

APPENDIX E. SHADOW FLICKER IMPACT ASSESSMENT

SHADOW - Main Result

Calculation: 190603 5xE126 132m Astr. Max vert. Windows 2

Assumptions for shadow calculations

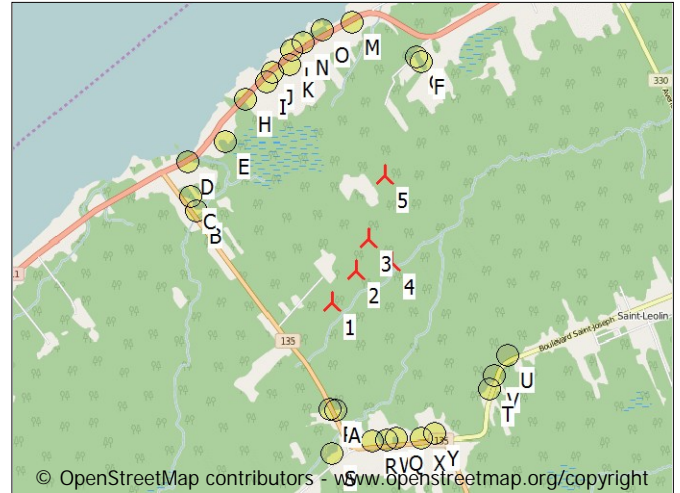
Maximum distance for influence No limit
 Minimum sun height over horizon for influence 3 °
 Day step for calculation 1 days
 Time step for calculation 1 minutes
 The calculated times are "worst case" given by the following assumptions:
 The sun is shining all the day, from sunrise to sunset
 The rotor 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: PrjAss Höhenraster (US NED 1 arc-second)
 Obstacles not used in calculation
 Eye height for map: 1,5 m
 Grid resolution: 10,0 m

All coordinates are in
 CA New Brunswick NAD83-NAD83 (US+CA)

WTGs

Easting	Northing	Z	Row data/Description	WTG type						
				Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]
1	2.595.332	7.642.010	36,2 ENERCON E-126 EP3 4000 127,0 !O! hub: 132,...	Yes	ENERCON	E-126 EP3-4.000	4.000	127,0	132,0	12,4
2	2.595.650	7.642.430	31,8 ENERCON E-126 EP3 4000 127,0 !O! hub: 132,...	Yes	ENERCON	E-126 EP3-4.000	4.000	127,0	132,0	12,4
3	2.595.814	7.642.857	28,0 ENERCON E-126 EP3 4000 127,0 !O! hub: 132,...	Yes	ENERCON	E-126 EP3-4.000	4.000	127,0	132,0	12,4
4	2.596.114	7.642.559	27,8 ENERCON E-126 EP3 4000 127,0 !O! hub: 132,...	Yes	ENERCON	E-126 EP3-4.000	4.000	127,0	132,0	12,4
5	2.596.009	7.643.700	21,9 ENERCON E-126 EP3 4000 127,0 !O! hub: 132,...	Yes	ENERCON	E-126 EP3-4.000	4.000	127,0	132,0	12,4



Shadow receptor-Input

No.	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]	[m]	[°]		[m]
A	2.595.416	7.640.587	42,9	3,0	3,0	1,0	90,0	"Green house mode"	4,0
B	2.593.521	7.643.184	14,5	3,0	3,0	1,0	90,0	"Green house mode"	4,0
C	2.593.442	7.643.379	14,2	3,0	3,0	1,0	90,0	"Green house mode"	4,0
D	2.593.399	7.643.833	14,6	3,0	3,0	1,0	90,0	"Green house mode"	4,0
E	2.593.892	7.644.107	13,9	3,0	3,0	1,0	90,0	"Green house mode"	4,0
F	2.596.479	7.645.206	23,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
G	2.596.410	7.645.275	23,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
H	2.594.150	7.644.677	15,9	3,0	3,0	1,0	90,0	"Green house mode"	4,0
I	2.594.431	7.644.910	18,4	3,0	3,0	1,0	90,0	"Green house mode"	4,0
J	2.594.500	7.645.032	18,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
K	2.594.722	7.645.143	16,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
L	2.594.748	7.645.333	17,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
M	2.595.553	7.645.714	12,5	3,0	3,0	1,0	90,0	"Green house mode"	4,0
N	2.594.896	7.645.439	14,7	3,0	3,0	1,0	90,0	"Green house mode"	4,0
O	2.595.150	7.645.603	12,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
P	2.595.328	7.640.591	43,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
Q	2.596.223	7.640.221	41,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
R	2.595.903	7.640.188	42,1	3,0	3,0	1,0	90,0	"Green house mode"	4,0
S	2.595.373	7.640.008	43,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
T	2.597.447	7.640.900	37,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
U	2.597.680	7.641.345	34,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
V	2.597.511	7.641.075	36,0	3,0	3,0	1,0	90,0	"Green house mode"	4,0
W	2.596.096	7.640.197	40,7	3,0	3,0	1,0	90,0	"Green house mode"	4,0
X	2.596.551	7.640.235	43,1	3,0	3,0	1,0	90,0	"Green house mode"	4,0
Y	2.596.728	7.640.297	41,1	3,0	3,0	1,0	90,0	"Green house mode"	4,0

SHADOW - Main Result

Calculation: 190603 5xE126 132m Astr. Max vert. Windows 2

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	11:32	87	0:15
C	10:25	85	0:13
D	5:09	54	0:10
E	7:07	51	0:13
F	0:00	0	0:00
G	0:00	0	0:00
H	3:17	21	0:15
I	7:18	46	0:16
J	9:03	40	0:16
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	3:57	34	0:11
U	6:39	57	0:11
V	2:22	21	0:10
W	0:00	0	0:00
X	0:00	0	0:00
Y	0:00	0	0:00

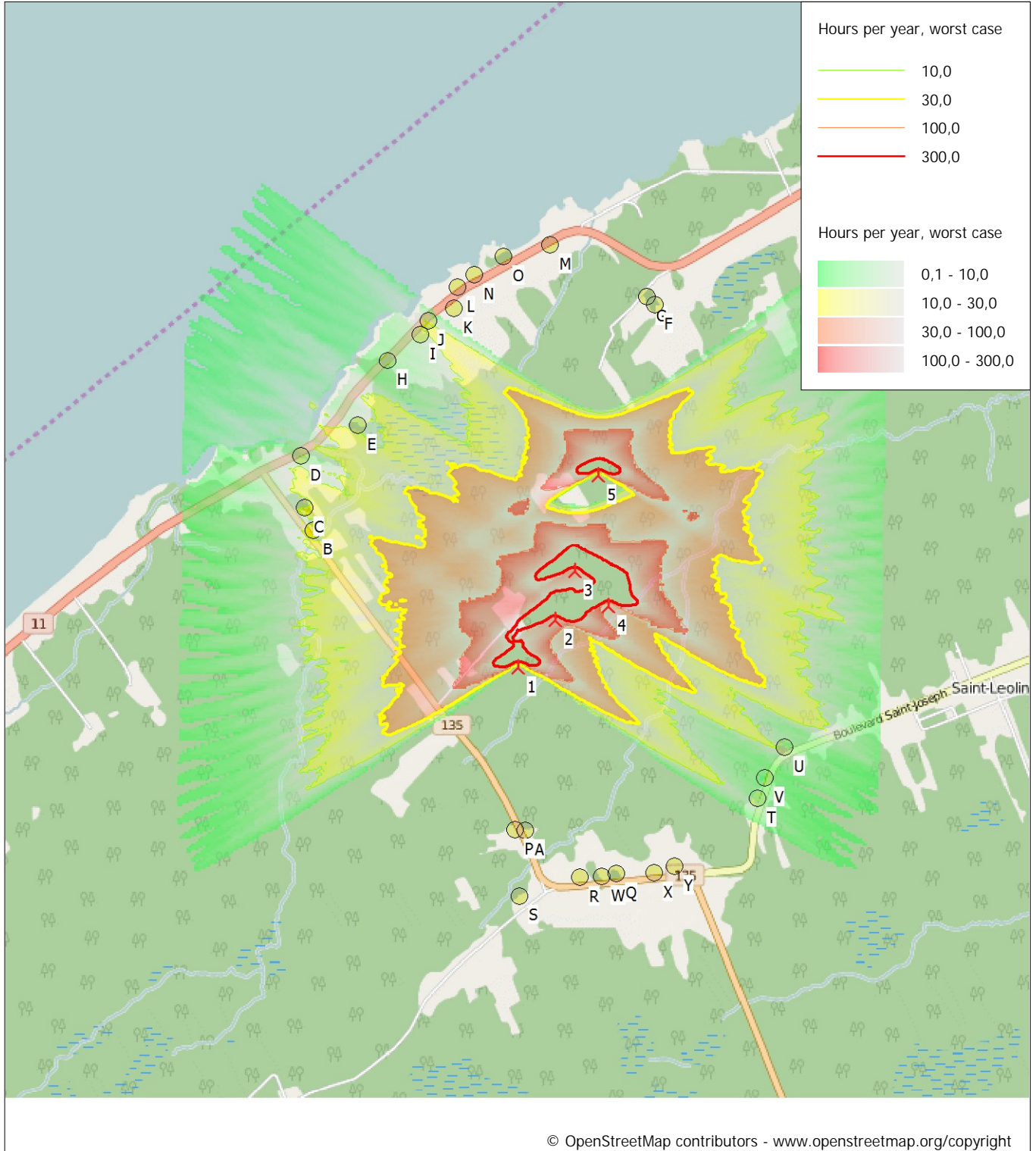
Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]
1	ENERCON E-126 EP3 4000 127.0 IO! hub: 132,0 m (TOT: 195,5 m) (282)	16:35
2	ENERCON E-126 EP3 4000 127.0 IO! hub: 132,0 m (TOT: 195,5 m) (283)	11:36
3	ENERCON E-126 EP3 4000 127.0 IO! hub: 132,0 m (TOT: 195,5 m) (284)	8:31
4	ENERCON E-126 EP3 4000 127.0 IO! hub: 132,0 m (TOT: 195,5 m) (285)	5:00
5	ENERCON E-126 EP3 4000 127.0 IO! hub: 132,0 m (TOT: 195,5 m) (286)	25:39

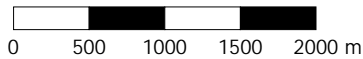
Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

SHADOW - Map

Calculation: 190603 5xE126 132m Astr. Max vert. Windows 2



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Map: Open Street Map 001 , Print scale 1:50.000, Map center CA New Brunswick NAD83-NAD83 (US+CA) East: 2.595.440 North: 7.642.940

New WTG Shadow receptor

Flicker map level: PrjAss Höhenraster (US NED 1 arc-second)