Appendix I:

Shadow Flicker Impact Assessment

Gaetz Brook Wind Farm
Shadow Flicker Assessment Report
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Report Information

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** The WindPRO v2.8, Decibel Module Calculation Results for the Enercon E-92 2.3 MW @ 98m Hub Height. To review General Specification for the Enercon E-92 2.3 MW please contact:

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1. Introduction

Natural Forces Wind Inc. has undertaken a shadow flicker impact assessment for the proposed Gaetz Brook Wind Farm to assess the potential impact of shadow flicker on the surrounding shadow receptors. Details outlining the shadow receptors, prediction methodology and assumptions made for the assessment are included herein, with complete WindPRO results supplied in the annexes. This report also provides background information on shadow flicker.

As there are very few federal, provincial or municipal guidelines or policies for governing or quantifying what is an acceptable amount of shadow flicker at this time, the German standards, *Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergianlagen*, have been adopted for this study. Often, careful site design in the first instance is recommended, followed by industry accepted mitigation strategies thereafter. This assessment will be used as supporting documentation to demonstrate compliance with these standards. The shadow flicker analysis was conducted using the Shadow module of the software package, WindPRO version 2.8.

2. Background

Flicker is caused by incident light rays on a moving object which then casts an intermittent shadow on a receptor. This intermittent shadow, perceived as a change in light intensity to an observer, as it pertains to wind turbines, is referred to as shadow flicker. Shadow flicker is caused by incident sun rays on the rotor blades as they turn.

For shadow flicker to occur, the following criteria must be met:

1. The sun must be shining and not obscured by any cloud cover.
2. The wind turbine must be between the sun and the shadow receptor.
3. The line of sight between the turbine and the shadow receptor must be clear. Light-impermeable obstacles, such as vegetation, buildings, awnings etc., will prevent shadow flicker from occurring at the receptor.
4. The shadow receptor has to be close enough to the turbine to be in the shadow.

3. Policy and Guidelines

As previously stated, there are very few federal, provincial or municipal guidelines or policies for governing or quantifying what is an acceptable amount of shadow flicker. As a result, the German standards have been adopted for this study. The German shadow flicker guidelines provide a means of quantifying acceptable levels of shadow flicker exposure based on the astronomic worst case.
Acceptable levels at shadow receptors are:

- no more than 30 hours per year of astronomical maximum shadow (worst case), and
- no more than 30 minutes on the worst day of astronomical maximum shadow (worst case).

The guidelines also stipulate two factors that limit the shadow flicker effect, due to optic conditions in the atmosphere:

1) the angle of the sun over the horizon, which must be at least 3 degrees, and
2) the blade of the WTG must cover at least 20 % of the sun.

Receptors not exposed to more than 30 minutes per day on the worst affected day or a total of 30 hours per year from all surrounding wind turbines are considered unlikely to require technical mitigation.

4. General Description of Project Site and Surrounds

The proposed Gaetz Brook Wind Farm consists of a single turbine wind farm located in Halifax Regional Municipality, Nova Scotia. Currently, Enercon E-92 2.3 MW wind turbine generators (WTG) are being considered for the project. For this initial assessment, Enercon E-92 2.3 MW were used to calculate sound pressure levels, however if the WTG type was to change a new shadow flicker assessment would be conducted. The project site is situated approximately 1.3 kilometres south of the Gaetz Brook community and adjacent to Highway 107. Land around the proposed project area is zoned as a Rural Wind Zone and so, will not require re-zoning. A map of the site and surrounding receptors is included in Annex A.

5. Description of Receptors

The 338 points of reception taken into consideration for this shadow flicker assessment are to represent residential buildings and/or seasonal homes located within approximately 2,000 m of the proposed WTG. Each receptor represents an individual dwelling located on Marine Drive, Pine Hill Drive, Lakehill Drive, Brookside Lane or other surrounding roads. It should be noted that there are no residential buildings and/or seasonal homes located within 1,000m of the turbine. Details of receptor distances to nearest WTG are detailed in Table 2. Receptor IDs included in Table 2 correspond with the WindPRO generated map included in Annex B.

6. Description of Sources

6.1. Turbine Locations

A map of the project area with the proposed WTG layout is illustrated in Annex A. The nearest proposed large scale wind farm project to the proposed Gaetz Brook Wind Farm is in North Preston Nova Scotia located approximately 18 km West of the Gaetz Brook wind farm. A small scale turbine with an approximate hub height of 36 m and capacity of 100 kW is located 6.5 km West of the proposed project in Porters Lake.

Due to the scale of the turbine in Porters Lake and the distance separating the Gaetz Brook Wind Farm to the proposed project in North Preston, no cumulative shadow flicker impact will be evaluated. The UTM coordinates of the WTG is given below:

483812 m E, 4956090 m N (Zone 20, NAD 83)

6.2. Turbine Types

The WTG model being considered for the proposed wind farm is the Enercon E-82 2.3 MW. The WTG will have a hub height of 98 m and a rotor diameter of 92 m as shown in Table 2, which outline the WTG's main characteristics. This model WTG utilizes a horizontal axis, 3-blade design and a microprocessor pitch control system (Enercon Canada, 2012).

Table 1: Enercon E-92 2.3 MW turbine characteristics (Enercon Canada, 2012).

WTG Type	Rotor Diameter (m)	Hub Height (m)	Swept area (m^2)	Rated Output (MW)
E-92 2.3MW	92.0	98	6648	2.3

7. Impact Assessment

7.1. Prediction Methodology

The shadow flicker impact was calculated at each receptor using the Shadow module of the software package, WindPRO version 2.8. The model simulates the Earth's orbit and rotation, to provide the astronomical maximum shadow, also known as the astronomical worst-case scenario. The astronomical maximum shadow calculation assumes that for every day of the year:

1. The sky is cloudless between sunrise and sunset,
2. The turbine is always in operation, and
3. The wind direction changes throughout the day such that the rotor plane is perpendicular to the incident sun rays at all times.

The position of the sun relative to the wind turbine rotor plane and the resulting shadow is calculated in steps of one minute intervals throughout a complete year. If the rotor plane, assumed to be a solid disk equivalent in size to the swept area shown in Table 1 casts a shadow on a receptor window during one of these intervals, it is registered as one minute of potential shadow impact.

As previously noted, following the German guidelines, the impact of shadow flicker on surrounding receptors is limited by two factors. The first being that the angle of the sun over the horizon must be greater than 3 degrees, due to optic conditions in the atmosphere which cause the shadow to dissipate before it could potentially reach a receptor. The second is that the blade of the wind turbine must cover at least 20% of the incident solar rays in order to have a noticeable effect. Distances from WTG to receptors are shown inTable 2, where it can be seen that the closest receptor to a WTG is 1,022m.

Each receptor was treated as a 'greenhouse' with 3m high windows for 360° of the building. Furthermore, no topographical shielding (other buildings, barns, trees etc.) has been considered between the wind turbine and receptors. This is a worst-case assumption and results in a conservative prediction of the potential shadow flicker impacts.

Annex B provides results of the analysis for shadow flicker at each of the 338 receptors used in this assessment as well as a list of parameters assumed for the prediction.

7.2. Results of Shadow Flicker Predictions

The results of the shadow flicker prediction model at each receptor, as summarized in Table 2, prove compliance with the German standards of no more than 30 hours per year of astronomical maximum shadow (worst case), and no more than 30 minutes on the worst day of astronomical maximum shadow (worst case). Furthermore, some receptors within 2,000 m of the WTGs will not encounter any shadow flicker impacts.

Table 2: Predicted shadow flicker times for E92-2.3 @ 98 m hub height.

Receptor ID	Distance from WTG	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
		Total hrs/yr	Days/year	Max hrs/day

	(m)	(hr : min)		(hr : min)
A	1987	0:00	0	0:00
B	1976	0:00	0	0:00
C	1952	0:00	0	0:00
D	1964	0:00	0	0:00
E	1960	0:00	0	0:00
F	1946	0:00	0	0:00
G	1948	0:00	0	0:00
H	1949	0:00	0	0:00
I	1914	0:00	0	0:00
J	1912	0:00	0	0:00
K	1890	0:00	0	0:00
L	1907	0:00	0	0:00
M	1889	0:00	0	0:00
N	1871	0:00	0	0:00
O	1866	0:00	0	0:00
P	1855	0:00	0	0:00
Q	1833	0:00	0	0:00
R	1856	0:00	0	0:00
S	1827	0:00	0	0:00
T	1817	0:00	0	0:00
U	1829	0:00	0	0:00
V	1811	0:00	0	0:00
W	1795	0:00	0	0:00
X	1794	0:00	0	0:00
Y	1786	0:00	0	0:00
Z	1796	0:00	0	0:00
AA	1802	0:00	0	0:00
AB	1745	0:00	0	0:00
AC	1734	0:00	0	0:00
AD	1727	0:00	0	0:00
AE	1737	0:00	0	0:00
AF	1709	0:00	0	0:00
AG	1680	0:00	0	0:00
AH	1672	0:00	0	0:00
AI	1654	0:00	0	0:00
AJ	1734	0:00	0	0:00
AK	1651	0:00	0	0:00
AL	1663	0:00	0	0:00
AM	1631	3:01	16	0:14
AN	1624	3:04	18	0:14
AO	1628	3:00	17	0:14
AP	1624	3:00	17	0:14

Receptor ID	Distance from WTG (m)	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
		Total hrs/yr (hr : min)	Days/year	Max hrs/day (hr : min)
AQ	1633	3:40	21	0:14
AR	1588	3:14	18	0:14
AS	1617	3:37	21	0:14
AT	1585	3:13	18	0:14
AU	1547	3:24	18	0:14
AV	1640	0:00	0	0:00
AW	1547	3:19	18	0:14
AX	1621	3:21	19	0:14
AY	1587	3:24	19	0:14
AZ	1601	3:30	19	0:14
BA	1506	3:30	18	0:15
BB	1567	3:24	19	0:14
BC	1544	3:31	19	0:15
BD	1545	3:32	19	0:15
BE	1520	3:33	19	0:15
BF	1529	3:32	19	0:15
BG	1580	6:16	33	0:15
BH	1516	3:35	19	0:15
BI	1575	3:40	20	0:14
BJ	1499	3:37	19	0:15
BK	1491	3:38	19	0:15
BL	1478	3:39	19	0:15
BM	1529	3:37	20	0:15
BN	1546	3:40	20	0:14
BO	1536	3:40	20	0:15
BP	1505	5:33	28	0:16
BQ	1471	3:45	19	0:15
BR	1492	3:48	19	0:15
BS	1451	3:45	19	0:15
BT	1477	3:50	20	0:15
BU	1434	3:52	19	0:16
BV	1415	3:56	19	0:16
BW	1426	3:54	20	0:15
BX	1406	4:04	20	0:16
BY	1455	3:54	20	0:15
BZ	1391	4:06	20	0:16
CA	1395	4:03	20	0:16
CB	1432	4:02	20	0:16
CC	1362	4:20	21	0:16

Receptor ID	Distance from WTG (m)	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
		Total hrs/yr (hr : min)	Days/year	Max hrs/day (hr : min)
CD	1341	4:27	21	0:16
CE	1352	4:25	21	0:17
CF	1353	4:27	21	0:16
CG	1326	4:35	21	0:17
CH	1320	4:44	22	0:17
CI	1309	4:47	22	0:17
CJ	1301	4:51	22	0:17
CK	1313	4:51	22	0:17
CL	1332	4:52	22	0:17
CM	1319	4:46	22	0:17
CN	1325	4:51	22	0:17
CO	1311	4:58	23	0:17
CP	1259	5:02	23	0:17
CQ	1331	5:00	23	0:17
CR	1323	5:12	24	0:17
CS	1234	5:12	22	0:18
CT	1314	5:13	23	0:17
CU	1236	5:17	23	0:18
CV	1221	5:30	23	0:18
CW	1538	0:00	0	0:00
CX	1293	5:39	25	0:18
CY	1424	7:12	34	0:17
CZ	1266	5:35	24	0:18
DA	1453	8:06	38	0:16
DB	1177	5:38	23	0:19
DC	1379	6:23	30	0:17
DD	1351	6:24	29	0:17
DE	1258	5:56	25	0:18
DF	1164	5:56	24	0:19
DG	1254	6:04	26	0:18
DH	1356	7:37	35	0:17
DI	1263	6:23	28	0:18
DJ	1275	6:35	30	0:18
DK	1372	8:30	40	0:17
DL	1285	6:51	30	0:18
DM	1121	6:30	26	0:20
DN	1119	6:38	26	0:20
DO	1077	7:08	28	0:21
DP	1239	8:47	37	0:19

Receptor ID	Distance from WTG (m)	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
		Total hrs/yr (hr : min)	Days/year	Max hrs/day (hr : min)
DQ	1071	7:21	28	0:21
DR	1384	8:05	36	0:16
DS	1402	4:26	26	0:13
DT	1388	5:36	30	0:15
DU	1242	9:49	42	0:19
DV	1391	1:52	17	0:08
DW	1281	15:24	56	0:19
DX	1382	0:00	0	0:00
DY	1281	14:38	54	0:19
DZ	1009	8:19	29	0:22
EA	1337	2:39	20	0:10
EB	1286	8:04	36	0:17
EC	1136	11:01	42	0:20
ED	1010	9:04	32	0:22
EE	1264	8:38	36	0:18
EF	1041	9:27	33	0:22
EG	1416	0:00	0	0:00
EH	1611	0:00	0	0:00
EI	1376	0:00	0	0:00
EJ	1270	1:57	16	0:09
EK	1557	0:00	0	0:00
EL	1670	0:00	0	0:00
EM	1529	0:00	0	0:00
EN	1505	0:00	0	0:00
EO	1446	0:00	0	0:00
EP	1395	0:00	0	0:00
EQ	1476	0:00	0	0:00
ER	1590	0:00	0	0:00
ES	1283	0:00	0	0:00
ET	1616	0:00	0	0:00
EU	1539	0:00	0	0:00
EV	1312	0:00	0	0:00
EW	1101	14:47	48	0:22
EX	1302	0:00	0	0:00
EY	1513	0:00	0	0:00
EZ	1309	0:00	0	0:00
FA	1566	0:00	0	0:00
FB	1038	15:21	48	0:23
FC	1328	0:00	0	0:00

Receptor ID	Distance from WTG (m)	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
		Total hrs/yr (hr : min)	Days/year	Max hrs/day (hr : min)
FD	1520	0:00	0	0:00
FE	1348	0:00	0	0:00
FF	1121	0:00	0	0:00
FG	1900	0:00	0	0:00
FH	1279	0:00	0	0:00
FI	1485	0:00	0	0:00
FJ	1297	0:00	0	0:00
FK	1094	0:00	0	0:00
FL	1393	0:00	0	0:00
FM	1732	0:00	0	0:00
FN	1495	0:00	0	0:00
FO	1673	0:00	0	0:00
FP	1161	0:00	0	0:00
FQ	1507	0:00	0	0:00
FR	1176	0:00	0	0:00
FS	1524	0:00	0	0:00
FT	1206	0:00	0	0:00
FU	1664	0:00	0	0:00
FV	1794	0:00	0	0:00
FW	1540	0:00	0	0:00
FX	1267	0:00	0	0:00
FY	1160	0:00	0	0:00
FZ	1183	0:00	0	0:00
GA	1271	0:00	0	0:00
GB	1587	0:00	0	0:00
GC	1198	0:00	0	0:00
GD	1293	0:00	0	0:00
GE	1232	0:00	0	0:00
GF	1395	0:00	0	0:00
GG	1442	0:00	0	0:00
GH	1483	0:00	0	0:00
GI	1878	0:00	0	0:00
GJ	1494	0:00	0	0:00
GK	1705	0:00	0	0:00
GL	1809	0:00	0	0:00
GM	1177	0:00	0	0:00
GN	1364	0:00	0	0:00
GO	1418	0:00	0	0:00
GP	1282	0:00	0	0:00

Receptor ID	Distance from WTG (m)	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
		Total hrs/yr (hr : min)	Days/year	Max hrs/day (hr : min)
GQ	1472	0:00	0	0:00
GR	1504	0:00	0	0:00
GS	1168	0:00	0	0:00
GT	1271	0:00	0	0:00
GU	1844	0:00	0	0:00
GV	1282	0:00	0	0:00
GW	1570	0:00	0	0:00
GX	1893	0:00	0	0:00
GY	1512	0:00	0	0:00
GZ	1359	0:00	0	0:00
HA	1272	0:00	0	0:00
HB	1591	0:00	0	0:00
HC	1282	0:00	0	0:00
HD	1567	0:00	0	0:00
HE	1919	0:00	0	0:00
HF	1145	0:00	0	0:00
HG	1372	0:00	0	0:00
HH	1943	0:00	0	0:00
HI	1793	0:00	0	0:00
HJ	1971	0:00	0	0:00
HK	1164	0:00	0	0:00
HL	1819	0:00	0	0:00
HM	1861	0:00	0	0:00
HN	1393	0:00	0	0:00
HO	1174	0:00	0	0:00
HP	1197	0:00	0	0:00
HQ	1914	0:00	0	0:00
HR	1344	0:00	0	0:00
HS	1234	0:00	0	0:00
HT	1437	0:00	0	0:00
HU	1688	0:00	0	0:00
HV	1444	0:00	0	0:00
HW	1375	0:00	0	0:00
HX	1463	0:00	0	0:00
HY	1130	0:00	0	0:00
HZ	1667	0:00	0	0:00
IA	1886	0:00	0	0:00
IB	1842	0:00	0	0:00
IC	1909	0:00	0	0:00

Receptor ID	Distance from WTG (m)	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
		Total hrs/yr (hr : min)	Days/year	Max hrs/day (hr : min)
ID	1929	0:00	0	0:00
IE	1087	0:00	0	0:00
IF	1085	0:00	0	0:00
IG	1978	0:00	0	0:00
IH	1633	0:00	0	0:00
II	1272	0:00	0	0:00
IJ	1848	0:00	0	0:00
IK	1192	0:00	0	0:00
IL	1118	0:00	0	0:00
IM	1393	0:00	0	0:00
IN	1143	0:00	0	0:00
IO	1974	0:00	0	0:00
IP	1223	0:00	0	0:00
IQ	1333	0:00	0	0:00
IR	1845	0:00	0	0:00
IS	1266	0:00	0	0:00
IT	1560	0:00	0	0:00
IU	1241	0:00	0	0:00
IV	1528	0:00	0	0:00
IW	1253	0:00	0	0:00
IX	1162	0:00	0	0:00
IY	1503	0:00	0	0:00
IZ	1517	0:00	0	0:00
JA	1171	0:00	0	0:00
JB	1490	0:00	0	0:00
JC	1355	0:00	0	0:00
JD	1278	0:00	0	0:00
JE	1516	0:00	0	0:00
JF	1184	0:00	0	0:00
JG	1322	0:00	0	0:00
JH	1280	0:00	0	0:00
JI	1206	0:00	0	0:00
JJ	1285	0:00	0	0:00
JK	1532	0:00	0	0:00
JL	1170	0:00	0	0:00
JM	1233	0:00	0	0:00
JN	1190	0:00	0	0:00
JO	1299	0:00	0	0:00
JP	1502	0:00	0	0:00

Receptor ID	Distance from WTG (m)	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
		Total hrs/yr (hr : min)	Days/year	Max hrs/day (hr : min)
JQ	1173	0:00	0	0:00
JR	1394	0:00	0	0:00
JS	1537	0:00	0	0:00
JT	1144	0:00	0	0:00
JU	1309	0:00	0	0:00
JV	1498	0:00	0	0:00
JW	1251	0:00	0	0:00
JX	1100	0:00	0	0:00
JY	1232	0:00	0	0:00
JZ	1341	0:00	0	0:00
KA	1486	0:00	0	0:00
KB	1074	0:00	0	0:00
KC	1281	0:00	0	0:00
KD	1181	0:00	0	0:00
KE	1241	0:00	0	0:00
KF	1048	0:00	0	0:00
KG	1159	0:00	0	0:00
KH	1303	0:00	0	0:00
KI	1480	0:00	0	0:00
KJ	1203	0:00	0	0:00
KK	1065	0:00	0	0:00
KL	1476	0:00	0	0:00
KM	1139	0:00	0	0:00
KN	1261	0:00	0	0:00
KO	1143	0:00	0	0:00
KP	1148	0:00	0	0:00
KQ	1089	0:00	0	0:00
KR	1006	0:00	0	0:00
KS	1441	0:00	0	0:00
KT	1218	0:00	0	0:00
KU	1359	0:00	0	0:00
KV	1340	0:00	0	0:00
KW	1221	0:00	0	0:00
KX	1206	0:00	0	0:00
KY	1170	0:00	0	0:00
KZ	1321	0:00	0	0:00
LA	1126	0:00	0	0:00
LB	1145	0:00	0	0:00
LC	1272	0:00	0	0:00

Receptor ID	Distance from WTG (m)	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
		Total hrs/yr (hr : min)	Days/year	Max hrs/day (hr : min)
LD	1302	0:00	0	0:00
LE	1425	0:00	0	0:00
LF	1409	0:00	0	0:00
LG	1224	0:00	0	0:00
LH	1207	0:00	0	0:00
LI	1375	0:00	0	0:00
LJ	1351	0:00	0	0:00
LK	1209	0:00	0	0:00
LL	1188	0:00	0	0:00
LM	1297	0:00	0	0:00
LN	1329	0:00	0	0:00
LO	1156	0:00	0	0:00
LP	1285	0:00	0	0:00
LQ	1014	0:00	0	0:00
LR	1079	0:00	0	0:00
LS	1292	0:00	0	0:00
LT	1253	0:00	0	0:00
LU	1187	0:00	0	0:00
LV	1101	0:00	0	0:00
LW	1238	0:00	0	0:00
LX	1148	0:00	0	0:00
LY	1120	0:00	0	0:00
LZ	1599	4:29	24	0:15

While all receptors are subject to less than 30hrs/year or 30mins/day, the worst affected receptors are displayed in Table 3 and Table 4. Receptor ID labels on the results in Annex B correspond with the WindPRO ID listed in Table 2, 3 and 4.

Table 3: Receptors receiving the most amount predicted worst case shadow flicker hours per year.

Receptor ID	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
	Total hrs/yr (hr : min)	Days/year	Max hrs/day (hr : min)
DW	15:24	56	0:19
FB	15:21	48	0:23
EW	14:47	48	0:22
DY	14:38	54	0:19
EC	11:01	42	0:20
DU	9:49	42	0:19

EF	9:27	33	0:22
ED	9:04	32	0:22
DP	8:47	37	0:19
EE	8:38	36	0:18

Table 4: Receptors receiving the most amount predicted worst case shadow flicker hours per day.

Receptor ID	Predicted Shadow Flicker at Receptors Astronomical Worst Case		
	Total hrs/yr (hr : min)	Days/year	Max hrs/day (hr : min)
FB	15:21	48	0:23
EW	14:47	48	0:22
EF	9:27	33	0:22
ED	9:04	32	0:22
DZ	8:19	29	0:22
DQ	7:21	28	0:21
DO	7:08	28	0:21
EC	11:01	42	0:20
DN	6:38	26	0:20
DM	6:30	26	0:20

8. Conclusions and Recommendations

Natural Forces Wind Inc. has completed a thorough assessment to evaluate the astronomical worst case shadow flicker impact of the proposed Gaetz Brook Wind Farm at all receptors representing dwellings within 2,000 m of a proposed wind turbine generator. Based on the parameters used to run the shadow flicker prediction model in the WindPRO software, it has been shown that the predicted duration of shadow flicker emitted by the wind turbine generators at all points of reception is significantly less than the German guidelines, adopted for this assessment. As a result of this study, no mitigation strategies are recommended.

9. References

Enercon Canada (2012). *Enercon E-92 2.3 MW Wind Turbine Generator data sheet.*

Enercon Canada (2012). *Enercon E-82 2.3 MW Wind Turbine Generator data sheet.*

WEA-Schattenwurf-Hinweise (2002). *Hinweise zur Ermittlung und Beurteilung der optischen Immissionen von Windenergianlagen (Notes on the identification and assessment of the optical pollutions of Wind Turbines).* WindPRO

Nielson, P. (2012). *Windpro 2.8 user guide*. (1st ed.). Denmark: EMD International A/S.

ANNEX A

Site Layout Map

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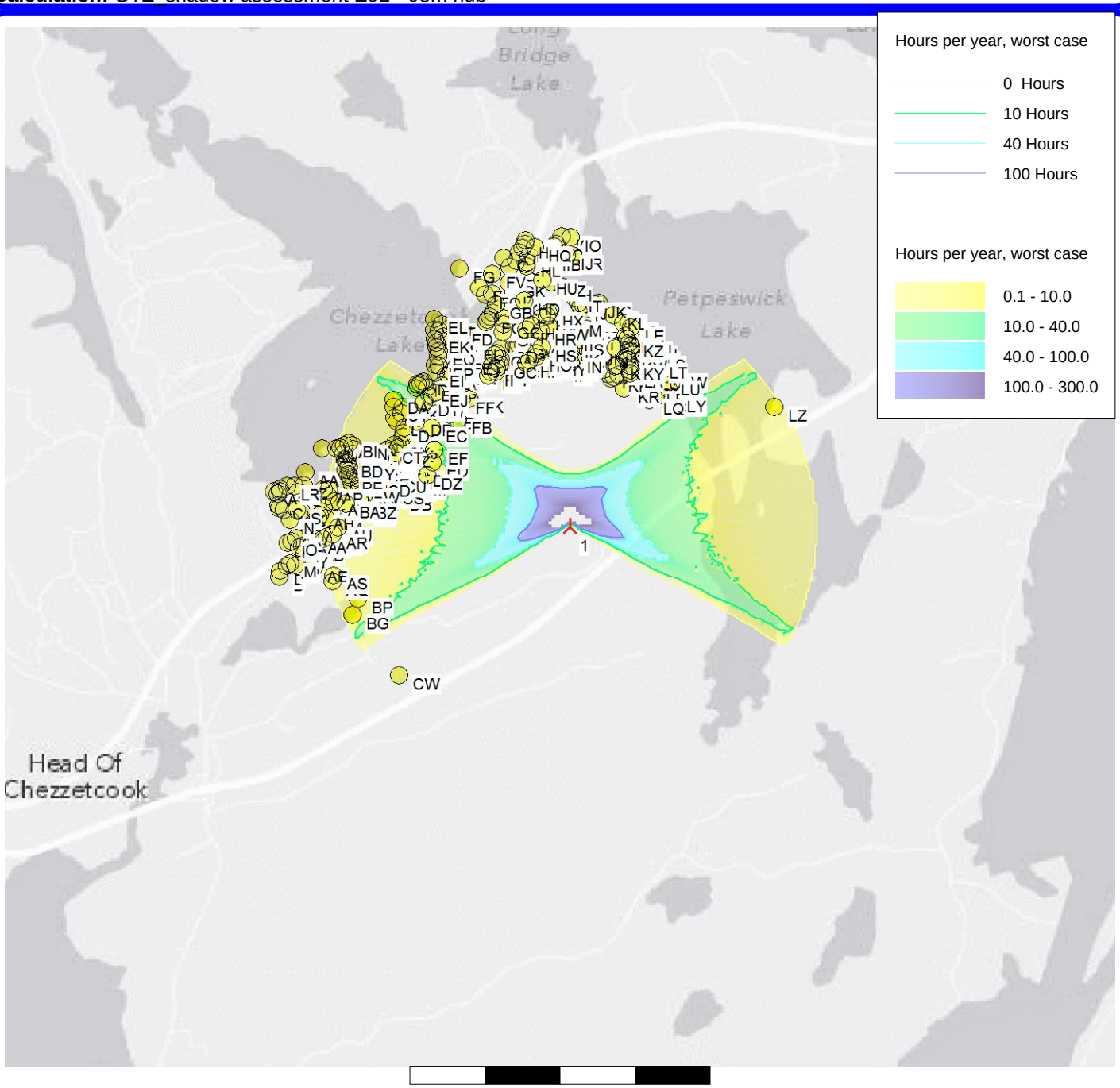
SHADOW - Map

Calculation: GTZ_shadow assessment E92 - 98m hub



Map: GTZ_ARC background map , Print scale 1:40,000, Map center UTM (north)-NAD83 (US+CA) Zone: 20 East: 483,820 North: 4,956,080

New WTG Shadow receptor

Flicker map level: Height Contours: CONTOURLINE_ONLINEDATA_0.wpo (1)

ANNEX B

WindPRO v2.8, Shadow Module Calculation Results

E92-2.3 MW @ 98m Hub Height

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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

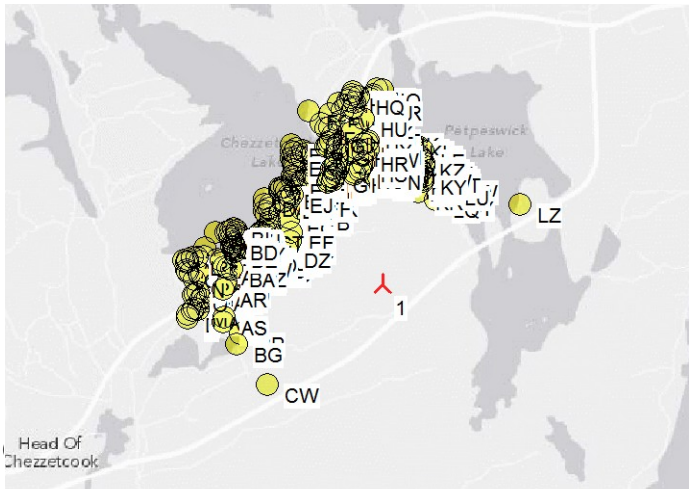
Assumptions for shadow calculations

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

The calculated times are "worst case" given by the following assumptions:
- The sun is shining all the day, from sunrise to sunset
- The rotor plane is always perpendicular to the line from the WTG to the sun
- The WTG is always operating

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: Height Contours: CONTOURLINE_ONLINEDATA_0.wpo
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10.0 m



Scale 1:75,000

New WTG Shadow receptor

WTGs

	UTM (north)-NAD83 (US+CA) Zone: 20				WTG type						Shadow data	
	East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated	Rotor diameter	Hub height	Calculation distance	RPM
			[m]					[kW]	[m]	[m]	[m]	[RPM]
1	483,812	4,956,090	78.1	ENERCON E-92 2,3 MW 2300 92.0 ...	Yes	ENERCON	E-92 2,3 MW-2,300	2,300	92.0	98.0	1,639	16.0

Shadow receptor-Input

No.	UTM (north)-NAD83 (US+CA) Zone: 20 East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
A	481,843	4,956,354	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
B	481,862	4,955,770	10.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
C	481,867	4,956,257	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
D	481,868	4,955,810	11.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
E	481,868	4,956,337	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
F	481,872	4,956,239	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
G	481,882	4,956,351	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
H	481,883	4,956,366	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
I	481,903	4,956,227	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
J	481,915	4,955,848	12.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
K	481,924	4,956,004	15.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
L	481,929	4,956,391	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
M	481,937	4,955,864	12.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
N	481,942	4,956,157	19.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
O	481,947	4,956,016	16.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
P	481,972	4,955,854	12.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
Q	481,980	4,956,032	17.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
R	481,980	4,956,389	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
S	481,990	4,956,229	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
T	481,999	4,955,970	15.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
U	482,001	4,956,345	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
V	482,004	4,956,200	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
W	482,020	4,955,984	16.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"

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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

UTM (north)-NAD83 (US+CA) Zone: 20

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
X	482,022	4,956,216	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
Y	482,033	4,955,931	15.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
Z	482,042	4,956,392	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AA	482,053	4,956,482	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AB	482,070	4,955,977	16.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AC	482,078	4,956,088	18.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AD	482,085	4,956,114	18.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AE	482,095	4,955,828	13.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AF	482,105	4,956,025	16.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AG	482,134	4,956,165	19.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AH	482,143	4,956,186	19.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AI	482,159	4,956,025	16.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AJ	482,167	4,956,639	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AK	482,168	4,956,240	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AL	482,172	4,956,367	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AM	482,183	4,956,166	19.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AN	482,189	4,956,043	17.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AO	482,200	4,956,320	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AP	482,210	4,956,358	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AQ	482,219	4,955,732	11.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AR	482,224	4,956,058	17.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AS	482,226	4,955,774	12.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AT	482,239	4,956,281	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AU	482,265	4,956,105	18.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AV	482,266	4,956,637	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AW	482,276	4,956,275	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AX	482,289	4,956,647	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AY	482,310	4,956,601	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
AZ	482,315	4,956,657	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BA	482,316	4,956,264	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BB	482,318	4,956,565	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BC	482,321	4,956,491	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BD	482,334	4,956,541	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BE	482,338	4,956,461	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BF	482,344	4,956,516	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BG	482,346	4,955,502	10.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BH	482,349	4,956,489	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BI	482,351	4,956,677	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BJ	482,354	4,956,440	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BK	482,357	4,956,415	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BL	482,365	4,956,389	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BM	482,372	4,956,604	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BN	482,374	4,956,659	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BO	482,375	4,956,632	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BP	482,385	4,955,612	12.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BQ	482,388	4,956,460	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BR	482,402	4,956,579	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BS	482,402	4,956,435	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BT	482,410	4,956,554	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BU	482,410	4,956,392	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BV	482,412	4,956,293	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BW	482,412	4,956,360	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BX	482,413	4,956,231	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BY	482,422	4,956,520	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
BZ	482,431	4,956,260	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"

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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

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UTM (north)-NAD83 (US+CA) Zone: 20

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
CA	482,434	4,956,309	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CB	482,438	4,956,494	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CC	482,494	4,956,433	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CD	482,508	4,956,406	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CE	482,509	4,956,449	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CF	482,513	4,956,467	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CG	482,527	4,956,417	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CH	482,548	4,956,471	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CI	482,566	4,956,490	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CJ	482,566	4,956,465	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CK	482,567	4,956,506	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CL	482,569	4,956,570	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CM	482,570	4,956,535	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CN	482,571	4,956,555	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CO	482,582	4,956,544	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CP	482,583	4,956,362	20.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CQ	482,583	4,956,601	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CR	482,599	4,956,618	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CS	482,606	4,956,353	22.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CT	482,614	4,956,631	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CU	482,624	4,956,431	20.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CV	482,642	4,956,439	20.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CW	482,644	4,955,089	26.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CX	482,651	4,956,660	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CY	482,654	4,956,918	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
CZ	482,656	4,956,605	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DA	482,656	4,956,970	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DB	482,656	4,956,312	26.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DC	482,658	4,956,845	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DD	482,672	4,956,816	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DE	482,680	4,956,639	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DF	482,690	4,956,401	24.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DG	482,697	4,956,663	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DH	482,706	4,956,875	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DI	482,713	4,956,712	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DJ	482,715	4,956,738	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DK	482,716	4,956,916	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DL	482,725	4,956,775	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DM	482,740	4,956,417	26.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DN	482,761	4,956,475	25.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DO	482,798	4,956,453	29.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DP	482,807	4,956,814	21.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DQ	482,811	4,956,471	29.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DR	482,812	4,957,046	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DS	482,815	4,957,075	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DT	482,821	4,957,063	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DU	482,823	4,956,841	21.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DV	482,836	4,957,082	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DW	482,854	4,956,941	21.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DX	482,859	4,957,091	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DY	482,862	4,956,949	21.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
DZ	482,870	4,956,452	38.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EA	482,881	4,957,049	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EB	482,898	4,956,995	21.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EC	482,904	4,956,773	27.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"

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1791 Barrington Street Suite 1030
CA-HALIFAX, Nova Scotia B3J 3L1

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Calculated:
04/06/2013 11:39 AM/2.8.579

SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

UTM (north)-NAD83 (US+CA) Zone: 20

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
ED	482,907	4,956,540	34.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EE	482,915	4,956,980	22.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EF	482,918	4,956,623	32.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EG	482,939	4,957,205	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EH	482,939	4,957,444	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EI	482,939	4,957,153	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EJ	482,940	4,957,013	22.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EK	482,940	4,957,380	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EL	482,942	4,957,516	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EM	482,951	4,957,354	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EN	482,951	4,957,324	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EO	482,960	4,957,258	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EP	482,962	4,957,196	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EQ	482,965	4,957,299	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
ER	482,967	4,957,437	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
ES	482,977	4,957,064	22.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
ET	482,989	4,957,481	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EU	483,001	4,957,397	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EV	483,011	4,957,129	20.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EW	483,026	4,956,861	30.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EX	483,028	4,957,130	20.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EY	483,039	4,957,391	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
EZ	483,049	4,957,154	20.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FA	483,050	4,957,459	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FB	483,080	4,956,826	34.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FC	483,084	4,957,201	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FD	483,096	4,957,431	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FE	483,097	4,957,233	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FF	483,109	4,956,963	30.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FG	483,117	4,957,858	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FH	483,121	4,957,166	21.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FI	483,146	4,957,417	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FJ	483,159	4,957,211	21.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FK	483,161	4,956,969	30.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FL	483,171	4,957,327	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FM	483,246	4,957,727	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FN	483,285	4,957,489	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FO	483,288	4,957,679	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FP	483,293	4,957,128	26.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FQ	483,299	4,957,506	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FR	483,307	4,957,153	25.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FS	483,310	4,957,528	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FT	483,315	4,957,189	23.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FU	483,331	4,957,683	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FV	483,334	4,957,819	21.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FW	483,334	4,957,554	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FX	483,335	4,957,264	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FY	483,344	4,957,151	28.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
FZ	483,350	4,957,180	26.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GA	483,351	4,957,275	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GB	483,358	4,957,611	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GC	483,371	4,957,204	26.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GD	483,376	4,957,307	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GE	483,378	4,957,243	23.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GF	483,396	4,957,421	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"

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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

UTM (north)-NAD83 (US+CA) Zone: 20

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
GG	483,403	4,957,473	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GH	483,403	4,957,515	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GI	483,415	4,957,926	28.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GJ	483,422	4,957,532	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GK	483,446	4,957,755	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GL	483,455	4,957,863	24.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GM	483,461	4,957,213	30.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GN	483,464	4,957,409	21.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GO	483,466	4,957,465	20.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GP	483,468	4,957,325	22.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GQ	483,469	4,957,522	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GR	483,476	4,957,556	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GS	483,485	4,957,211	30.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GT	483,487	4,957,319	23.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GU	483,499	4,957,907	26.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GV	483,500	4,957,333	24.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GW	483,506	4,957,630	20.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GX	483,517	4,957,960	29.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GY	483,526	4,957,575	21.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
GZ	483,528	4,957,419	24.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HA	483,530	4,957,330	26.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HB	483,531	4,957,656	20.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HC	483,542	4,957,343	26.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HD	483,544	4,957,634	21.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HE	483,545	4,957,991	29.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HF	483,550	4,957,205	32.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HG	483,553	4,957,437	24.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HH	483,557	4,958,017	30.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HI	483,564	4,957,866	22.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HJ	483,566	4,958,046	30.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HK	483,568	4,957,228	31.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HL	483,573	4,957,893	23.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HM	483,585	4,957,937	25.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HN	483,586	4,957,464	25.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HO	483,609	4,957,246	32.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HP	483,619	4,957,271	31.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HQ	483,625	4,957,995	26.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HR	483,651	4,957,424	26.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HS	483,655	4,957,314	30.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HT	483,661	4,957,519	24.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HU	483,668	4,957,772	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HV	483,693	4,957,529	23.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HW	483,701	4,957,460	25.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HX	483,707	4,957,549	23.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HY	483,725	4,957,217	34.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
HZ	483,731	4,957,755	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IA	483,736	4,957,974	21.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IB	483,739	4,957,931	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IC	483,752	4,957,998	22.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
ID	483,769	4,958,018	21.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IE	483,774	4,957,176	36.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IF	483,801	4,957,175	37.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IG	483,803	4,958,068	21.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IH	483,809	4,957,723	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
II	483,815	4,957,362	29.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"

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Project:
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Calculated:
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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

UTM (north)-NAD83 (US+CA) Zone: 20

No.	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
			[m]	[m]	[m]	[m]	[°]	[°]	
IJ	483,835	4,957,938	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IK	483,846	4,957,282	34.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IL	483,847	4,957,208	37.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IM	483,852	4,957,482	25.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IN	483,860	4,957,232	37.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IO	483,865	4,958,063	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IP	483,868	4,957,311	32.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IQ	483,872	4,957,422	27.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IR	483,876	4,957,934	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IS	483,881	4,957,354	30.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IT	483,883	4,957,648	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IU	483,890	4,957,329	31.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IV	483,904	4,957,615	20.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IW	483,912	4,957,339	31.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IX	483,916	4,957,247	37.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IY	483,920	4,957,589	21.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
IZ	483,937	4,957,602	20.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JA	483,944	4,957,253	37.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JB	483,954	4,957,573	21.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JC	483,955	4,957,437	26.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JD	483,958	4,957,359	30.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JE	483,959	4,957,599	20.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JF	483,965	4,957,264	36.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JG	483,974	4,957,402	28.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JH	483,975	4,957,359	30.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JI	483,986	4,957,284	35.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JJ	483,991	4,957,363	29.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JK	484,006	4,957,610	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JL	484,010	4,957,243	39.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JM	484,012	4,957,306	34.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JN	484,012	4,957,263	37.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JO	484,021	4,957,372	29.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JP	484,027	4,957,576	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JQ	484,032	4,957,243	39.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JR	484,038	4,957,466	24.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JS	484,041	4,957,609	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JT	484,046	4,957,210	42.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JU	484,048	4,957,377	28.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JV	484,050	4,957,569	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JW	484,067	4,957,315	33.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JX	484,068	4,957,160	48.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JY	484,072	4,957,294	34.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
JZ	484,073	4,957,405	26.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KA	484,076	4,957,552	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KB	484,092	4,957,127	49.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KC	484,094	4,957,340	30.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KD	484,105	4,957,234	39.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KE	484,108	4,957,295	34.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KF	484,112	4,957,094	50.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KG	484,113	4,957,209	40.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KH	484,114	4,957,358	29.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KI	484,116	4,957,538	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KJ	484,131	4,957,250	37.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KK	484,132	4,957,106	47.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KL	484,139	4,957,530	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"

To be continued on next page...

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Calculated:
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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

UTM (north)-NAD83 (US+CA) Zone: 20

No.	East	North	Z [m]	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
KM	484,141	4,957,180	41.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KN	484,146	4,957,305	32.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KO	484,149	4,957,182	40.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KP	484,156	4,957,186	40.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KQ	484,164	4,957,120	43.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KR	484,194	4,957,020	48.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KS	484,204	4,957,476	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KT	484,213	4,957,240	34.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KU	484,218	4,957,387	22.8	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KV	484,223	4,957,365	24.7	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KW	484,225	4,957,239	34.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KX	484,228	4,957,222	35.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KY	484,237	4,957,180	37.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
KZ	484,241	4,957,339	26.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LA	484,242	4,957,131	40.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LB	484,243	4,957,151	39.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LC	484,251	4,957,283	30.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LD	484,252	4,957,315	28.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LE	484,253	4,957,445	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LF	484,260	4,957,426	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LG	484,271	4,957,224	33.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LH	484,283	4,957,201	34.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LI	484,294	4,957,377	20.2	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LJ	484,316	4,957,343	21.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LK	484,319	4,957,188	33.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LL	484,330	4,957,160	33.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LM	484,334	4,957,277	25.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LN	484,335	4,957,311	22.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LO	484,347	4,957,115	34.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LP	484,348	4,957,258	26.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LQ	484,363	4,956,941	44.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LR	484,386	4,957,004	38.3	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LS	484,390	4,957,245	22.1	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LT	484,412	4,957,191	23.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LU	484,481	4,957,070	25.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LV	484,483	4,956,963	33.9	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LW	484,495	4,957,123	20.0	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LX	484,498	4,957,011	29.5	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LY	484,521	4,956,957	30.4	3.0	3.0	1.0	0.0	90.0	"Green house mode"
LZ	485,199	4,956,886	22.6	3.0	3.0	1.0	0.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, worst case

No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	0:00	0	0:00
B	0:00	0	0:00
C	0:00	0	0:00
D	0:00	0	0:00
E	0:00	0	0:00
F	0:00	0	0:00

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Project:
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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

Shadow, worst case

No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
G	0:00	0	0:00
H	0:00	0	0:00
I	0:00	0	0:00
J	0:00	0	0:00
K	0:00	0	0:00
L	0:00	0	0:00
M	0:00	0	0:00
N	0:00	0	0:00
O	0:00	0	0:00
P	0:00	0	0:00
Q	0:00	0	0:00
R	0:00	0	0:00
S	0:00	0	0:00
T	0:00	0	0:00
U	0:00	0	0:00
V	0:00	0	0:00
W	0:00	0	0:00
X	0:00	0	0:00
Y	0:00	0	0:00
Z	0:00	0	0:00
AA	0:00	0	0:00
AB	0:00	0	0:00
AC	0:00	0	0:00
AD	0:00	0	0:00
AE	0:00	0	0:00
AF	0:00	0	0:00
AG	0:00	0	0:00
AH	0:00	0	0:00
AI	0:00	0	0:00
AJ	0:00	0	0:00
AK	0:00	0	0:00
AL	0:00	0	0:00
AM	3:01	16	0:14
AN	3:04	18	0:14
AO	3:00	17	0:14
AP	3:00	17	0:14
AQ	3:40	21	0:14
AR	3:14	18	0:14
AS	3:37	21	0:14
AT	3:13	18	0:14
AU	3:24	18	0:14
AV	0:00	0	0:00
AW	3:19	18	0:14
AX	3:21	19	0:14
AY	3:24	19	0:14
AZ	3:30	19	0:14
BA	3:30	18	0:15
BB	3:24	19	0:14
BC	3:31	19	0:15
BD	3:32	19	0:15
BE	3:33	19	0:15
BF	3:32	19	0:15
BG	6:16	33	0:15
BH	3:35	19	0:15
BI	3:40	20	0:14

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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
BJ	3:37	19	0:15
BK	3:38	19	0:15
BL	3:39	19	0:15
BM	3:37	20	0:15
BN	3:40	20	0:14
BO	3:40	20	0:15
BP	5:33	28	0:16
BQ	3:45	19	0:15
BR	3:48	19	0:15
BS	3:45	19	0:15
BT	3:50	20	0:15
BU	3:52	19	0:16
BV	3:56	19	0:16
BW	3:54	20	0:15
BX	4:04	20	0:16
BY	3:54	20	0:15
BZ	4:06	20	0:16
CA	4:03	20	0:16
CB	4:02	20	0:16
CC	4:20	21	0:16
CD	4:27	21	0:16
CE	4:25	21	0:17
CF	4:27	21	0:16
CG	4:35	21	0:17
CH	4:44	22	0:17
CI	4:47	22	0:17
CJ	4:51	22	0:17
CK	4:51	22	0:17
CL	4:52	22	0:17
CM	4:46	22	0:17
CN	4:51	22	0:17
CO	4:58	23	0:17
CP	5:02	23	0:17
CQ	5:00	23	0:17
CR	5:12	24	0:17
CS	5:12	22	0:18
CT	5:13	23	0:17
CU	5:17	23	0:18
CV	5:30	23	0:18
CW	0:00	0	0:00
CX	5:39	25	0:18
CY	7:12	34	0:17
CZ	5:35	24	0:18
DA	8:06	38	0:16
DB	5:38	23	0:19
DC	6:23	30	0:17
DD	6:24	29	0:17
DE	5:56	25	0:18
DF	5:56	24	0:19
DG	6:04	26	0:18
DH	7:37	35	0:17
DI	6:23	28	0:18
DJ	6:35	30	0:18
DK	8:30	40	0:17
DL	6:51	30	0:18

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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
DM	6:30	26	0:20
DN	6:38	26	0:20
DO	7:08	28	0:21
DP	8:47	37	0:19
DQ	7:21	28	0:21
DR	8:05	36	0:16
DS	4:26	26	0:13
DT	5:36	30	0:15
DU	9:49	42	0:19
DV	1:52	17	0:08
DW	15:24	56	0:19
DX	0:00	0	0:00
DY	14:38	54	0:19
DZ	8:19	29	0:22
EA	2:39	20	0:10
EB	8:04	36	0:17
EC	11:01	42	0:20
ED	9:04	32	0:22
EE	8:38	36	0:18
EF	9:27	33	0:22
EG	0:00	0	0:00
EH	0:00	0	0:00
EI	0:00	0	0:00
EJ	1:57	16	0:09
EK	0:00	0	0:00
EL	0:00	0	0:00
EM	0:00	0	0:00
EN	0:00	0	0:00
EO	0:00	0	0:00
EP	0:00	0	0:00
EQ	0:00	0	0:00
ER	0:00	0	0:00
ES	0:00	0	0:00
ET	0:00	0	0:00
EU	0:00	0	0:00
EV	0:00	0	0:00
EW	14:47	48	0:22
EX	0:00	0	0:00
EY	0:00	0	0:00
EZ	0:00	0	0:00
FA	0:00	0	0:00
FB	15:21	48	0:23
FC	0:00	0	0:00
FD	0:00	0	0:00
FE	0:00	0	0:00
FF	0:00	0	0:00
FG	0:00	0	0:00
FH	0:00	0	0:00
FI	0:00	0	0:00
FJ	0:00	0	0:00
FK	0:00	0	0:00
FL	0:00	0	0:00
FM	0:00	0	0:00
FN	0:00	0	0:00
FO	0:00	0	0:00

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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
FP	0:00	0	0:00
FQ	0:00	0	0:00
FR	0:00	0	0:00
FS	0:00	0	0:00
FT	0:00	0	0:00
FU	0:00	0	0:00
FV	0:00	0	0:00
FW	0:00	0	0:00
FX	0:00	0	0:00
FY	0:00	0	0:00
FZ	0:00	0	0:00
GA	0:00	0	0:00
GB	0:00	0	0:00
GC	0:00	0	0:00
GD	0:00	0	0:00
GE	0:00	0	0:00
GF	0:00	0	0:00
GG	0:00	0	0:00
GH	0:00	0	0:00
GI	0:00	0	0:00
GJ	0:00	0	0:00
GK	0:00	0	0:00
GL	0:00	0	0:00
GM	0:00	0	0:00
GN	0:00	0	0:00
GO	0:00	0	0:00
GP	0:00	0	0:00
GQ	0:00	0	0:00
GR	0:00	0	0:00
GS	0:00	0	0:00
GT	0:00	0	0:00
GU	0:00	0	0:00
GV	0:00	0	0:00
GW	0:00	0	0:00
GX	0:00	0	0:00
GY	0:00	0	0:00
GZ	0:00	0	0:00
HA	0:00	0	0:00
HB	0:00	0	0:00
HC	0:00	0	0:00
HD	0:00	0	0:00
HE	0:00	0	0:00
HF	0:00	0	0:00
HG	0:00	0	0:00
HH	0:00	0	0:00
HI	0:00	0	0:00
HJ	0:00	0	0:00
HK	0:00	0	0:00
HL	0:00	0	0:00
HM	0:00	0	0:00
HN	0:00	0	0:00
HO	0:00	0	0:00
HP	0:00	0	0:00
HQ	0:00	0	0:00
HR	0:00	0	0:00

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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
HS	0:00	0	0:00
HT	0:00	0	0:00
HU	0:00	0	0:00
HV	0:00	0	0:00
HW	0:00	0	0:00
HX	0:00	0	0:00
HY	0:00	0	0:00
HZ	0:00	0	0:00
IA	0:00	0	0:00
IB	0:00	0	0:00
IC	0:00	0	0:00
ID	0:00	0	0:00
IE	0:00	0	0:00
IF	0:00	0	0:00
IG	0:00	0	0:00
IH	0:00	0	0:00
II	0:00	0	0:00
IJ	0:00	0	0:00
IK	0:00	0	0:00
IL	0:00	0	0:00
IM	0:00	0	0:00
IN	0:00	0	0:00
IO	0:00	0	0:00
IP	0:00	0	0:00
IQ	0:00	0	0:00
IR	0:00	0	0:00
IS	0:00	0	0:00
IT	0:00	0	0:00
IU	0:00	0	0:00
IV	0:00	0	0:00
IW	0:00	0	0:00
IX	0:00	0	0:00
IY	0:00	0	0:00
IZ	0:00	0	0:00
JA	0:00	0	0:00
JB	0:00	0	0:00
JC	0:00	0	0:00
JD	0:00	0	0:00
JE	0:00	0	0:00
JF	0:00	0	0:00
JG	0:00	0	0:00
JH	0:00	0	0:00
JI	0:00	0	0:00
JJ	0:00	0	0:00
JK	0:00	0	0:00
JL	0:00	0	0:00
JM	0:00	0	0:00
JN	0:00	0	0:00
JO	0:00	0	0:00
JP	0:00	0	0:00
JQ	0:00	0	0:00
JR	0:00	0	0:00
JS	0:00	0	0:00
JT	0:00	0	0:00
JU	0:00	0	0:00

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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

No.	Shadow, worst case Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
JV	0:00	0	0:00
JW	0:00	0	0:00
JX	0:00	0	0:00
JY	0:00	0	0:00
JZ	0:00	0	0:00
KA	0:00	0	0:00
KB	0:00	0	0:00
KC	0:00	0	0:00
KD	0:00	0	0:00
KE	0:00	0	0:00
KF	0:00	0	0:00
KG	0:00	0	0:00
KH	0:00	0	0:00
KI	0:00	0	0:00
KJ	0:00	0	0:00
KK	0:00	0	0:00
KL	0:00	0	0:00
KM	0:00	0	0:00
KN	0:00	0	0:00
KO	0:00	0	0:00
KP	0:00	0	0:00
KQ	0:00	0	0:00
KR	0:00	0	0:00
KS	0:00	0	0:00
KT	0:00	0	0:00
KU	0:00	0	0:00
KV	0:00	0	0:00
KW	0:00	0	0:00
KX	0:00	0	0:00
KY	0:00	0	0:00
KZ	0:00	0	0:00
LA	0:00	0	0:00
LB	0:00	0	0:00
LC	0:00	0	0:00
LD	0:00	0	0:00
LE	0:00	0	0:00
LF	0:00	0	0:00
LG	0:00	0	0:00
LH	0:00	0	0:00
LI	0:00	0	0:00
LJ	0:00	0	0:00
LK	0:00	0	0:00
LL	0:00	0	0:00
LM	0:00	0	0:00
LN	0:00	0	0:00
LO	0:00	0	0:00
LP	0:00	0	0:00
LQ	0:00	0	0:00
LR	0:00	0	0:00
LS	0:00	0	0:00
LT	0:00	0	0:00
LU	0:00	0	0:00
LV	0:00	0	0:00
LW	0:00	0	0:00
LX	0:00	0	0:00

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SHADOW - Main Result

Calculation: GTZ_ shadow assessment E92 - 98m hub

...continued from previous page

Shadow, worst case

No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
LY	0:00	0	0:00
LZ	4:29	24	0:15

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	ENERCON E-92 2,3 MW 2300 92.0 !-! hub: 98.0 m (TOT: 144.0 m) (1)	132:16	