.2 Objectives

As part of this study the following main objectives have been identified as outcomes for this report:

- Calculation of shadow flicker occurrences for the worst-case scenario assessment with all WTGs operating; and,
- The assessment of the receptors considered in the 'impact zone' of the potential shadow effects.

1.3 Input Data

The study was based on the following information:

- General arrangement and layout drawings of the wind farm, including topography.
- Wind Turbine supplier data – geometric sizing, rotor diameter and hub height; and,
- Astronomical and metrological data – sun movement, sunlight phases, wind direction and frequency of occurrence at the receptor location.

2. PROJECT DETAILS

2.1 Project Background

The project is located just off the Gulf of Suez, in the eastern part of Egypt approximately 300 km southeast of the capital, Cairo. Two separate WTG layouts for Scatec Wind Farm are considered for the shadow flicker assessment. Layout 1 consists of 27 WTGs. Layout 2 consists of 25 WTGs. Each cover an area of approximately 25 km^2.

Figure 2 shows the Project location in a regional context, and Figure 3 shows the Project location in a local context for Layout 1, while Figure 4 shows the Project location in a local context for Layout 2.

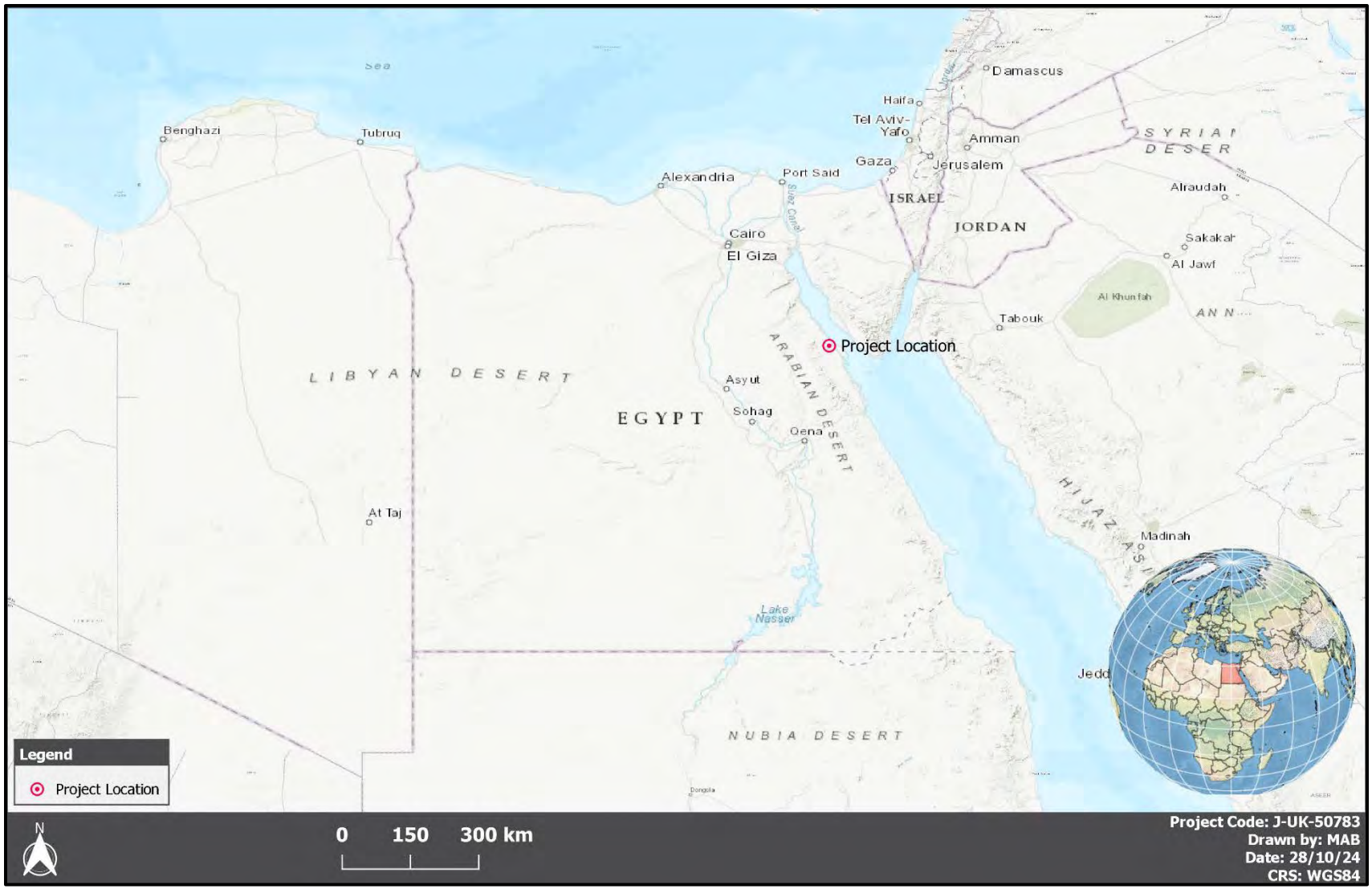

Figure 2: Scatec Wind Farm Project Area - Regional Context

Figure 3: Scatec Wind Farm Project Area - Local Context – Scatec Layout 1

Figure 4: Scatec Wind Farm Project Area - Local Context – Scatec Layout 2

2.2 Wind Turbine Site Layout

The project layout for Layout 1 is shown in Figure 5. Layout 1 consists of 27 WTGs with a rated power of 7.5 MW. Table 1 details the Envision EN169.5-7.5 MW turbine type basic specifications:

Table 1: Envision EN169.5-7.5 MW Wind Turbine Generator Specification

Manufacturer	Envision
Model Type	Envision EN169.5-7.5 MW
Rated Power	7,500 kW
Rotor Diameter	169.5 m
Hub Height	100 m

The coordinates of each of the WTG sites are listed in Appendix A.

The project Layout for Layout 2 is shown in Figure 6. Layout 2 consists of 25 WTGs each with a rated power of 8.0 MW. Table 2 details the Envision EN169.5-8.0 MW turbine type basic specifications:

Table 2: Envision EN169.5-8.0 MW Wind Turbine Generator Specification

Manufacturer	Envision
Model Type	Envision EN169.5-8.0 MW
Rated Power	8,000 kW
Rotor Diameter	169.5 m
Hub Height	100 m

The coordinates of each of the WTG sites for Layout 2 are listed in Appendix A.

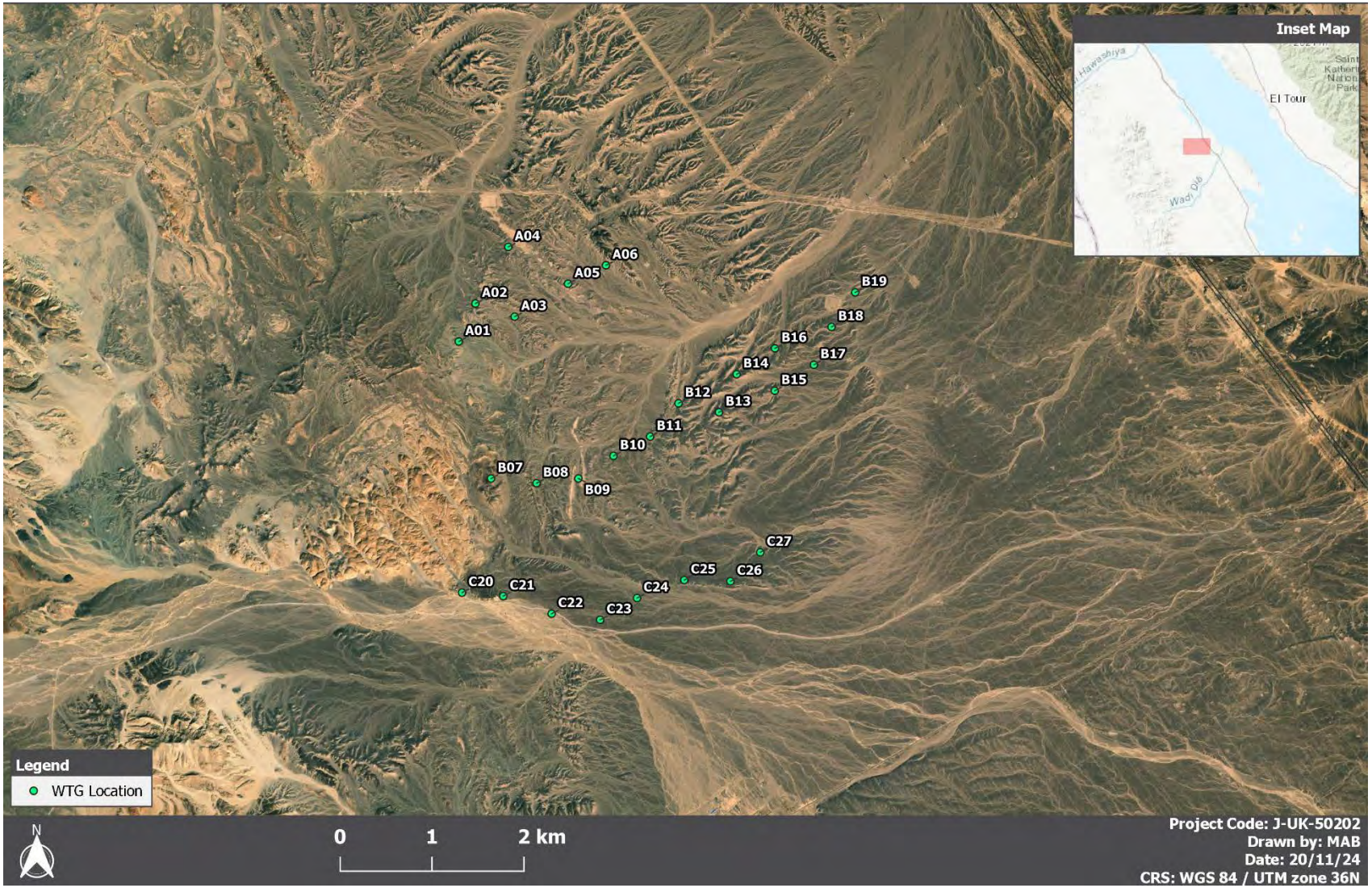

Figure 5: Location of Wind Turbine Sites – Layout 1

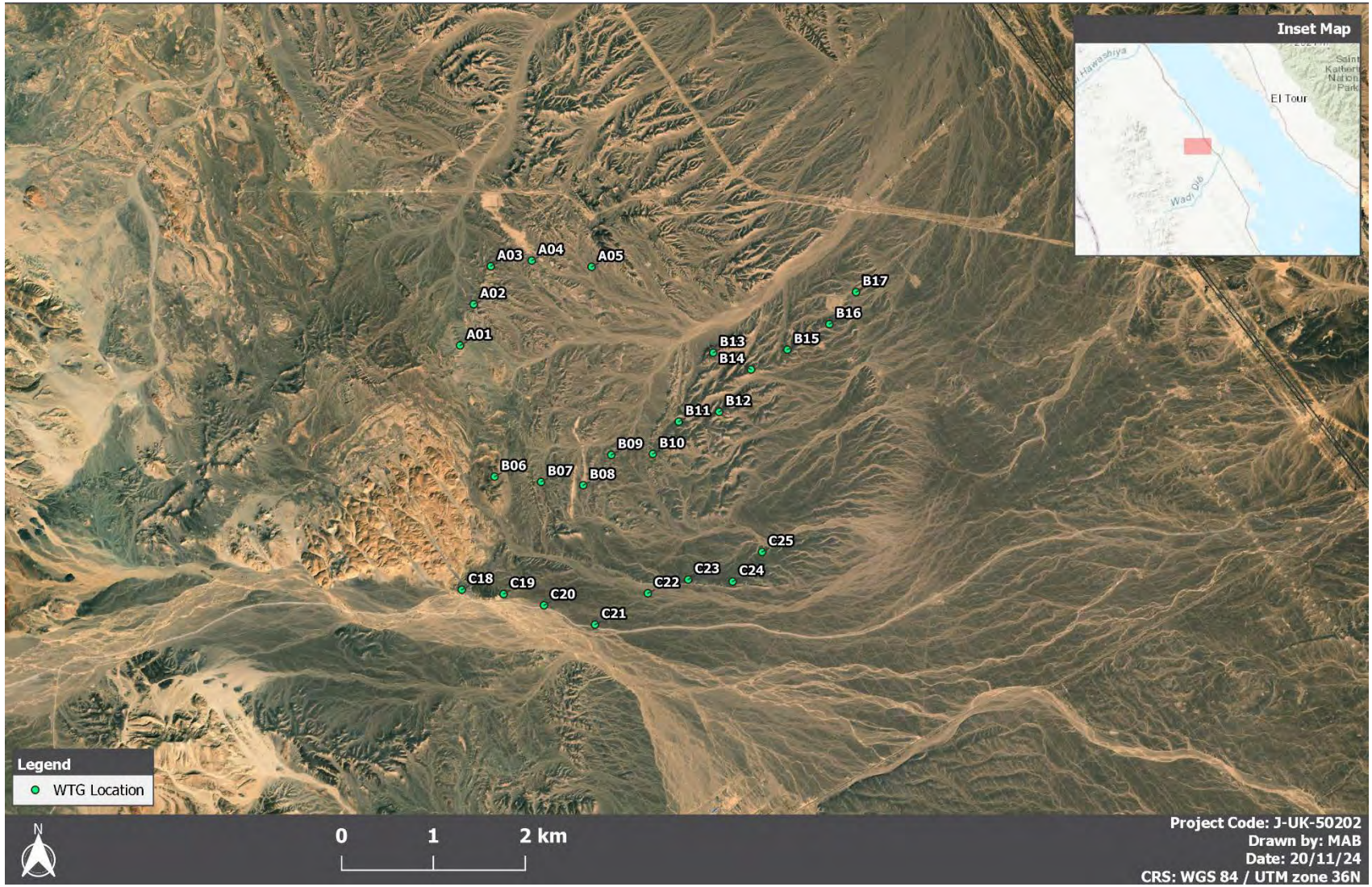

Figure 6: Location of Wind Turbine Sites – Layout 2

3. IDENTIFICATION AND ANALYSIS OF REGULATIONS AND STANDARDS

3.1 Regulatory Framework for Shadow Flicker

There are currently no laws or regulation regarding shadow flicker and blade glint from the operation of WTGs in Egypt. However, several countries (including the UK, Germany and Australia) have developed guidelines around the potential shadow flicker impacts and are aligned with the World Bank Group guidelines. The relevant guidelines include:

- The World Bank Group Environmental, Health, And Safety Guidelines for Wind Energy[1].
- Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergianlagen; Stand: 13.03.2002 (WEA-Shattenwurf-Hinweise)[2] – German Standard for the evaluation of optical emissions from WTGs.
- Planning Practice Guidance for Renewable and Low Carbon Energy 2013[3].
- Australian Department of State Development, Infrastructure, Local Government and Planning, State Code 23: Wind Farm Development[4].

The German guidelines refer the following limit of the shadow and is set by two factors:

- The angle of the Sun over the horizon must be at least 3 degrees; and,
- The blade of the WTG must cover at least 20% of the Sun.

The limits of shadow impact for a neighbour to a wind farm according to the guidelines are:

- A maximum of 30 hours per year of astronomical maximum shadow (considered worst case); and,
- A maximum of 30 minutes per day of astronomical maximum shadow (considered worst case).

If one of these thresholds is exceeded, mitigation measures should be devised in the form of curtailment strategies which would not allow for shadow flicker to occur – i.e., not operate certain WTGs at times and conditions when shadow flicker would occur.

Shadow flickering effects are only considered for domestic dwellings, workplaces, learning and/or health care spaces/facilities with one or more windows / openings that face in the direction of the WTGs / Wind Farm in question, or that are located nearby. Areas which are not used for human occupancy are not considered in this assessment (i.e., garages and storage areas).

[1] T. W. B. Group, "Environmental, Health, And Safety Guidelines for Wind Energy.," 2015.

[2] WEA-Shattenwurf-Hinweise, Hinweise zur Ermittlung und Beurteilung der optschen Immissionen vo fWindernerianlagen, 2002.

[3] D. f. C. a. L. Government, "Planning Practice Guidance for Renewable and Low Carbon Energy," London, 2013.

[4] I. L. G. a. P. Australian Department of State Development, "Planning guidance State Code 23: Wind Farm Development," Brisbane, 2022.

4. SHADOW FLICKER MODEL AND CALCULATION

4.1 Shadow Flicker Model

Shadow flicker for the Project was modelled in WindPRO Version 3.6. WindPRO is considered to be an industry standard software program for WTG calculations. The software simulates the suns movement throughout the year and evaluates the potential shadow flicker at a specific location (domestic dwelling) based on the wind turbine generator locations and their surroundings.

The software gives a conservative estimate of the number of hours per year that shadows could be cast by the rotation of the turbine blades.

4.2 Shadow Flicker Calculation Methodology

The German guidelines[2] which have been applied in this study, provide a shadow flicker calculation method which considers the following parameters:

- The position of the WTGs – x, y, z coordinates;
- The hub height and rotor diameter;
- The position of the shadow receptor object – x, y, z coordinates;
- The size of the window and its orientation, both directional (relative to South) and tilt (angle of plane to the horizontal);
- The geographic position (latitude and longitude);
- Time zone and daylight-saving time information; and,
- A simulation model, which holds information about the Earth's orbit and rotation relative to the Sun.

An illustration of the shadow flicker calculation prognosis is presented in Figure 7.

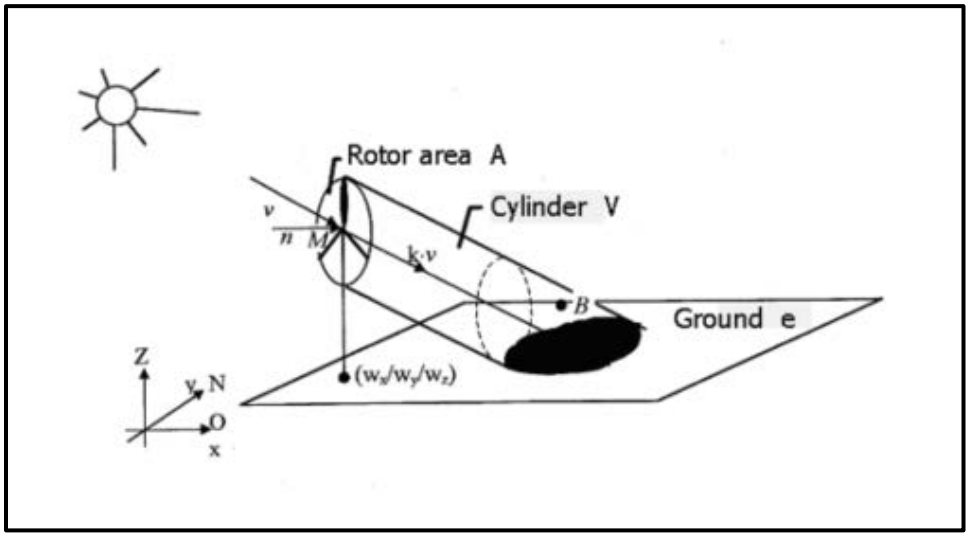

Figure 7: Shadow Flicker Calculation Prognosis[5]

The sun is modelled by a single-point source of light, whereas in reality the sun is not defined by a point source and is instead a sphere. Due to the spherical shape of the sun, there are shading areas in which the sunbeams or part of the sunbeams are covered by objects[5].

The model further assumes clear sky during 100% of the year (which is not the case in reality). Therefore, the model produces the worst-case scenario in line with a conservative assessment methodology.

The calculation model used within WindPRO uses the following parameters outlined in Table 3 below to define the shadow propagation angle behind the rotor disk:

Table 3: Shadow Propagation Angle Parameters

The diameter of the Sun (D)	1,390,000 km
The distance to the Sun (d)	150,000,000 km
Angle of attack	0.531 degrees

4.3 Assumptions and Settings for Shadow Calculations

The following calculations and assumptions were used for WindPRO calculations:

- Calculations only when more than 20% of the sun is covered by the blade;
- Minimum sun height over the horizon of influence: **3°**;
- Day step for calculation: **1 day**;
- Time step for calculation: **1 minute**;
- A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non-visible WTG do not contribute to calculated flicker values;

[5] E. I. A/S, WindPRO 3.1 User Guide, 2016.

- A WTG will be visible if it is visible from any part of the receiver window;
- Sensitive Receptors are modelled using the greenhouse mode, meaning that each Sensitive Receptor will face all directions (360 degree visibility);
- All Sensitive Receptors have been modelled taking into consideration the following;
  - They are single story buildings, and so shadow flicker has been calculated at a height of 1m above ground level (equivalent to the first floor windows).
  - Window height**: 1 meter**;
  - Window Width: **1 meter**;
  - Window tilt: **90º**;
  - The identified receptors are simulated as fixed points with the possibility to view 360°C, representing an unrealistic scenario, as real windows would be facing only a particular direction;
- The ZVI calculation is based on the following assumptions:
  - Height contours are used;
  - Eye height: **1.5 m**;
  - Grid Resolution: **10.0 m**;
- The calculated times are "worst-case" given by the following assumptions:
  - The sun is shining continuously during the day, from sunrise to sunset;
  - The rotor plane is always perpendicular to the line from the WTG to the sun; and
  - The WTG is always operating.

5. SHADOW FLICKER GRID MAP RESULTS

The calculation results presented are for the worst-case shadow flicker. This is because the calculation standards only predict for worst-case scenarios, which represents the optimum conditions for shadow flicker to occur. The shadow flicker is quantified by whether or not the WTG is in operation and WTG rotor position is between the sun and the receptor. In the case of these calculations all WTGs are in operation.

5.1 Identification of Surrounding Areas Sensitive Receivers

A total of 35 sensitive receivers (SR) have been identified within the vicinity of Scatec wind farm. The sensitive receptors are domestic dwellings and there is no other type of sensitive receptor identified

within the vicinity of Scatec wind farm, including workplaces, learning and/or health care spaces/facilities. The complete list of identified receptors is detailed in Appendix B.

Figure 8 shows the SRs in relation to Layout 1 and Figure 9 shows the SRs in relation to Layout 2.

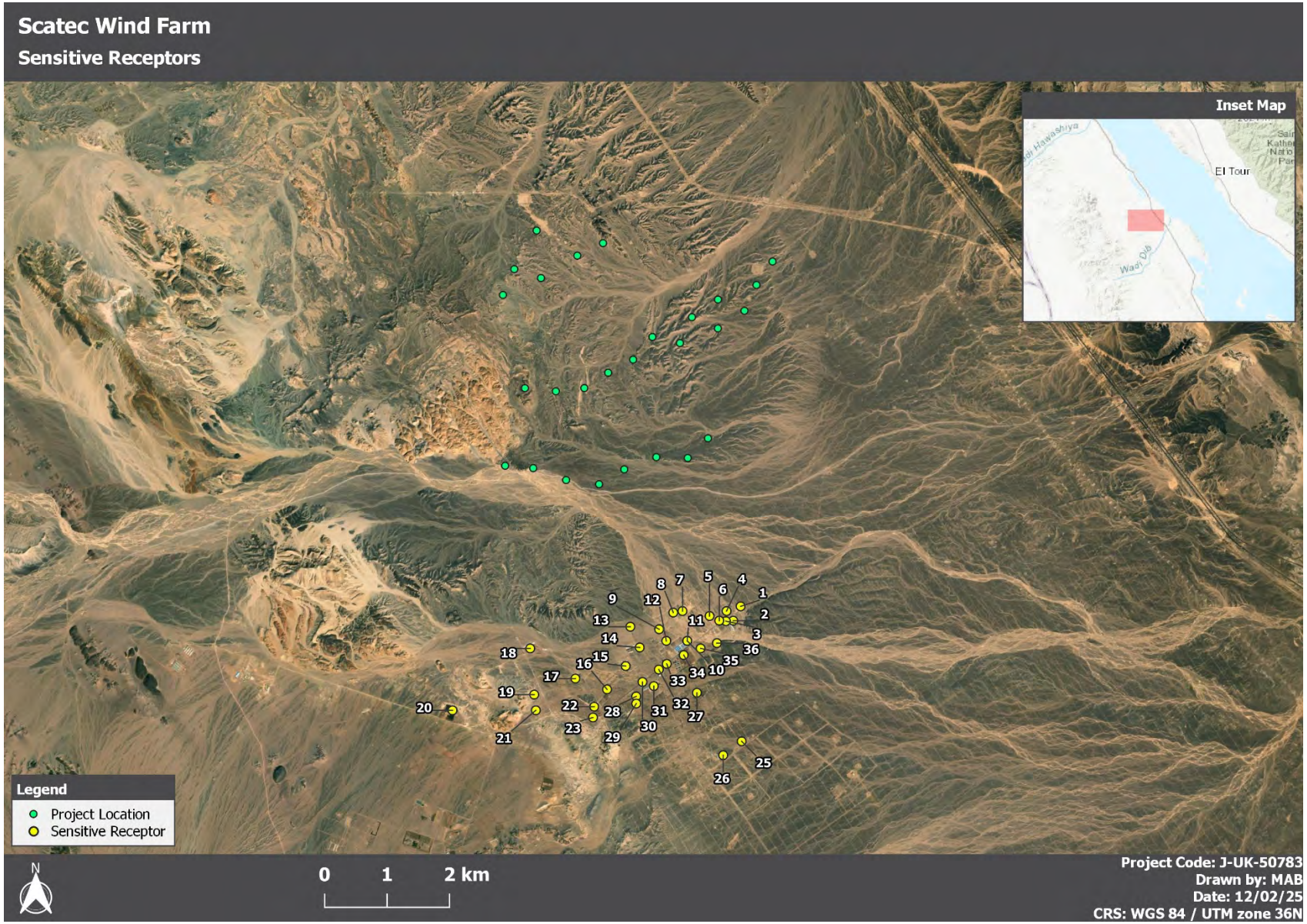

Figure 8: Sensitive Receiver Locations – Layout 1

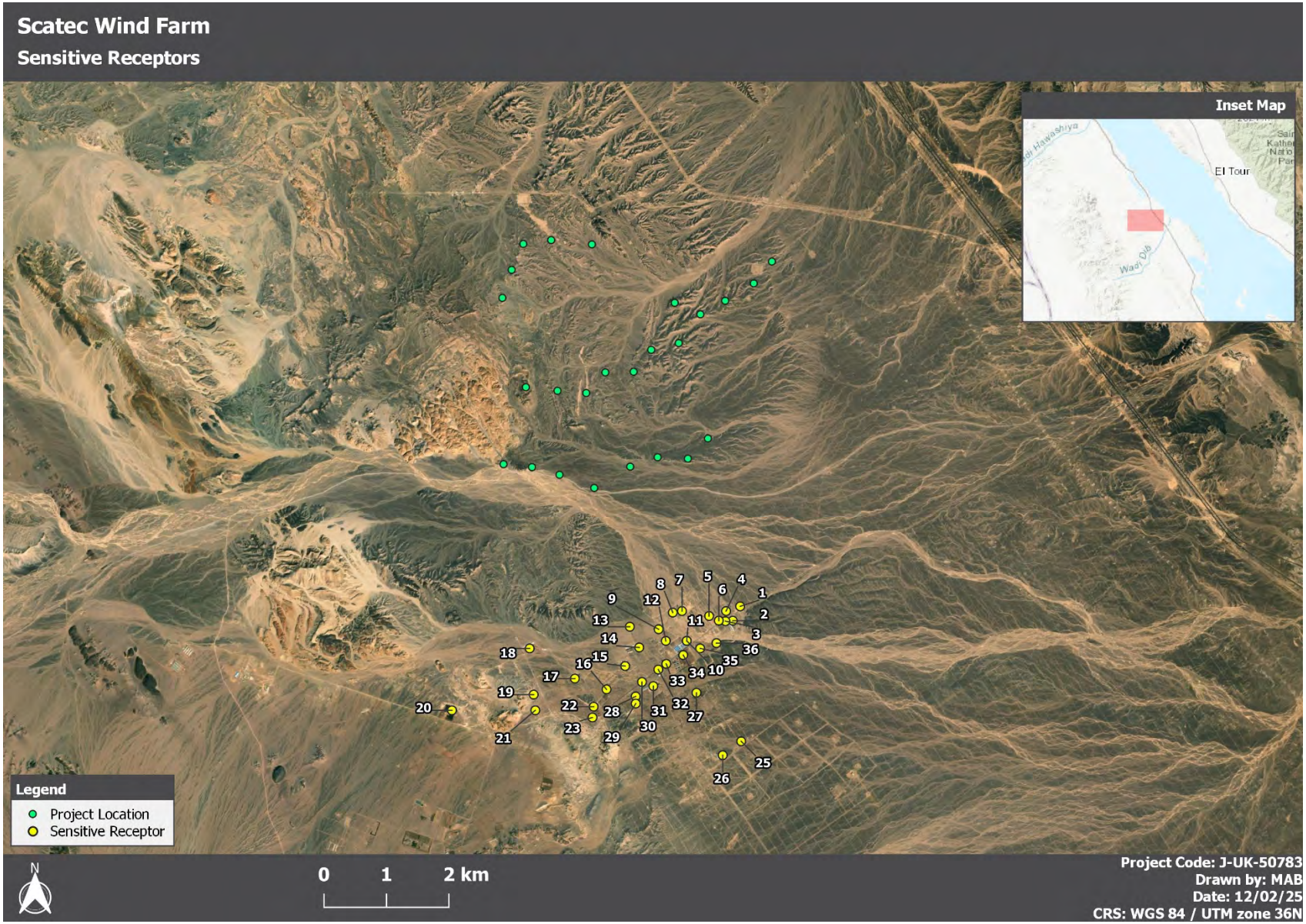

Figure 9: Sensitive Receptor Locations – Layout 2

5.2 Results for Shadow Flicker at Sensitive Receivers

Layout 1:

- Figure 10 presents the worst-case scenario results of the shadow flicker assessment at the identified receptors as total hours per year.
- Figure 11 presents the worst-case scenario results of the shadow flicker assessment at the identified receptors as maximum minutes per day.

Layout 2:

- Figure 12 presents the worst-case scenario results of the shadow flicker assessment at the identified receptors as total hours per year.
- Figure 13 presents the worst-case scenario results of the shadow flicker assessment at the identified receptors as maximum minutes per day.

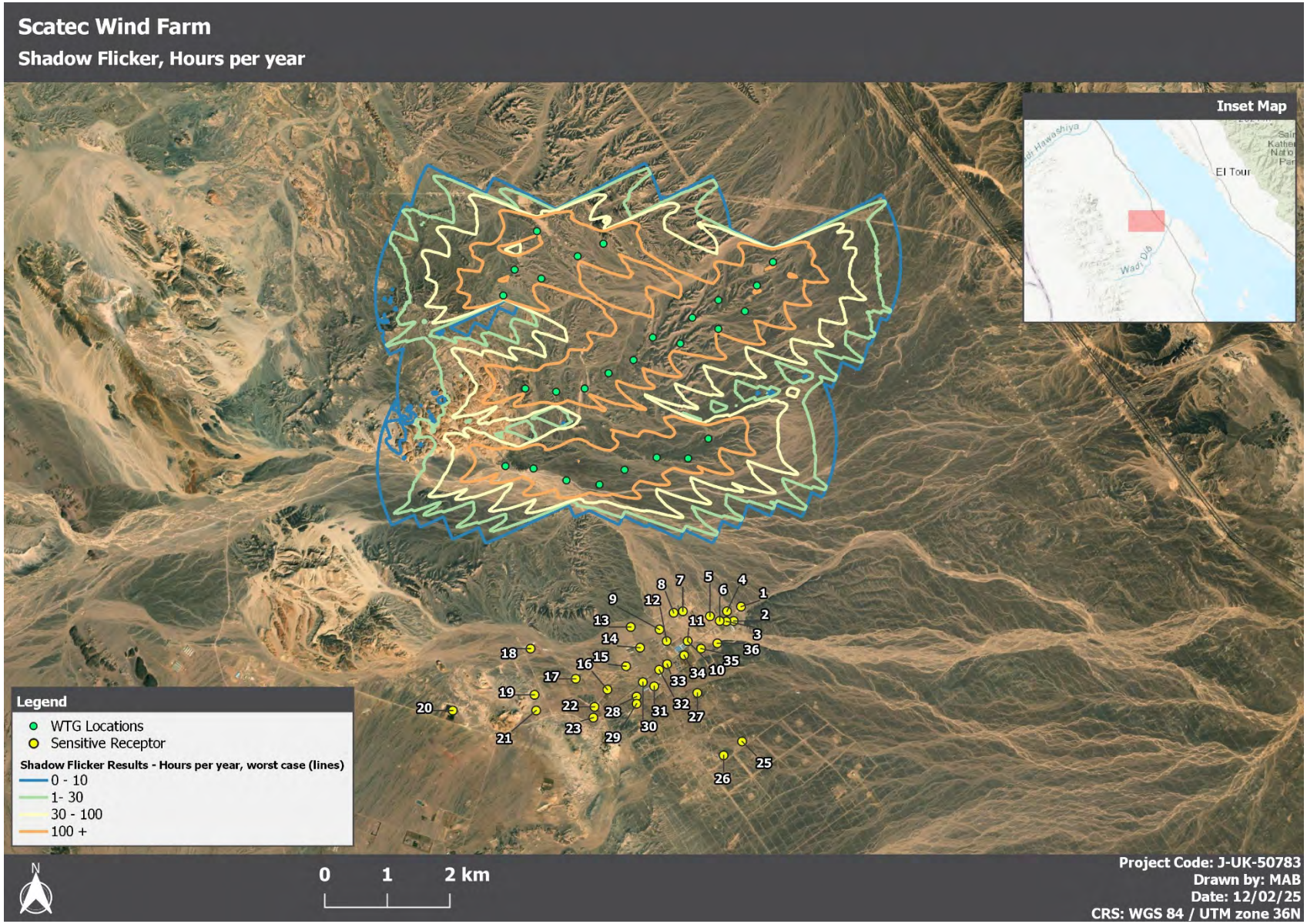

Figure 10: Shadow Flicker Map for Worst Case Scenario (hours per year) – Layout 1

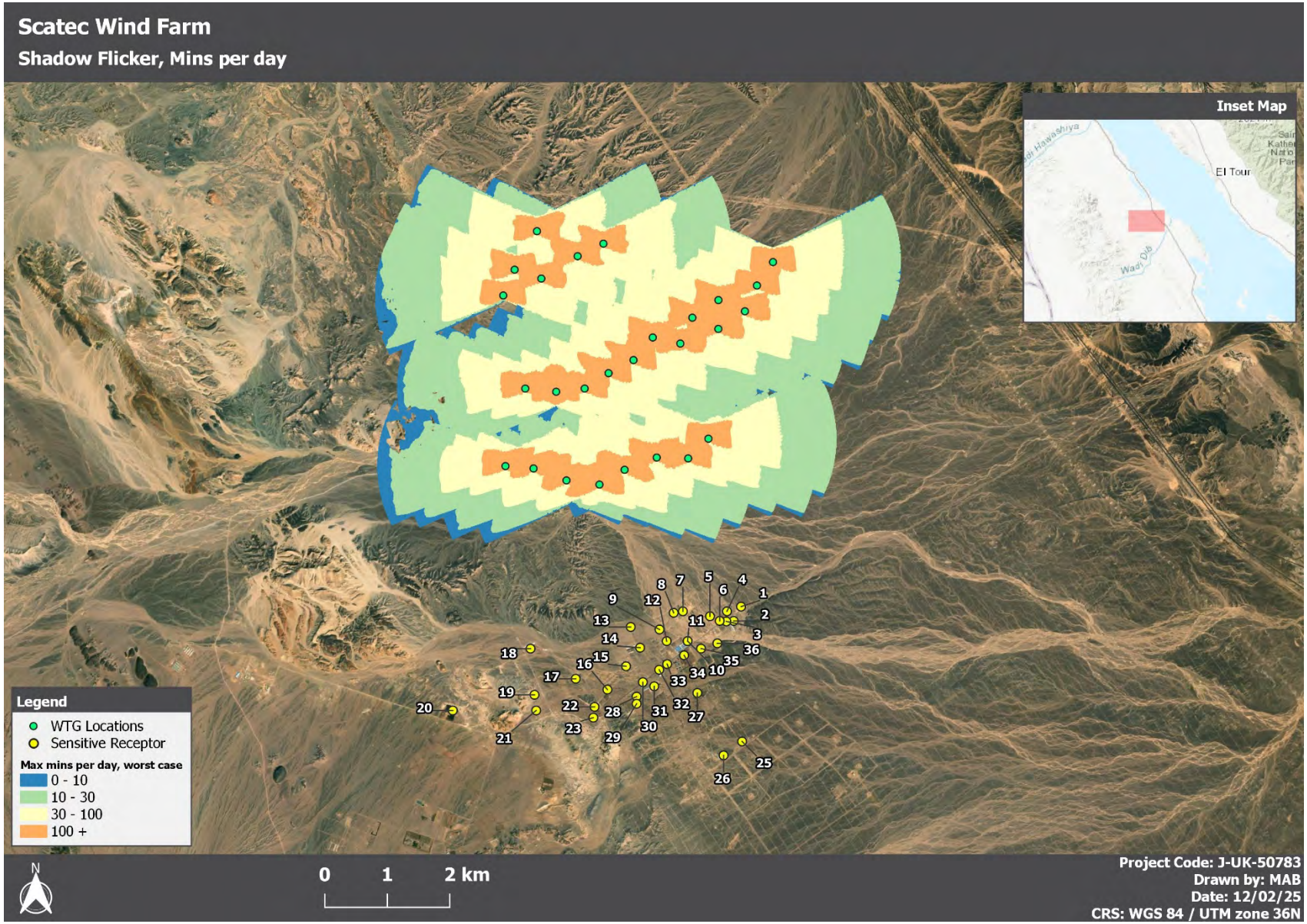

Figure 11: Shadow Flicker Map for Worst Case Scenario (mins per day) – Layout 1

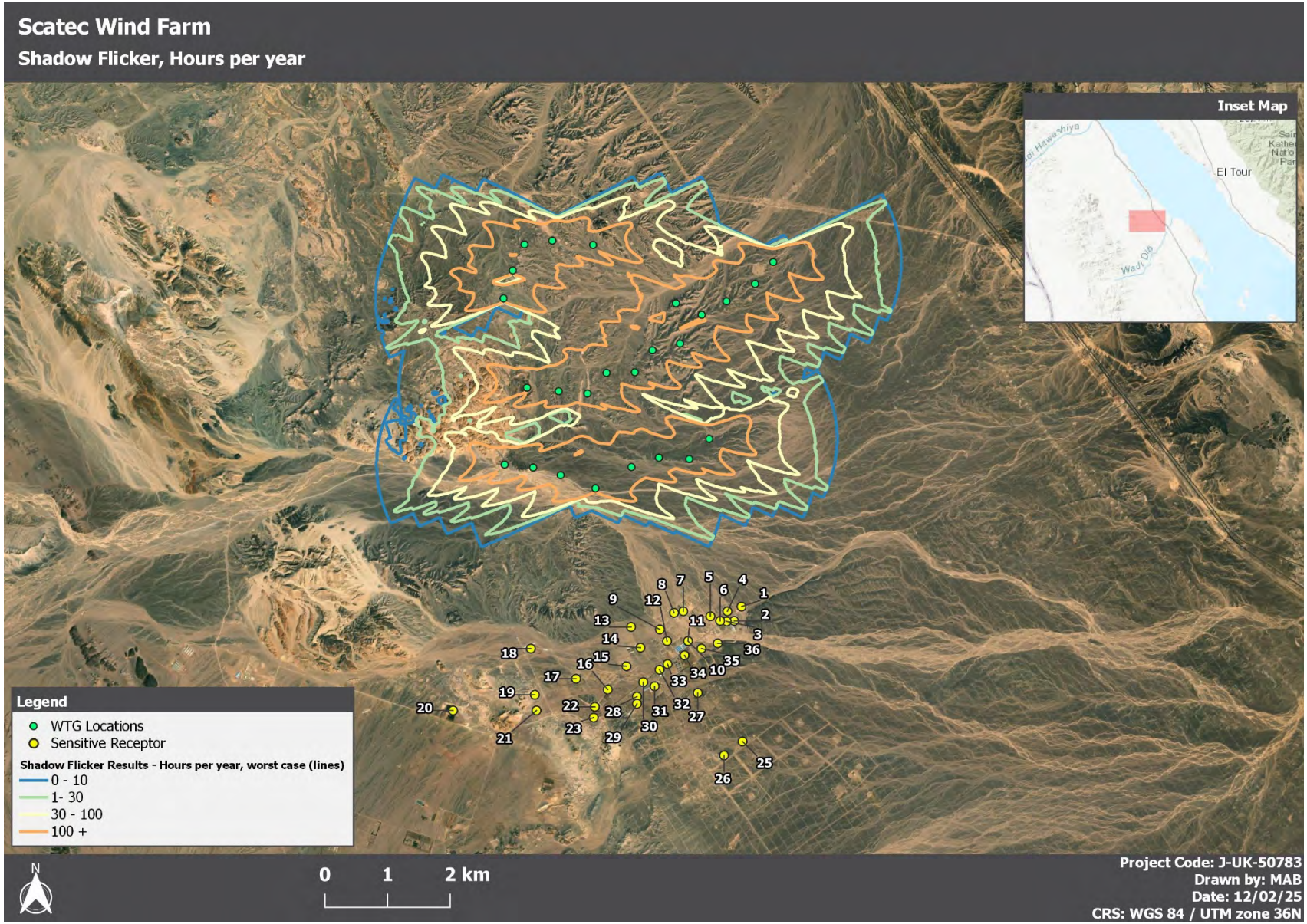

Figure 12: Shadow Flicker Map for Worst Case Scenario (hours per year) – Layout 2

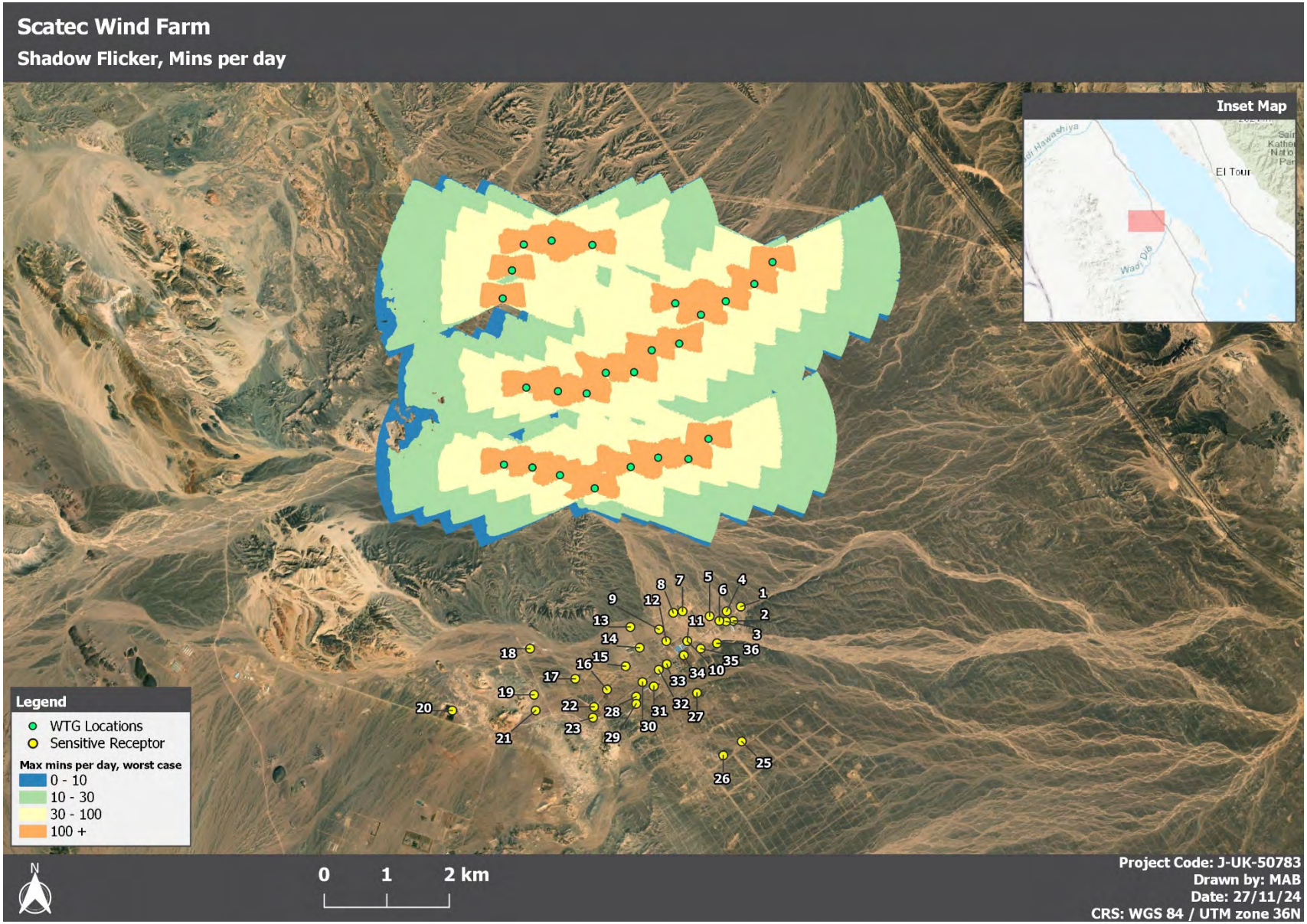

Figure 13: Shadow Flicker Map for Worst Case Scenario (mins per day) – Layout 2

6. SHADOW FLICKER RESULTS AND IMPACT ASSESSMENT

6.1 Shadow Flicker Impact Assessment

The maximum possible duration of shadow flicker was calculated at the nearest dwellings with full time residents (sensitive receivers) and compared to the limits set by the Project standards for shadow flicker according to the following parameters:

- Accumulated exposure on sensitive receptors should not exceed a total of 30 hours per year;
- Exposure on sensitive receptors should not be longer than 30 minutes per day.

The comparison for the above limits is presented in the following assessment tables:

- Table 4: Shadow flicker impacts in terms of hours per year for Layout 1.
- Table 5: Shadow flicker impacts in terms of minutes per day for Layout 1
- Table 6: Shadow flicker impacts in terms of hours per year for Layout 2.
- Table 7: Shadow flicker impacts in terms of minutes per day for Layout 2

As noted within the table below, none of receptors are impacted by shadow flicker. In fact, the entire Wadi Dara village is outside of the shadow flicker limits from the turbines.

Table 4: Assessment of shadow flicker for 'hours per year' limitation for Layout 1

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM hours per year]	Limit – Hours per Year	Shadow Flicker Exceedance
SR1	523397	3096856	00:00	30	No
SR2	523279	3096627	00:00	30	No
SR3	523162	3096619	00:00	30	No
SR4	523172	3096781	00:00	30	No
SR5	522900	3096702	00:00	30	No
SR6	523055	3096628	00:00	30	No
SR7	522467	3096781	00:00	30	No
SR8	522320	3096757	00:00	30	No
SR9	522093	3096490	00:00	30	No
SR10	522542	3096304	00:00	30	No
SR11	522542	3096304	00:00	30	No
SR12	522207	3096304	00:00	30	No
SR13	521633	3096530	00:00	30	No
SR14	521782	3096199	00:00	30	No
SR15	521557	3095902	00:00	30	No
SR16	521259	3095529	00:00	30	No
SR17	520753	3095702	00:00	30	No

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM hours per year]	Limit – Hours per Year	Shadow Flicker Exceedance
SR18	520030	3096184	00:00	30	No
SR19	520094	3095446	00:00	30	No
SR20	518786	3095195	00:00	30	No
SR21	520120	3095195	00:00	30	No
SR22	521054	3095253	00:00	30	No
SR23	521035	3095080	00:00	30	No
SR25	523414	3094699	00:00	30	No
SR26	523118	3094477	00:00	30	No
SR27	522698	3095475	00:00	30	No
SR28	521726	3095417	00:00	30	No
SR29	521727	3095302	00:00	30	No
SR30	521827	3095647	00:00	30	No
SR31	522008	3095582	00:00	30	No
SR32	522088	3095846	00:00	30	No
SR33	522215	3095936	00:00	30	No
SR34	522487	3096077	00:00	30	No
SR35	522757	3096184	00:00	30	No
SR36	523017	3096269	00:00	30	No

Table 5: Assessment of shadow flicker for 'minutes per day' limitation for Layout 1

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM minutes per day]	Limit – Minutes per day	Shadow Flicker Exceedance
SR1	523397	3096856	00:00	30	No
SR2	523279	3096627	00:00	30	No
SR3	523162	3096619	00:00	30	No
SR4	523172	3096781	00:00	30	No
SR5	522900	3096702	00:00	30	No
SR6	523055	3096628	00:00	30	No
SR7	522467	3096781	00:00	30	No
SR8	522320	3096757	00:00	30	No
SR9	522093	3096490	00:00	30	No
SR10	522542	3096304	00:00	30	No
SR11	522542	3096304	00:00	30	No
SR12	522207	3096304	00:00	30	No
SR13	521633	3096530	00:00	30	No
SR14	521782	3096199	00:00	30	No

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM minutes per day]	Limit – Minutes per day	Shadow Flicker Exceedance
SR15	521557	3095902	00:00	30	No
SR16	521259	3095529	00:00	30	No
SR17	520753	3095702	00:00	30	No
SR18	520030	3096184	00:00	30	No
SR19	520094	3095446	00:00	30	No
SR20	518786	3095195	00:00	30	No
SR21	520120	3095195	00:00	30	No
SR22	521054	3095253	00:00	30	No
SR23	521035	3095080	00:00	30	No
SR25	523414	3094699	00:00	30	No
SR26	523118	3094477	00:00	30	No
SR27	522698	3095475	00:00	30	No
SR28	521726	3095417	00:00	30	No
SR29	521727	3095302	00:00	30	No
SR30	521827	3095647	00:00	30	No
SR31	522008	3095582	00:00	30	No
SR32	522088	3095846	00:00	30	No
SR33	522215	3095936	00:00	30	No
SR34	522487	3096077	00:00	30	No
SR35	522757	3096184	00:00	30	No
SR36	523017	3096269	00:00	30	No

Table 6: Assessment of shadow flicker for 'hours per year' limitation for Layout 2

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM hours per year]	Limit – Hours per Year	Shadow Flicker Exceedance
SR1	523397	3096856	00:00	30	No
SR2	523279	3096627	00:00	30	No
SR3	523162	3096619	00:00	30	No
SR4	523172	3096781	00:00	30	No
SR5	522900	3096702	00:00	30	No
SR6	523055	3096628	00:00	30	No
SR7	522467	3096781	00:00	30	No
SR8	522320	3096757	00:00	30	No
SR9	522093	3096490	00:00	30	No
SR10	522542	3096304	00:00	30	No
SR11	522542	3096304	00:00	30	No

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM hours per year]	Limit – Hours per Year	Shadow Flicker Exceedance
SR12	522207	3096304	00:00	30	No
SR13	521633	3096530	00:00	30	No
SR14	521782	3096199	00:00	30	No
SR15	521557	3095902	00:00	30	No
SR16	521259	3095529	00:00	30	No
SR17	520753	3095702	00:00	30	No
SR18	520030	3096184	00:00	30	No
SR19	520094	3095446	00:00	30	No
SR20	518786	3095195	00:00	30	No
SR21	520120	3095195	00:00	30	No
SR22	521054	3095253	00:00	30	No
SR23	521035	3095080	00:00	30	No
SR25	523414	3094699	00:00	30	No
SR26	523118	3094477	00:00	30	No
SR27	522698	3095475	00:00	30	No
SR28	521726	3095417	00:00	30	No
SR29	521727	3095302	00:00	30	No
SR30	521827	3095647	00:00	30	No
SR31	522008	3095582	00:00	30	No
SR32	522088	3095846	00:00	30	No
SR33	522215	3095936	00:00	30	No
SR34	522487	3096077	00:00	30	No
SR35	522757	3096184	00:00	30	No
SR36	523017	3096269	00:00	30	No

Table 7: Assessment of shadow flicker for 'minutes per day' limitation for Layout 2

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM minutes per day]	Limit – Minutes per day	Shadow Flicker Exceedance
SR1	523397	3096856	00:00	30	No
SR2	523279	3096627	00:00	30	No
SR3	523162	3096619	00:00	30	No
SR4	523172	3096781	00:00	30	No
SR5	522900	3096702	00:00	30	No
SR6	523055	3096628	00:00	30	No
SR7	522467	3096781	00:00	30	No
SR8	522320	3096757	00:00	30	No

Receptor	UTM East	UTM North	Astronomical maximum possible shadow flickering [HH:MM minutes per day]	Limit – Minutes per day	Shadow Flicker Exceedance
SR9	522093	3096490	00:00	30	No
SR10	522542	3096304	00:00	30	No
SR11	522542	3096304	00:00	30	No
SR12	522207	3096304	00:00	30	No
SR13	521633	3096530	00:00	30	No
SR14	521782	3096199	00:00	30	No
SR15	521557	3095902	00:00	30	No
SR16	521259	3095529	00:00	30	No
SR17	520753	3095702	00:00	30	No
SR18	520030	3096184	00:00	30	No
SR19	520094	3095446	00:00	30	No
SR20	518786	3095195	00:00	30	No
SR21	520120	3095195	00:00	30	No
SR22	521054	3095253	00:00	30	No
SR23	521035	3095080	00:00	30	No
SR25	523414	3094699	00:00	30	No
SR26	523118	3094477	00:00	30	No
SR27	522698	3095475	00:00	30	No
SR28	521726	3095417	00:00	30	No
SR29	521727	3095302	00:00	30	No
SR30	521827	3095647	00:00	30	No
SR31	522008	3095582	00:00	30	No
SR32	522088	3095846	00:00	30	No
SR33	522215	3095936	00:00	30	No
SR34	522487	3096077	00:00	30	No
SR35	522757	3096184	00:00	30	No
SR36	523017	3096269	00:00	30	No

6.2 Summary of Shadow Flicker Exceedances

The limits set by the Project Standard for ‘hours per year’ and ‘minutes per day’ were not exceeded at any of the sensitive receivers in relation to either of the proposed WTG development layouts located within the surrounding area.

7. CUMULATIVE IMPACT ASSESSMENT

7.1 Cumulative Impact Assessment

Cumulative shadow flicker impacts from Scatec Wind Farm proposed layouts and the nearby SWE Wind Farm were considered. Cumulative shadow flicker impact refers to the combined shadow flicker impact from multiple wind farms on specific SRs. The shadow flicker impact from one or multiple WTGs at one wind farm could be combined with additional shadow flicker impact from one or multiple WTGs at another wind farm, and therefore increase the total shadow flicker exposure at a particular SR.

SWE Wind Farm consists of 69 wind turbine generators, each with a rated power of 8 MW. Table 8 details the Envision EN171-8.0 MW turbine type basic specifications:

Table 8: Envision EN171-8.0 MW Wind Turbine Specification

Manufacturer	Envision
Model Type	Envision EN171-8.0 MW
Rated Power	8000 kW
Rotor Diameter	182 m
Hub Height	110 m

7.2 Cumulative Impact Results

Figure 14 and Figure 15 show the limit of shadow flicker extent from the Scatec Wind Farm Layout 1 and SWE Wind Farms. It is demonstrated that shadow flicker impacts between the two wind farms do not overlap at any of the identified receptors.

Figure 16 and Figure 17show the limit of shadow flicker extent from the Scatec Wind Farm Layout 2 and SWE Wind Farms. It is demonstrated that shadow flicker impacts between the two wind farms do not overlap at any of the identified receptors.

It can be concluded that no further action is necessary regarding cumulative shadow flicker impact.

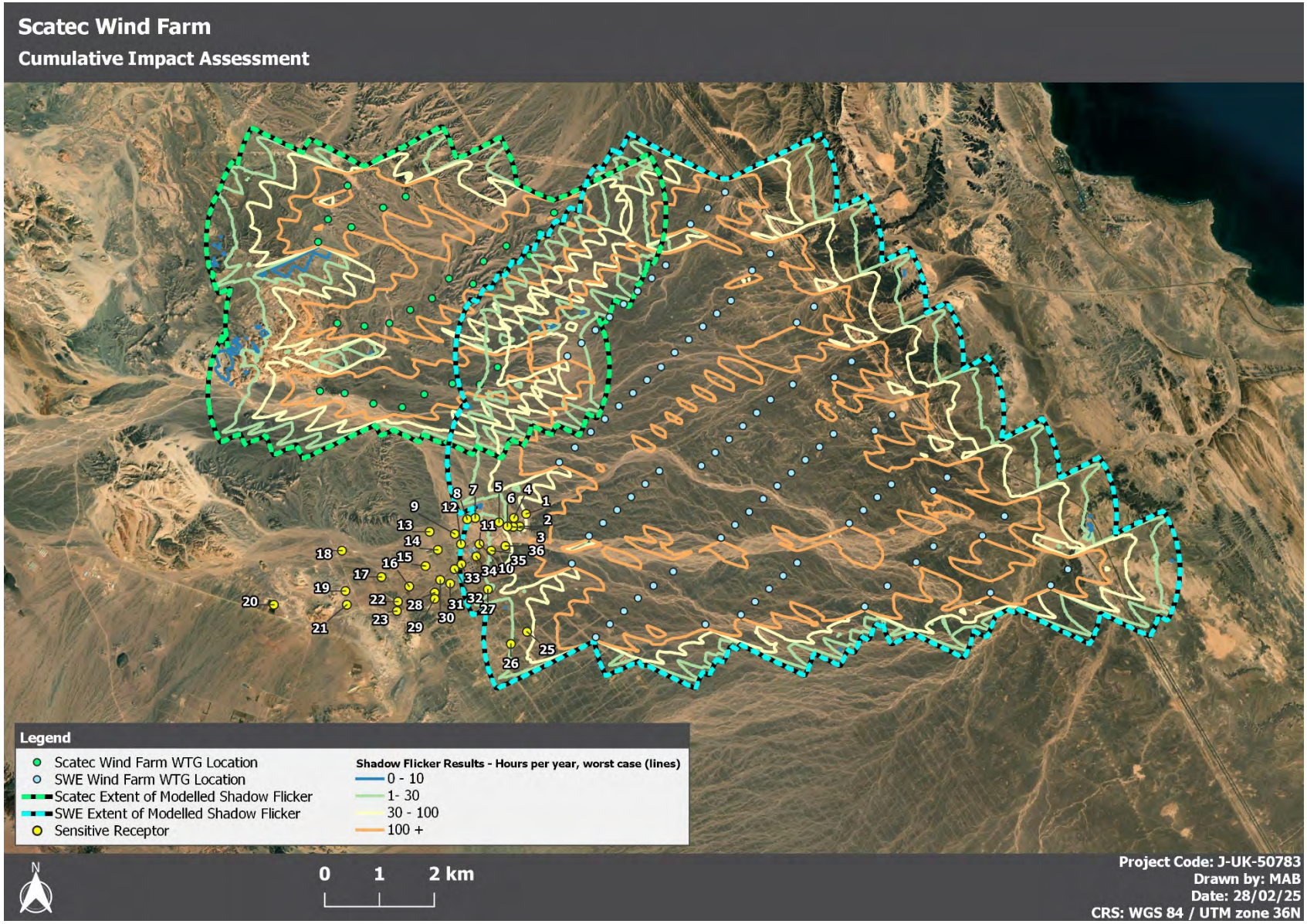

Figure 14: Cumulative Impact Assessment for Worst Case Scenario (hours per year) – Layout 1

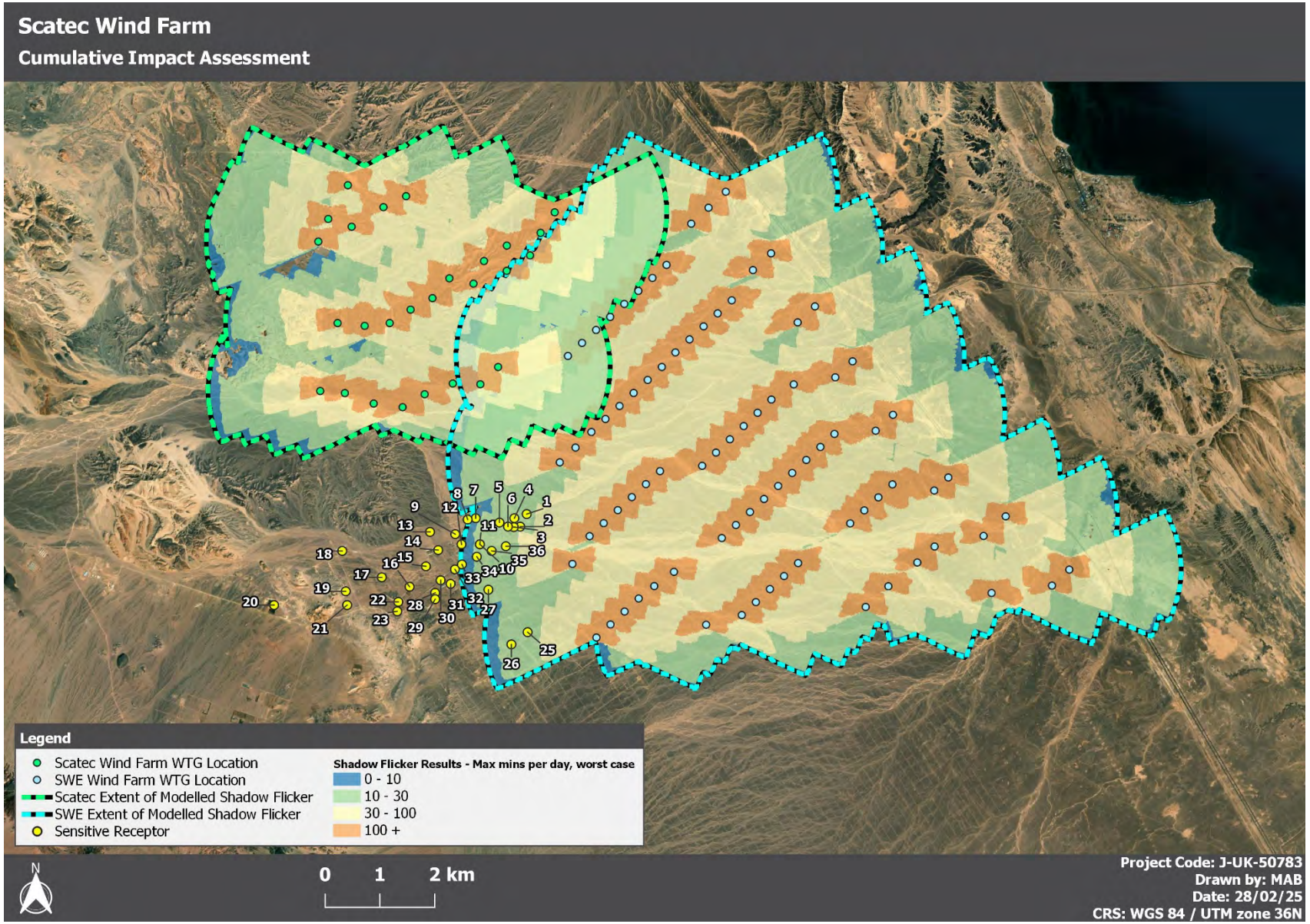

Figure 15: Cumulative Impact Assessment for Worst Case Scenario (mins per day) – Layout 1

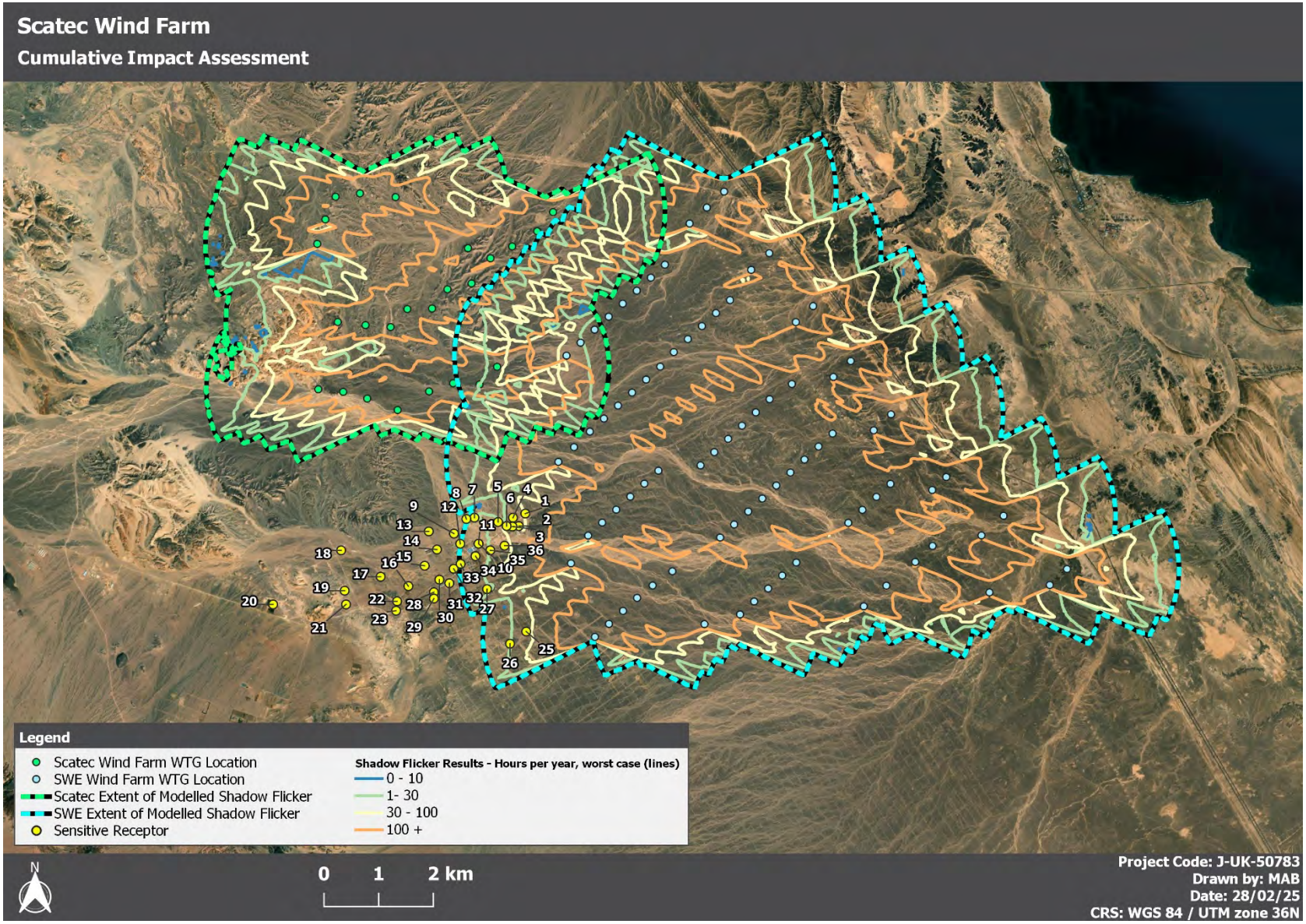

Figure 16: Cumulative Impact Assessment for Worst Case Scenario (hours per year) – Layout 2

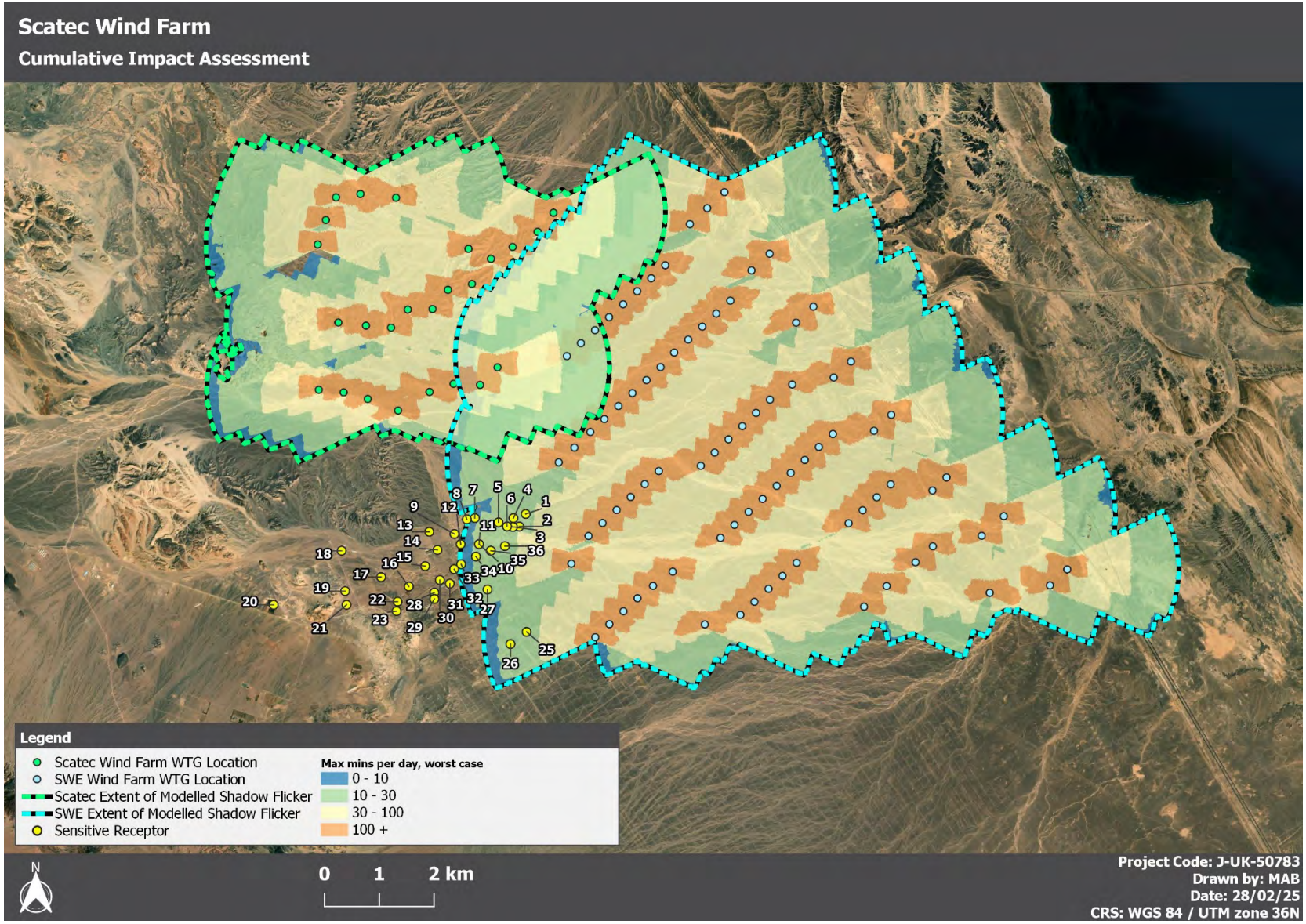

Figure 17: Cumulative Impact Assessment for Worst Case Scenario (mins per day) – Layout 2

8. CONCLUSIONS AND RECOMMENDATIONS

A shadow flicker assessment was undertaken for the Scatec Wind Farm Project in accordance with the assessment criteria of the German guideline for shadow flicker. WindPRO 3.6 industry standard software was utilised to predict the worst-case scenario.

The results of the prediction calculations showed that under worst-case conditions for Scatec Wind Farm Layout 1, and for Scatec Wind Farm Layout 2, shadow flicker does not occur over the recommended maximum of 30 days per year and/or 30 minutes per day, at any of the identified sensitive receptors.

Taking the above into account, no curtailment measures are deemed necessary for either proposed layout.

The following mitigation measures are recommended for both proposed layouts:

- Grievance mechanism to be established to follow up any shadow flicker related grievance.

In case limit values provided in Project Standards are exceeded due to the contribution of the Project operation, mitigation measures (e.g. improving the curtailment conditions at the receptor, limiting the operational hours of the certain WTGs for the certain hours at certain dates/seasons) to be decided with grievance holder.

APPENDIX A – SCATEC WTG COORDINATES

Table 9: Scatec WTG Coordinates – Layout 1

Wind Turbine Generator (WTG)	(UTM Easting) (mE)	(UTM Northing) (mN)
A01	519593.3	3101832.3
A02	519774.8	3102245.4
A03	520202.1	3102103
A04	520132.4	3102861
A05	520782.7	3102460.4
A06	521195.5	3102661.1
B07	519945.2	3100343.6
B08	520439.6	3100292.9
B09	520895.6	3100344.3
B10	521277.5	3100589.5
B11	521676.5	3100799.3
B12	521985.1	3101160.8
B13	522425.8	3101063.6
B14	522618	3101477
B15	523033	3101297.6
B16	523034.7	3101758.6
B17	523458.7	3101579.9
B18	523650.9	3101991.4
B19	523908.1	3102366.7
C20	519628.4	3099103.1
C21	520077.7	3099065.4
C22	520604.3	3098874.7
C23	521132	3098807.8
C24	521534.1	3099044.6
C25	522048.1	3099240.4
C26	522550.8	3099226.4
C27	522874.9	3099541.6

Table 10: Scatec WTG Coordinates – Layout 2

Wind Turbine Generator (WTG)	(UTM Easting) (mE)	(UTM Northing) (mN)
A01	519593.1	3101785.8
A02	519741.4	3102233.7
A03	519927.8	3102647.5
A04	520373.7	3102709.6
A05	521025.1	3102640.9
B06	519968.8	3100358.5
B07	520475.1	3100301.3
B08	520934.2	3100265
B09	521240	3100595.1
B10	521692.4	3100605.4

B11	521974.3	3100956.4
B12	522414	3101063.1
B13	522350.2	3101706.8
B14	522761.1	3101523.5
B15	523157.8	3101739.8
B16	523614.4	3102017.2
B17	523905.2	3102366.4
C18	519611.5	3099127.8
C19	520066.9	3099081
C20	520506.9	3098958.4
C21	521062.5	3098748.4
C22	521637.9	3099088.8
C23	522077	3099238.1
C24	522561.1	3099216.9
C25	522881.4	3099538.9

APPENDIX B – SENSITIVE RECEPTOR IDENTIFICIATION

Table 11: Sensitive Receptor Locations for Shadow Flicker Assessment

SR	SR Coordinates	
	(UTM Easting) (mE)	(UTM Northing) (mN)
SR1	523397	3096856
SR2	523279	3096627
SR3	523162	3096619
SR4	523172	3096781
SR5	522900	3096702
SR6	523055	3096628
SR7	522467	3096781
SR8	522320	3096757
SR9	522093	3096490
SR10	522542	3096304
SR11	522542	3096304
SR12	522207	3096304
SR13	521633	3096530
SR14	521782	3096199
SR15	521557	3095902
SR16	521259	3095529
SR17	520753	3095702
SR18	520030	3096184
SR19	520094	3095446
SR20	518786	3095195
SR21	520120	3095195
SR22	521054	3095253
SR23	521035	3095080
SR25	523414	3094699
SR26	523118	3094477
SR27	522698	3095475
SR28	521726	3095417
SR29	521727	3095302
SR30	521827	3095647
SR31	522008	3095582
SR32	522088	3095846
SR33	522215	3095936
SR34	522487	3096077
SR35	522757	3096184
SR36	523017	3096269

SR24 not included as building was not occupied.]