

PUHURI OY

KOPSAN TUULIVOIMAHANKE

**Generic 7 x RD120 x HH143 (106,5 dB)
Melun ja varjostuksen laskentatulokset**

P12580

4.4.2012

Project:

Kopsan tuulivoimapuisto

Description:

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Kopsan Tuulivoimapuisto

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Licensed user:

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Calculated:

4.4.2012 15:18/2.7.487

FCG

DECIBEL - Main Result

Calculation: 7 x RD120 x HH143 (106,5 dB)

Noise calculation model:

ISO 9613-2 General

Wind speed:

8,0 m/s

Ground attenuation:

General, Ground factor: 0,5

Meteorological coefficient, C0:

0,0 dB

Type of demand in calculation:

1: WTG noise is compared to demand (DK, DE, SE, NL etc.)

Noise values in calculation:

All noise values are mean values (Lwa) (Normal)

Pure tones:

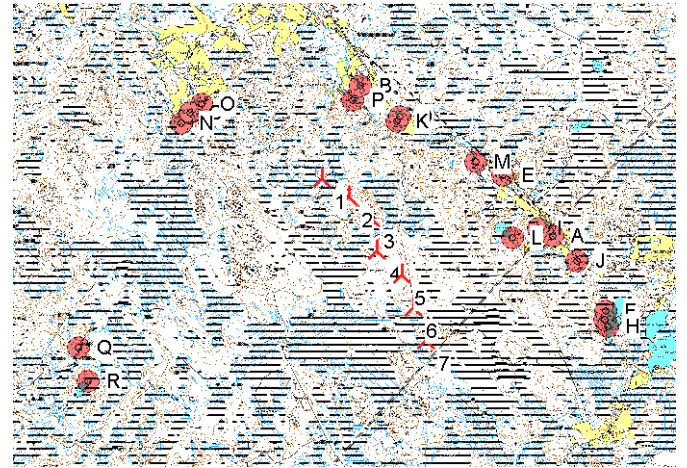
Pure and Impulse tone penalty are added to WTG source noise

Height above ground level, when no value in NSA object:

1,5 m Don't allow override of model height with height from NSA object

Deviation from "official" noise demands. Negative is more restrictive, positive is less restrictive.:

0,0 dB(A)



Scale 1:125 000

New WTG

Noise sensitive area

WTGs

KKJ Zone: 3												Noise data									
East		North	Z	Row data/Description		WTG type															
				Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Creator	Name	Wind speed [m/s]	Status	Hub height [m]	LwA_ref [dB(A)]	Pure tones	Octave data				
KKJ Zone: 3			[m]																		
1	3 390 794	7 163 402	95,0	Generic	RD120_I	EC3A 3000 120,0...	Yes	Generic	RD120_I	EC3A-3 000	3 000	120,0	143,0	USER	Level 0 - Mode 0 - - 04-2012	8,0	ExtraPolated	143,0	106,5	0 dB	Generic *)
2	3 391 237	7 163 103	105,0	Generic	RD120_I	EC3A 3000 120,0...	Yes	Generic	RD120_I	EC3A-3 000	3 000	120,0	143,0	USER	Level 0 - Mode 0 - - 04-2012	8,0	ExtraPolated	143,0	106,5	0 dB	Generic *)
3	3 391 596	7 162 750	109,7	Generic	RD120_I	EC3A 3000 120,0...	Yes	Generic	RD120_I	EC3A-3 000	3 000	120,0	143,0	USER	Level 0 - Mode 0 - - 04-2012	8,0	ExtraPolated	143,0	106,5	0 dB	Generic *)
4	3 391 697	7 162 207	105,0	Generic	RD120_I	EC3A 3000 120,0...	Yes	Generic	RD120_I	EC3A-3 000	3 000	120,0	143,0	USER	Level 0 - Mode 0 - - 04-2012	8,0	ExtraPolated	143,0	106,5	0 dB	Generic *)
5	3 392 111	7 161 799	115,0	Generic	RD120_I	EC3A 3000 120,0...	Yes	Generic	RD120_I	EC3A-3 000	3 000	120,0	143,0	USER	Level 0 - Mode 0 - - 04-2012	8,0	ExtraPolated	143,0	106,5	0 dB	Generic *)
6	3 392 307	7 161 262	109,1	Generic	RD120_I	EC3A 3000 120,0...	Yes	Generic	RD120_I	EC3A-3 000	3 000	120,0	143,0	USER	Level 0 - Mode 0 - - 04-2012	8,0	ExtraPolated	143,0	106,5	0 dB	Generic *)
7	3 392 512	7 160 713	105,0	Generic	RD120_I	EC3A 3000 120,0...	Yes	Generic	RD120_I	EC3A-3 000	3 000	120,0	143,0	USER	Level 0 - Mode 0 - - 04-2012	8,0	ExtraPolated	143,0	106,5	0 dB	Generic *)

*)Notice: One or more noise data for this WTG is generic or input by user

Calculation Results

Sound Level

Noise sensitive area		KKJ Zone: 3			Demands			Sound Level		Demands fulfilled ?		
No.	Name	East	North	Z	Imission height	Noise	Distance	From WTGs	Noise	Distance	All	
				[m]	[m]	[dB(A)]	[m]	[dB(A)]				
	A Asutus	3 394 616	7 162 445	91,6	1,5	50,0	50	27,9	Yes	Yes	Yes	
	B Asutus	3 391 429	7 164 937	75,9	1,5	50,0	50	30,8	Yes	Yes	Yes	
	C Asutus	3 388 608	7 164 492	72,6	1,5	50,0	50	25,8	Yes	Yes	Yes	
	D Asutus	3 392 076	7 164 428	78,5	1,5	50,0	50	32,5	Yes	Yes	Yes	
	E Asutus	3 393 783	7 163 446	87,5	1,5	50,0	50	29,6	Yes	Yes	Yes	
	F Loma-asunto	3 395 493	7 161 203	100,0	1,5	40,0		24,9	Yes		Yes	
	G Loma-asunto	3 395 479	7 161 053	101,7	1,5	40,0		24,9	Yes		Yes	
	H Loma-asunto	3 395 523	7 160 943	97,5	1,5	40,0		24,7	Yes		Yes	
	I Asumisalue	3 394 381	7 162 570	90,0	1,5	50,0	50	28,7	Yes	Yes	Yes	
	J Asumisalue	3 395 024	7 162 033	95,0	1,5	50,0	50	26,6	Yes	Yes	Yes	
	K Asumisalue	3 392 032	7 164 347	78,7	1,5	50,0	50	33,1	Yes	Yes	Yes	
	L Järvelä	3 393 943	7 162 417	101,9	1,5	40,0	600	31,0	Yes	Yes	Yes	
	M Kapakankorpi	3 393 340	7 163 673	85,0	1,5	40,0	50	30,8	Yes	Yes	Yes	
	N Pökökangas	3 388 453	7 164 305	75,8	1,5	50,0	50	25,6	Yes	Yes	Yes	
	O Kahlola	3 388 790	7 164 633	70,6	1,5	40,0	50	26,2	Yes	Yes	Yes	
	P Kurula	3 391 306	7 164 693	75,9	1,5	50,0	50	32,5	Yes	Yes	Yes	
	Q Patama	3 386 743	7 160 595	71,3	1,5	40,0	50	20,3	Yes	Yes	Yes	
	R Sikolampi	3 386 901	7 160 029	72,5	1,5	40,0	50	20,2	Yes	Yes	Yes	

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FCG

DECIBEL - Main Result

Calculation: 7 x RD120 x HH143 (106,5 dB)

Distances (m)**WTG**

NSA	1	2	3	4	5	6	7
A	3940	3442	3035	2928	2587	2594	2725
B	1662	1844	2194	2743	3211	3779	4361
C	2444	2974	3459	3843	4419	4911	5434
D	1642	1568	1745	2253	2629	3174	3740
E	2989	2569	2295	2426	2347	2636	3014
F	5188	4661	4193	3927	3435	3187	3022
G	5240	4711	4238	3954	3449	3179	2986
H	5329	4799	4322	4029	3517	3231	3019
I	3682	3189	2790	2708	2397	2452	2634
J	4446	3935	3502	3332	2922	2824	2838
K	1558	1477	1656	2166	2550	3098	3666
L	3299	2792	2371	2256	1934	2003	2225
M	2560	2179	1973	2202	2241	2623	3074
N	2510	3033	3507	3863	4434	4910	5420
O	2353	2886	3380	3787	4366	4872	5406
P	1389	1592	1965	2517	3004	3574	4159
Q	4928	5146	5310	5209	5501	5604	5770
R	5151	5315	5427	5267	5503	5545	5653

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DECIBEL - Detailed results

Calculation: 7 x RD120 x HH143 (106,5 dB) Noise calculation model: ISO 9613-2 General 8,0 m/s

Assumptions

Calculated L(DW) = LWA,ref + K + Dc - (Adiv + Aatm + Agr + Abar + Amisc) - Cmet
(when calculated with ground attenuation, then Dc = Domega)

LWA,ref:	Sound pressure level at WTG
K:	Pure tone
Dc:	Directivity correction
Adiv:	the attenuation due to geometrical divergence
Aatm:	the attenuation due to atmospheric absorption
Agr:	the attenuation due to ground effect
Abar:	the attenuation due to a barrier
Amisc:	the attenuation due to miscellaneous other effects
Cmet:	Meteorological correction

Calculation Results

Noise sensitive area: A Asutus

WTG

Wind speed: 8,0 m/s

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	3 940	3 942	15,57	106,5	0,00	82,91	-	-	0,00	0,00	-	0,00
2	3 442	3 446	17,34	106,5	0,00	81,75	-	-	0,00	0,00	-	0,00
3	3 035	3 039	18,97	106,5	0,00	80,66	-	-	0,00	0,00	-	0,00
4	2 928	2 933	19,43	106,5	0,00	80,35	-	-	0,00	0,00	-	0,00
5	2 587	2 592	21,01	106,5	0,00	79,27	-	-	0,00	0,00	-	0,00
6	2 594	2 599	20,98	106,5	0,00	79,30	-	-	0,00	0,00	-	0,00
7	2 725	2 729	20,35	106,5	0,00	79,72	-	-	0,00	0,00	-	0,00

Sum 27,90

- Data undefined due to calculation with octave data

Noise sensitive area: B Asutus

WTG

Wind speed: 8,0 m/s

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	1 662	1 669	26,42	106,5	0,00	75,45	-	-	0,00	0,00	-	0,00
2	1 844	1 852	25,17	106,5	0,00	76,35	-	-	0,00	0,00	-	0,00
3	2 194	2 201	23,06	106,5	0,00	77,85	-	-	0,00	0,00	-	0,00
4	2 743	2 749	20,26	106,5	0,00	79,78	-	-	0,00	0,00	-	0,00
5	3 211	3 216	18,24	106,5	0,00	81,15	-	-	0,00	0,00	-	0,00
6	3 779	3 783	16,12	106,5	0,00	82,56	-	-	0,00	0,00	-	0,00
7	4 361	4 364	14,23	106,5	0,00	83,80	-	-	0,00	0,00	-	0,00

Sum 30,83

- Data undefined due to calculation with octave data

Noise sensitive area: C Asutus

WTG

Wind speed: 8,0 m/s

No.	Distance [m]	Sound distance [m]	Calculated [dB(A)]	LwA,ref [dB(A)]	Dc [dB]	Adiv [dB]	Aatm [dB]	Agr [dB]	Abar [dB]	Amisc [dB]	A [dB]	Cmet [dB]
1	2 444	2 449	21,73	106,5	0,00	78,78	-	-	0,00	0,00	-	0,00
2	2 974	2 979	19,23	106,5	0,00	80,48	-	-	0,00	0,00	-	0,00
3	3 459	3 464	17,27	106,5	0,00	81,79	-	-	0,00	0,00	-	0,00
4	3 843	3 847	15,90	106,5	0,00	82,70	-	-	0,00	0,00	-	0,00
5	4 419	4 423	14,08	106,5	0,00	83,91	-	-	0,00	0,00	-	0,00
6	4 911	4 914	12,85	106,5	0,00	84,83	-	-	0,00	0,00	-	0,00
7	5 434	5 437	11,65	106,5	0,00	85,71	-	-	0,00	0,00	-	0,00

Sum 25,85

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DECIBEL - Detailed results

Calculation: 7 x RD120 x HH143 (106,5 dB) Noise calculation model: ISO 9613-2 General 8,0 m/s

Noise sensitive area: D Asutus

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	1 642	1 649	26,56	106,5	0,00	75,35	-	-	0,00	0,00	-	0,00
2	1 568	1 577	27,09	106,5	0,00	74,96	-	-	0,00	0,00	-	0,00
3	1 745	1 753	25,83	106,5	0,00	75,88	-	-	0,00	0,00	-	0,00
4	2 253	2 259	22,74	106,5	0,00	78,08	-	-	0,00	0,00	-	0,00
5	2 629	2 635	20,80	106,5	0,00	79,42	-	-	0,00	0,00	-	0,00
6	3 174	3 179	18,39	106,5	0,00	81,04	-	-	0,00	0,00	-	0,00
7	3 740	3 744	16,25	106,5	0,00	82,47	-	-	0,00	0,00	-	0,00

Sum 32,47

- Data undefined due to calculation with octave data

Noise sensitive area: E Asutus

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	2 989	2 993	19,17	106,5	0,00	80,52	-	-	0,00	0,00	-	0,00
2	2 569	2 574	21,10	106,5	0,00	79,21	-	-	0,00	0,00	-	0,00
3	2 295	2 301	22,51	106,5	0,00	78,24	-	-	0,00	0,00	-	0,00
4	2 426	2 431	21,82	106,5	0,00	78,72	-	-	0,00	0,00	-	0,00
5	2 347	2 353	22,23	106,5	0,00	78,43	-	-	0,00	0,00	-	0,00
6	2 636	2 641	20,77	106,5	0,00	79,44	-	-	0,00	0,00	-	0,00
7	3 014	3 018	19,06	106,5	0,00	80,60	-	-	0,00	0,00	-	0,00

Sum 29,58

- Data undefined due to calculation with octave data

Noise sensitive area: F Loma-asunto

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	5 188	5 190	12,21	106,5	0,00	85,30	-	-	0,00	0,00	-	0,00
2	4 661	4 663	13,46	106,5	0,00	84,37	-	-	0,00	0,00	-	0,00
3	4 193	4 196	14,74	106,5	0,00	83,46	-	-	0,00	0,00	-	0,00
4	3 927	3 930	15,61	106,5	0,00	82,89	-	-	0,00	0,00	-	0,00
5	3 435	3 438	17,37	106,5	0,00	81,73	-	-	0,00	0,00	-	0,00
6	3 187	3 191	18,34	106,5	0,00	81,08	-	-	0,00	0,00	-	0,00
7	3 022	3 025	19,03	106,5	0,00	80,61	-	-	0,00	0,00	-	0,00

Sum 24,89

- Data undefined due to calculation with octave data

Noise sensitive area: G Loma-asunto

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	5 240	5 242	12,09	106,5	0,00	85,39	-	-	0,00	0,00	-	0,00
2	4 711	4 714	13,34	106,5	0,00	84,47	-	-	0,00	0,00	-	0,00
3	4 238	4 240	14,60	106,5	0,00	83,55	-	-	0,00	0,00	-	0,00
4	3 954	3 957	15,52	106,5	0,00	82,95	-	-	0,00	0,00	-	0,00
5	3 449	3 453	17,31	106,5	0,00	81,76	-	-	0,00	0,00	-	0,00
6	3 179	3 182	18,38	106,5	0,00	81,05	-	-	0,00	0,00	-	0,00
7	2 986	2 990	19,19	106,5	0,00	80,51	-	-	0,00	0,00	-	0,00

Sum 24,88

- Data undefined due to calculation with octave data

Noise sensitive area: H Loma-asunto

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	5 329	5 331	11,89	106,5	0,00	85,54	-	-	0,00	0,00	-	0,00

To be continued on next page...

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DECIBEL - Detailed results

Calculation: 7 x RD120 x HH143 (106,5 dB) Noise calculation model: ISO 9613-2 General 8,0 m/s

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WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
2	4 799	4 801	13,12	106,5	0,00	84,63	-	-	0,00	0,00	-	0,00
3	4 322	4 325	14,34	106,5	0,00	83,72	-	-	0,00	0,00	-	0,00
4	4 029	4 032	15,27	106,5	0,00	83,11	-	-	0,00	0,00	-	0,00
5	3 517	3 521	17,06	106,5	0,00	81,93	-	-	0,00	0,00	-	0,00
6	3 231	3 235	18,17	106,5	0,00	81,20	-	-	0,00	0,00	-	0,00
7	3 019	3 023	19,04	106,5	0,00	80,61	-	-	0,00	0,00	-	0,00

Sum 24,67

- Data undefined due to calculation with octave data

Noise sensitive area: I Asumisalue

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	3 682	3 684	16,46	106,5	0,00	82,33	-	-	0,00	0,00	-	0,00
2	3 189	3 192	18,34	106,5	0,00	81,08	-	-	0,00	0,00	-	0,00
3	2 790	2 795	20,05	106,5	0,00	79,93	-	-	0,00	0,00	-	0,00
4	2 708	2 713	20,43	106,5	0,00	79,67	-	-	0,00	0,00	-	0,00
5	2 397	2 403	21,97	106,5	0,00	78,61	-	-	0,00	0,00	-	0,00
6	2 452	2 457	21,69	106,5	0,00	78,81	-	-	0,00	0,00	-	0,00
7	2 634	2 639	20,78	106,5	0,00	79,43	-	-	0,00	0,00	-	0,00

Sum 28,74

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Noise sensitive area: J Asumisalue

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	4 446	4 448	14,01	106,5	0,00	83,96	-	-	0,00	0,00	-	0,00
2	3 935	3 938	15,58	106,5	0,00	82,91	-	-	0,00	0,00	-	0,00
3	3 502	3 506	17,12	106,5	0,00	81,90	-	-	0,00	0,00	-	0,00
4	3 332	3 335	17,77	106,5	0,00	81,46	-	-	0,00	0,00	-	0,00
5	2 922	2 927	19,46	106,5	0,00	80,33	-	-	0,00	0,00	-	0,00
6	2 824	2 828	19,90	106,5	0,00	80,03	-	-	0,00	0,00	-	0,00
7	2 838	2 842	19,84	106,5	0,00	80,07	-	-	0,00	0,00	-	0,00

Sum 26,58

- Data undefined due to calculation with octave data

Noise sensitive area: K Asumisalue

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	1 558	1 566	27,18	106,5	0,00	74,89	-	-	0,00	0,00	-	0,00
2	1 477	1 486	27,79	106,5	0,00	74,44	-	-	0,00	0,00	-	0,00
3	1 656	1 665	26,45	106,5	0,00	75,43	-	-	0,00	0,00	-	0,00
4	2 166	2 173	23,22	106,5	0,00	77,74	-	-	0,00	0,00	-	0,00
5	2 550	2 556	21,19	106,5	0,00	79,15	-	-	0,00	0,00	-	0,00
6	3 098	3 102	18,71	106,5	0,00	80,83	-	-	0,00	0,00	-	0,00
7	3 666	3 670	16,52	106,5	0,00	82,29	-	-	0,00	0,00	-	0,00

Sum 33,07

- Data undefined due to calculation with octave data

Noise sensitive area: L Järvelä

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	3 299	3 302	17,90	106,5	0,00	81,38	-	-	0,00	0,00	-	0,00
2	2 792	2 795	20,05	106,5	0,00	79,93	-	-	0,00	0,00	-	0,00
3	2 371	2 375	22,11	106,5	0,00	78,51	-	-	0,00	0,00	-	0,00

To be continued on next page...

Project:

Kopsan tuulivoimapuisto

Description:

Puhuri Oy
Kopsan Tuulivoimapuisto

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Calculated:
4.4.2012 15:18/2.7.487

DECIBEL - Detailed results

Calculation: 7 x RD120 x HH143 (106,5 dB) Noise calculation model: ISO 9613-2 General 8,0 m/s

...continued from previous page

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
4	2 256	2 261	22,73	106,5	0,00	78,08	-	-	0,00	0,00	-	0,00
5	1 934	1 940	24,61	106,5	0,00	76,76	-	-	0,00	0,00	-	0,00
6	2 003	2 008	24,19	106,5	0,00	77,06	-	-	0,00	0,00	-	0,00
7	2 225	2 230	22,89	106,5	0,00	77,97	-	-	0,00	0,00	-	0,00
Sum	31,00											

- Data undefined due to calculation with octave data

Noise sensitive area: M Kapakankorpi

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	2 560	2 565	21,14	106,5	0,00	79,18	-	-	0,00	0,00	-	0,00
2	2 179	2 185	23,15	106,5	0,00	77,79	-	-	0,00	0,00	-	0,00
3	1 973	1 980	24,36	106,5	0,00	76,93	-	-	0,00	0,00	-	0,00
4	2 202	2 208	23,02	106,5	0,00	77,88	-	-	0,00	0,00	-	0,00
5	2 241	2 248	22,80	106,5	0,00	78,03	-	-	0,00	0,00	-	0,00
6	2 623	2 628	20,83	106,5	0,00	79,39	-	-	0,00	0,00	-	0,00
7	3 074	3 078	18,81	106,5	0,00	80,76	-	-	0,00	0,00	-	0,00
Sum	30,78											

- Data undefined due to calculation with octave data

Noise sensitive area: N Pökökangas

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	2 510	2 515	21,39	106,5	0,00	79,01	-	-	0,00	0,00	-	0,00
2	3 033	3 037	18,98	106,5	0,00	80,65	-	-	0,00	0,00	-	0,00
3	3 507	3 511	17,10	106,5	0,00	81,91	-	-	0,00	0,00	-	0,00
4	3 863	3 867	15,83	106,5	0,00	82,75	-	-	0,00	0,00	-	0,00
5	4 434	4 438	14,04	106,5	0,00	83,94	-	-	0,00	0,00	-	0,00
6	4 910	4 914	12,85	106,5	0,00	84,83	-	-	0,00	0,00	-	0,00
7	5 420	5 423	11,69	106,5	0,00	85,68	-	-	0,00	0,00	-	0,00
Sum	25,63											

- Data undefined due to calculation with octave data

Noise sensitive area: O Kahlola

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	2 353	2 359	22,20	106,5	0,00	78,45	-	-	0,00	0,00	-	0,00
2	2 886	2 892	19,61	106,5	0,00	80,22	-	-	0,00	0,00	-	0,00
3	3 380	3 384	17,58	106,5	0,00	81,59	-	-	0,00	0,00	-	0,00
4	3 787	3 791	16,09	106,5	0,00	82,57	-	-	0,00	0,00	-	0,00
5	4 366	4 370	14,22	106,5	0,00	83,81	-	-	0,00	0,00	-	0,00
6	4 872	4 875	12,94	106,5	0,00	84,76	-	-	0,00	0,00	-	0,00
7	5 406	5 409	11,72	106,5	0,00	85,66	-	-	0,00	0,00	-	0,00
Sum	26,19											

- Data undefined due to calculation with octave data

Noise sensitive area: P Kurula

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	1 389	1 399	28,50	106,5	0,00	73,91	-	-	0,00	0,00	-	0,00
2	1 592	1 601	26,92	106,5	0,00	75,09	-	-	0,00	0,00	-	0,00
3	1 965	1 972	24,41	106,5	0,00	76,90	-	-	0,00	0,00	-	0,00
4	2 517	2 523	21,35	106,5	0,00	79,04	-	-	0,00	0,00	-	0,00
5	3 004	3 009	19,10	106,5	0,00	80,57	-	-	0,00	0,00	-	0,00

To be continued on next page...

Project:

Kopsan tuulivoimapuisto

Description:

Puhuri Oy
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DECIBEL - Detailed results

Calculation: 7 x RD120 x HH143 (106,5 dB) **Noise calculation model:** ISO 9613-2 General 8,0 m/s

...continued from previous page

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
6	3 574	3 578	16,85	106,5	0,00	82,07	-	-	0,00	0,00	-	0,00
7	4 159	4 162	14,85	106,5	0,00	83,39	-	-	0,00	0,00	-	0,00
Sum		32,49										

- Data undefined due to calculation with octave data

Noise sensitive area: Q Patama

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	4 928	4 931	12,81	106,5	0,00	84,86	-	-	0,00	0,00	-	0,00
2	5 146	5 149	12,30	106,5	0,00	85,23	-	-	0,00	0,00	-	0,00
3	5 310	5 313	11,93	106,5	0,00	85,51	-	-	0,00	0,00	-	0,00
4	5 209	5 212	12,15	106,5	0,00	85,34	-	-	0,00	0,00	-	0,00
5	5 501	5 504	11,51	106,5	0,00	85,81	-	-	0,00	0,00	-	0,00
6	5 604	5 607	11,29	106,5	0,00	85,97	-	-	0,00	0,00	-	0,00
7	5 770	5 773	10,94	106,5	0,00	86,23	-	-	0,00	0,00	-	0,00
Sum		20,34										

- Data undefined due to calculation with octave data

Noise sensitive area: R Sikolampi

WTG		Wind speed: 8,0 m/s										
No.	Distance	Sound distance	Calculated	LwA,ref	Dc	Adiv	Aatm	Agr	Abar	Amisc	A	Cmet
	[m]	[m]	[dB(A)]	[dB(A)]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1	5 151	5 154	12,29	106,5	0,00	85,24	-	-	0,00	0,00	-	0,00
2	5 315	5 318	11,92	106,5	0,00	85,51	-	-	0,00	0,00	-	0,00
3	5 427	5 429	11,67	106,5	0,00	85,70	-	-	0,00	0,00	-	0,00
4	5 267	5 270	12,02	106,5	0,00	85,44	-	-	0,00	0,00	-	0,00
5	5 503	5 506	11,50	106,5	0,00	85,82	-	-	0,00	0,00	-	0,00
6	5 545	5 548	11,41	106,5	0,00	85,88	-	-	0,00	0,00	-	0,00
7	5 653	5 655	11,19	106,5	0,00	86,05	-	-	0,00	0,00	-	0,00
Sum		20,18										

- Data undefined due to calculation with octave data

Project:

Kopsan tuulivoimapuisto

Description:

Puhuri Oy
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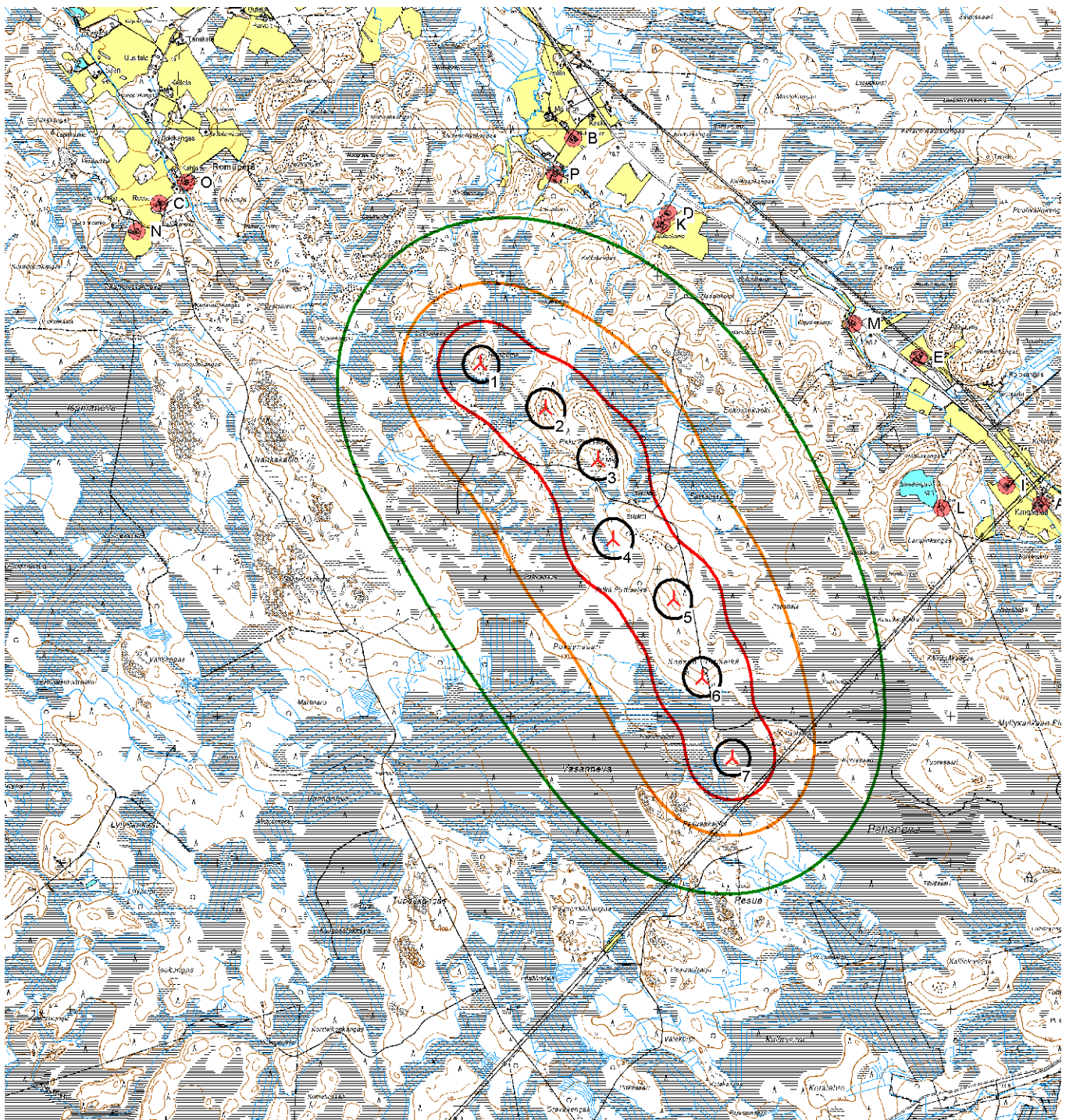
Calculated:

4.4.2012 15:18/2.7.487

FCG

DECIBEL - Map 8,0 m/s

Calculation: 7 x RD120 x HH143 (106,5 dB)



0 500 1000 1500 2000 m

Map: , Print scale 1:40 000, Map center KJ Finland Zone: 3 East: 3 391 310 North: 7 162 012

Noise calculation model: ISO 9613-2 General. Wind speed: 8,0 m/s

New WTG

Noise sensitive area

Height above sea level from active line object

35,0 dB(A)

40,0 dB(A)

45,0 dB(A)

50,0 dB(A)

Project:

Kopsan tuulivoimapuisto

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Calculated:

4.4.2012 14:42/2.7.487

FCG

SHADOW - Main Result

Calculation: 7 x RD120 x HH143

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) [LULEA]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0,60	2,61	4,18	6,47	8,80	10,60	9,50	6,88	4,22	2,77	1,22	0,17

Operational hours are calculated from WTGs in calculation and wind distribution:

Mittausmasto

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
465	402	481	577	613	816	900	1216	1211	842	631	514	8668

Idle start wind speed: Cut in wind speed from power curve

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: Kopsa korkeuskäyrä.wpo (5)

Area object(s) used in calculation:

Area object (ZVI): ZVI_REGIONS_Kopsa_1.w2r (43)

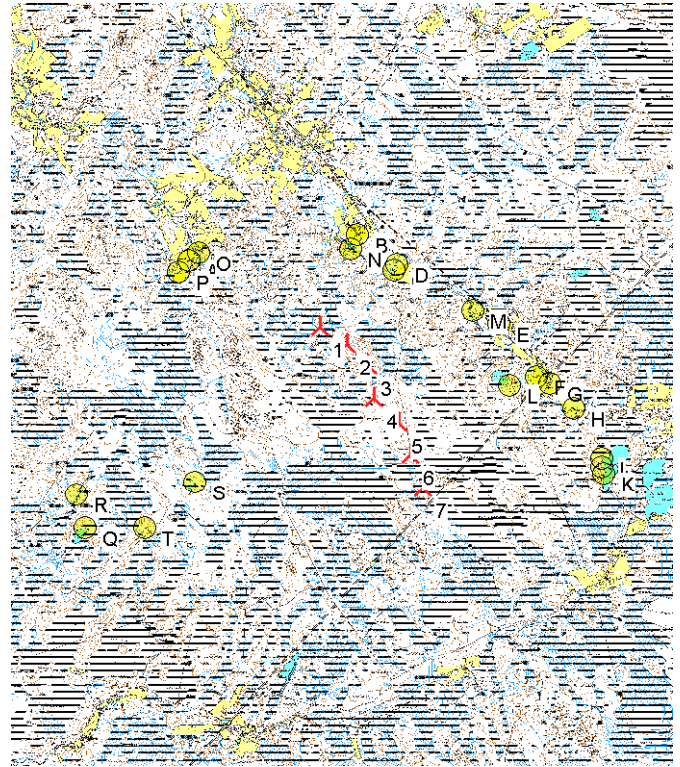
Kiinteistöt

Area object (ZVI): REGIONS_Kopsa_6.w2r (52)

Obstacles not used in calculation

Eye height: 1,5 m

Grid resolution: 10 m



New WTG

Scale 1:125 000

Shadow receptor

WTGs

KKJ Zone: 3				WTG type				Shadow data			
East	North	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Calculation distance [m]	RPM
KKJ Zone: 3			[m]								[RPM]
1	3 390 794	7 163 402	95,0 Generic RD120_IEC3A 30...	Yes	Generic	RD120_IEC3A-3 000	3 000	120,0	143,0	2 000	16,0
2	3 391 237	7 163 103	105,0 Generic RD120_IEC3A 30...	Yes	Generic	RD120_IEC3A-3 000	3 000	120,0	143,0	2 000	16,0
3	3 391 596	7 162 750	109,7 Generic RD120_IEC3A 30...	Yes	Generic	RD120_IEC3A-3 000	3 000	120,0	143,0	2 000	16,0
4	3 391 697	7 162 207	105,0 Generic RD120_IEC3A 30...	Yes	Generic	RD120_IEC3A-3 000	3 000	120,0	143,0	2 000	16,0
5	3 392 111	7 161 799	115,0 Generic RD120_IEC3A 30...	Yes	Generic	RD120_IEC3A-3 000	3 000	120,0	143,0	2 000	16,0
6	3 392 307	7 161 262	109,1 Generic RD120_IEC3A 30...	Yes	Generic	RD120_IEC3A-3 000	3 000	120,0	143,0	2 000	16,0
7	3 392 512	7 160 713	105,0 Generic RD120_IEC3A 30...	Yes	Generic	RD120_IEC3A-3 000	3 000	120,0	143,0	2 000	16,0

Shadow receptor-Input

KKJ Zone: 3										
No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
A	Asutus	3 388 617	7 164 491	72,7	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
B	Asutus	3 391 417	7 164 936	75,8	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
C	Asutus	3 392 028	7 164 342	78,7	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
D	Asutus	3 392 068	7 164 426	78,4	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
E	Asutus	3 393 770	7 163 443	87,5	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
F	Asutus	3 394 387	7 162 562	90,0	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
G	Asutus	3 394 612	7 162 443	91,4	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
H	Asutus	3 395 013	7 162 028	95,0	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
I	Loma-asunto	3 395 487	7 161 206	100,0	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
J	Loma-asunto	3 395 484	7 161 054	100,8	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
K	Loma-asunto	3 395 520	7 160 940	97,5	1,0	1,0	1,0	-180,0	0,0	"Green house mode"

To be continued on next page...

Project:

Kopsan tuulivoimapuisto

Description:

Puhuri Oy
Kopsan Tuulivoimapuisto

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 Calculated:
 4.4.2012 14:42/2.7.487



SHADOW - Main Result

Calculation: 7 x RD120 x HH143

...continued from previous page

KKJ Zone: 3

No.	Name	East	North	Z	Width	Height	Height a.g.l.	Degrees from south cw	Slope of window	Direction mode
				[m]	[m]	[m]	[m]	[°]	[°]	
L	Järvelä	3 393 941	7 162 422	101,8	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
M		3 393 340	7 163 673	85,0	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
N		3 391 306	7 164 693	75,9	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
O		3 388 790	7 164 633	70,6	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
P		3 388 453	7 164 305	75,8	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
Q		3 386 901	7 160 029	72,5	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
R		3 386 743	7 160 595	71,3	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
S	Loma-asunto	3 388 713	7 160 797	85,0	1,0	1,0	1,0	-180,0	0,0	"Green house mode"
T	Loma-asunto	3 387 892	7 160 033	83,2	1,0	1,0	1,0	-180,0	0,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, expected values

No.	Name	Shadow hours per year [h/year]
A	Asutus	0:00
B	Asutus	1:31
C	Asutus	3:11
D	Asutus	2:51
E	Asutus	0:00
F	Asutus	0:00
G	Asutus	0:00
H	Asutus	0:00
I	Loma-asunto	0:00
J	Loma-asunto	0:00
K	Loma-asunto	0:00
L	Järvelä	0:40
M		0:41
N		2:42
O		0:00
P		0:00
Q		0:00
R		0:00
S	Loma-asunto	0:00
T	Loma-asunto	0:00

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

No.	Name	Worst case [h/year]	Expected [h/year]
1	Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (760)	19:19	2:56
2	Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (761)	23:46	2:53
3	Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (762)	18:42	2:12
4	Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (763)	0:00	0:00
5	Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (764)	3:21	0:40
6	Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (765)	0:00	0:00
7	Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (766)	0:00	0:00

Project:

Kopsan tuulivoimapuisto

Description:

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Kopsan Tuulivoimapuisto

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Calculated:

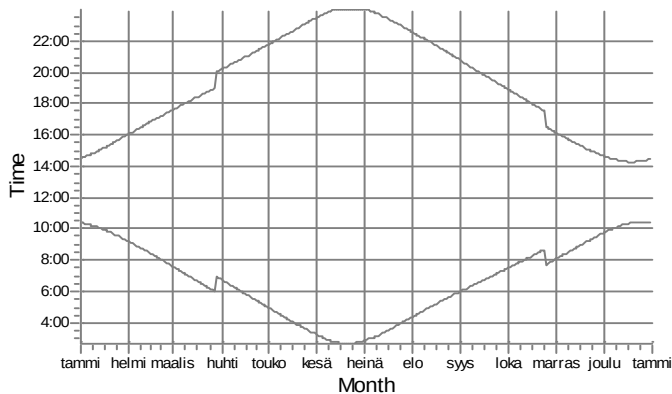
4.4.2012 14:42/2.7.487

FCG

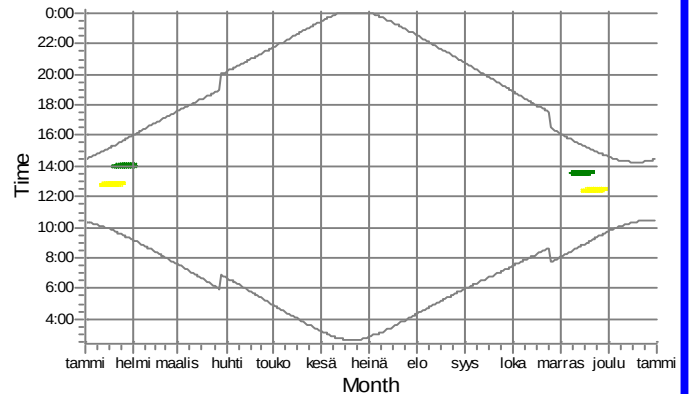
SHADOW - Calendar, graphical

Calculation: 7 x RD120 x HH143

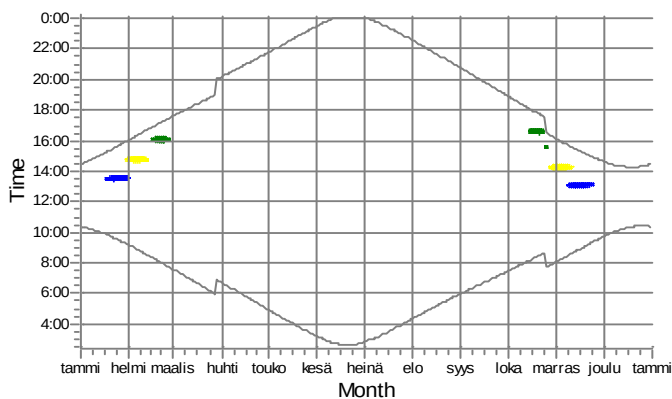
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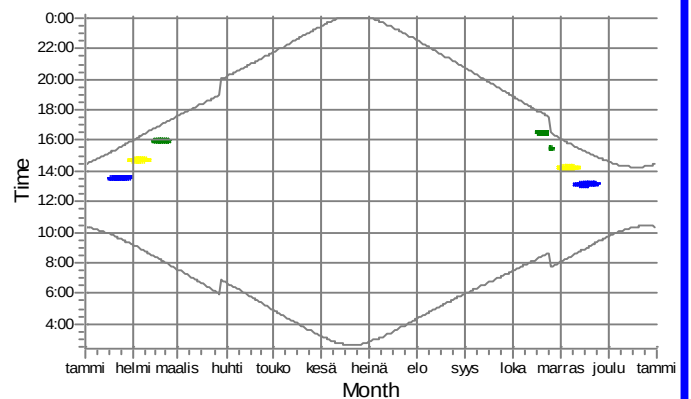
B: Asutus



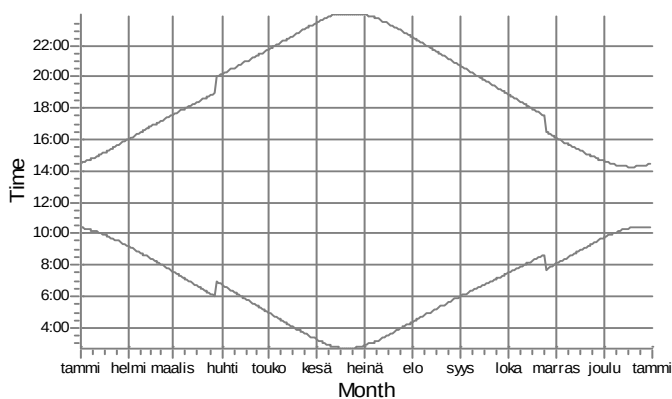
C: Asutus



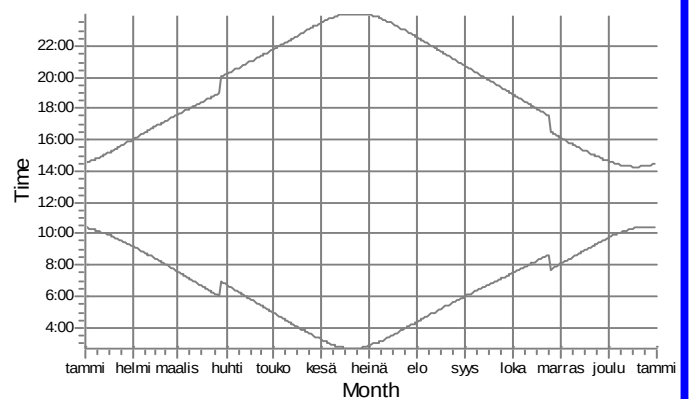
D: Asutus



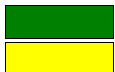
E: Asutus



F: Asutus



WTGs



1: Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (760)

2: Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (761)

3: Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (762)

Project:

Kopsan tuulivoimapuisto

Description:

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Kopsan Tuulivoimapuisto

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Calculated:

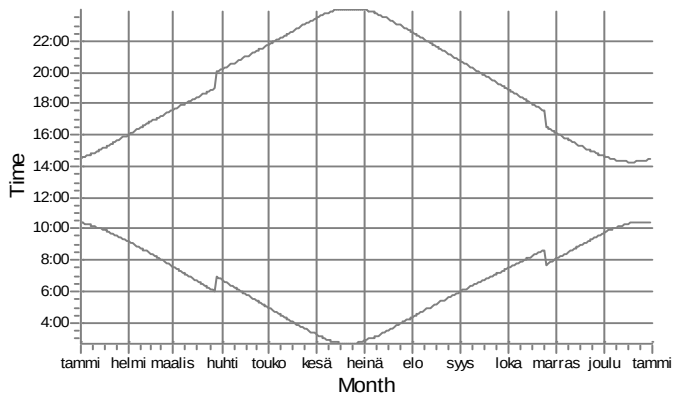
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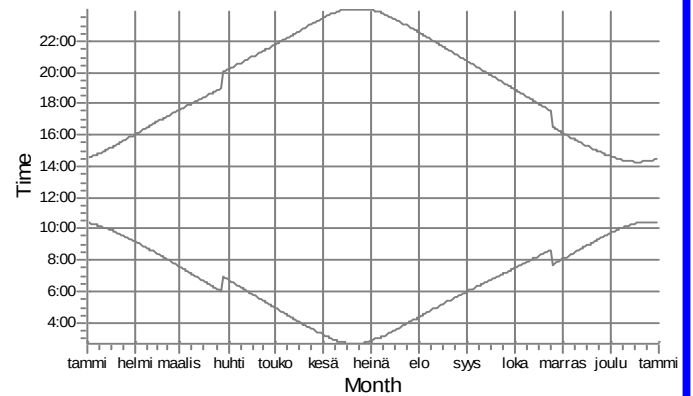
SHADOW - Calendar, graphical

Calculation: 7 x RD120 x HH143

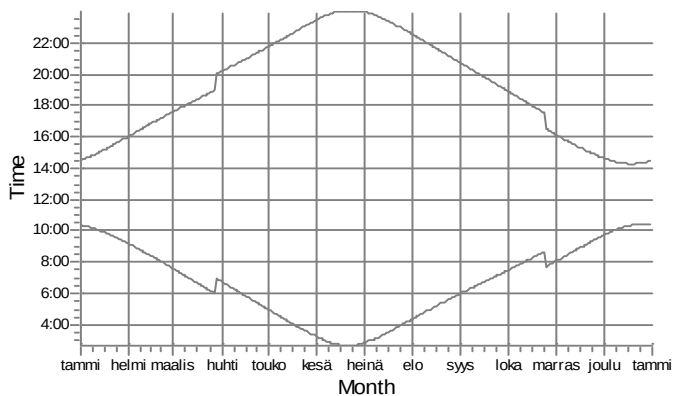
G: Asutus



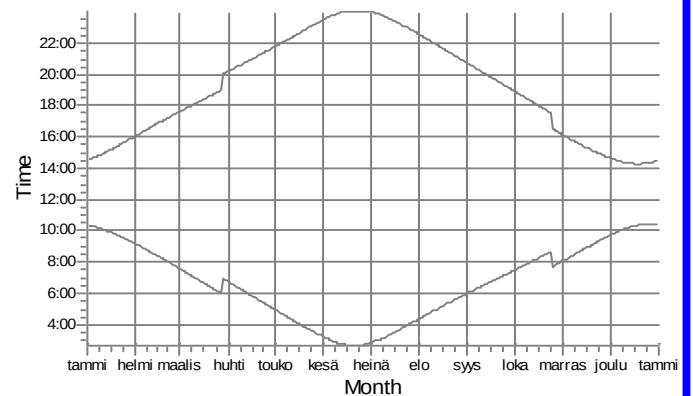
H: Asutus



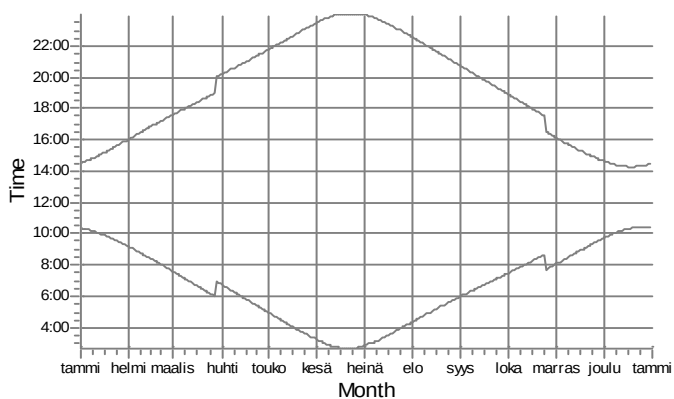
I: Loma-asunto



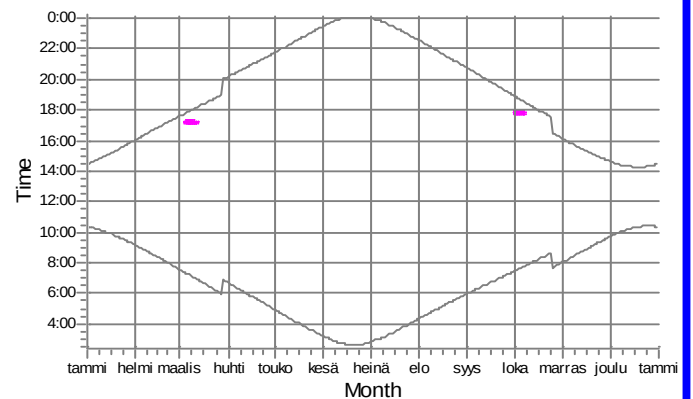
J: Loma-asunto



K: Loma-asunto



L: Järvelä



WTGs



5: Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (764)

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Calculated:

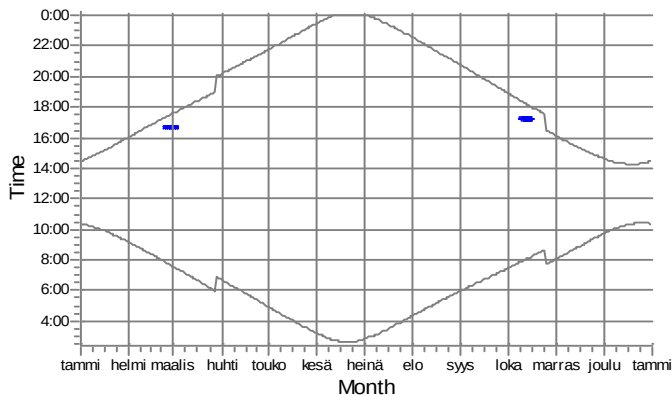
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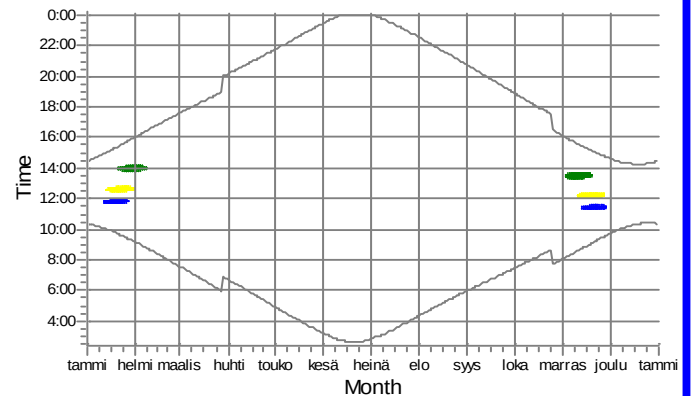
SHADOW - Calendar, graphical

Calculation: 7 x RD120 x HH143

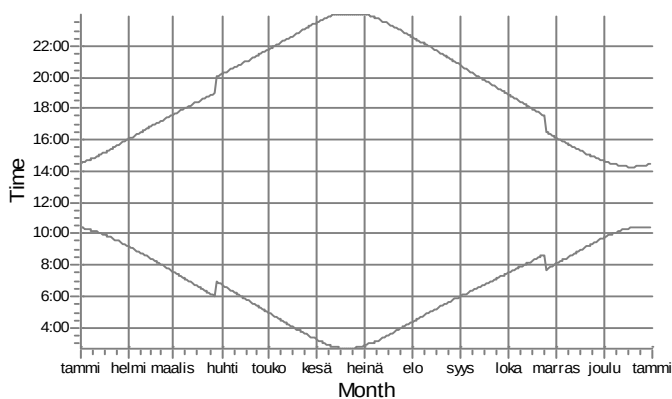
M: Shadow Receptor: 1,0 x 1,0 Azimuth: -180,0° Slope: 0,0° (13)



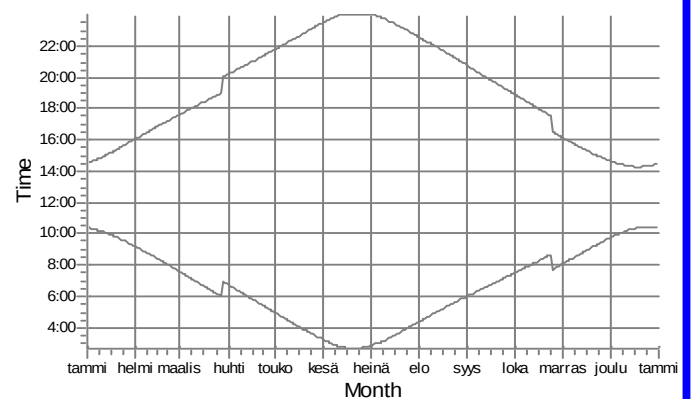
N: Shadow Receptor: 1,0 x 1,0 Azimuth: -180,0° Slope: 0,0° (14)



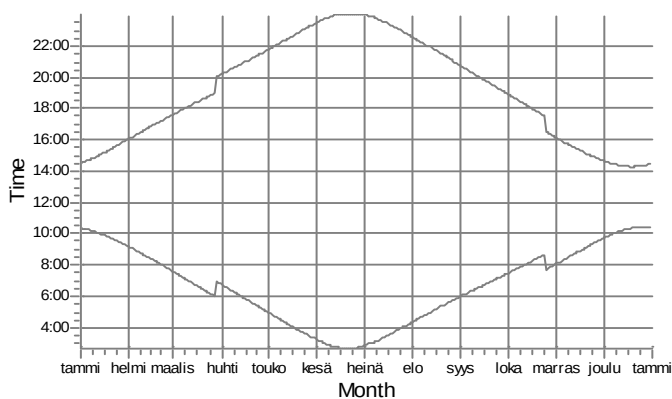
O: Shadow Receptor: 1,0 x 1,0 Azimuth: -180,0° Slope: 0,0° (15)



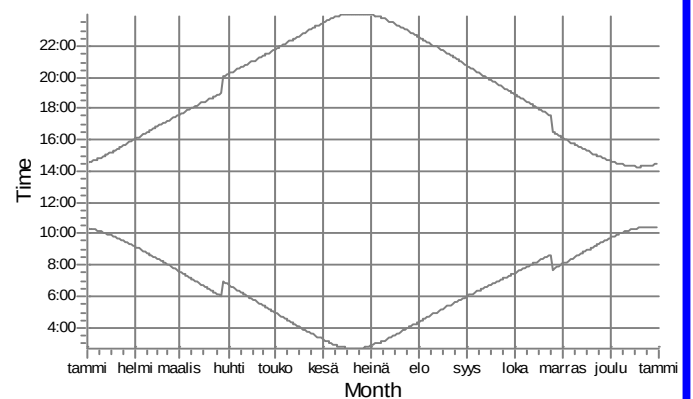
P: Shadow Receptor: 1,0 x 1,0 Azimuth: -180,0° Slope: 0,0° (16)



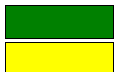
Q: Shadow Receptor: 1,0 x 1,0 Azimuth: -180,0° Slope: 0,0° (17)



R: Shadow Receptor: 1,0 x 1,0 Azimuth: -180,0° Slope: 0,0° (18)



WTGs



1: Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (760)

2: Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (761)



3: Generic RD120_IEC3A 3000 120.0 !O! hub: 143,0 m (762)

Project:

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Calculated:

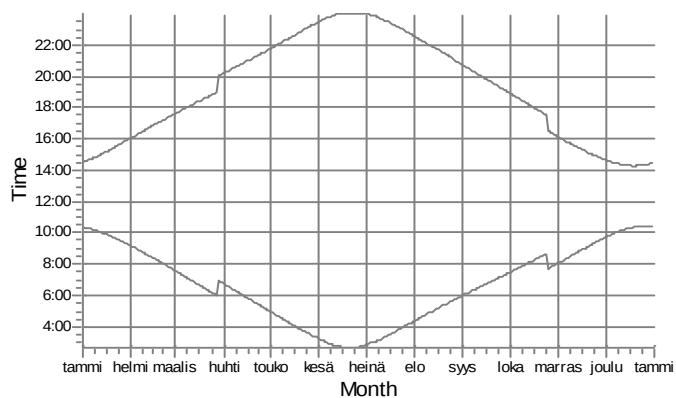
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FCG

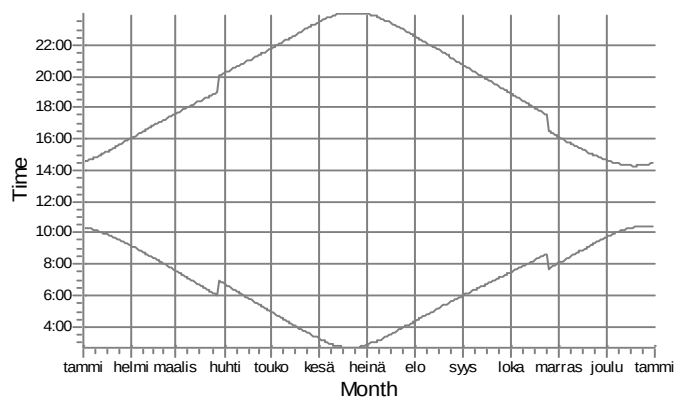
SHADOW - Calendar, graphical

Calculation: 7 x RD120 x HH143

S: Loma-asunto



T: Loma-asunto



WTGs

Project:

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Description:

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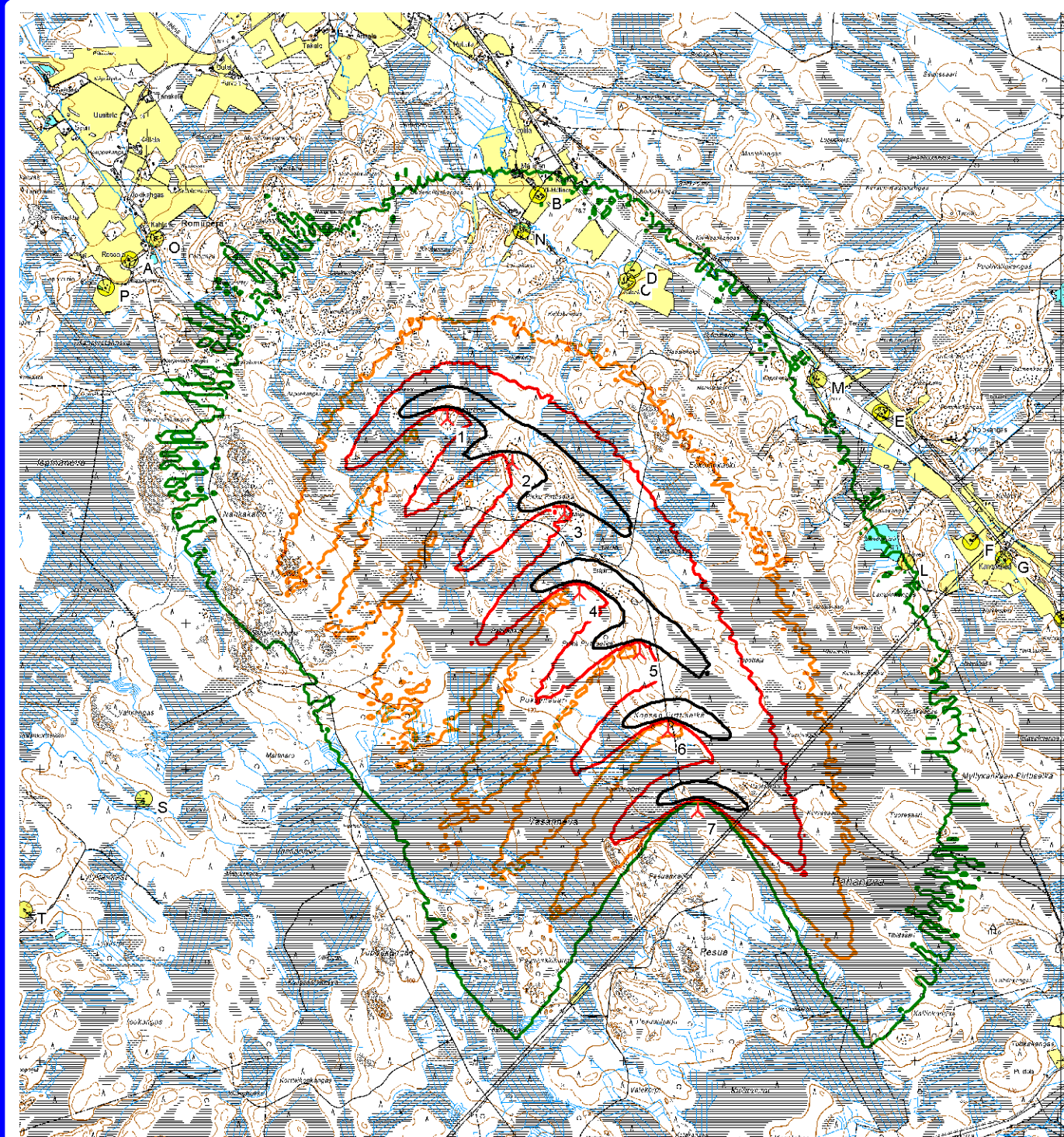
Calculated:

4.4.2012 14:42/2.7.487

FCG

SHADOW - Map

Calculation: 7 x RD120 x HH143



0 500 1000 1500 2000 m

Map: , Print scale 1:40 000, Map center KKJ Finland Zone: 3 East: 3 391 617 North: 7 162 305

New WTG

Shadow receptor

Isolines showing shadow in Hours per year, real case

1

8

20

50