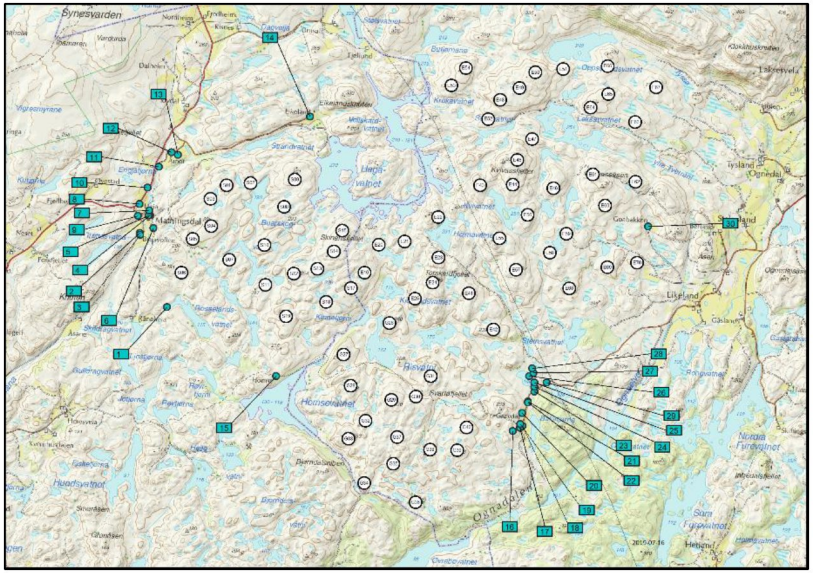
Calculation of noise immission from wind turbines
Case F01-F02 - Wind Farm Bjerkreim



Client Information
Client: Norsk Vind Energi AS
Reference: John Amund Lund

Project Information
Project: Wind Farm Bjerkreim
Project nr: 10-16075
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Calculation Conditions

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Wind farm	Turbine type	Number of turbines	Hub height [m]	Total height [m]	Noise emission [dBA]
Bjerkreim	Siemens SWT-DD-130	70	125	190	92,3-107,0

Calculation parameters	
Calculation program	SoundPLAN 7.4
Calculation standard	Nord2000
Search radius	20 000 m
Calculation height	1,5 m and 4,0 m
Air absorbtion	ISO 9613-1
Air pressure	1013,25 mbar
Relative humidity	70%
Temperature	15 °C
Temperature gradient	0,05 °C/m
Roughness length	0,3 m
Anemomenter height	10 m
Wind speed	Varies
Standard deviation wind speed	0,5 m/s
Wind direction	Downwind and wind statistics
Turbulence strength parameter wind	0,12 m4/3/s2
Turbulence strength parameter temperature	0,008 K/s2
Effective flow resistivity forrest/other	Impedance class D
Effective flow resistivity mountain	Impedance class E
Effective flow resistivity water	Impedance class H
Coordinate system	UTM WGS84 Zone: 32
Height data	1 m height contours

Calculation parameters	
Case F01:	Downwind for all wind directions for 8 m/s at 10 m height, turbines in production 290 days a year. (Note that 365 days running time is 1 dB higher).
Case F02:	Downwind for all wind directions for measured wind speed between 3-7 m/s at hub height. For wind speeds 8-31 m/s measured wind speed and wind direction in 30 ^{o} sectors is used according to page 6. This represents the most accurate yearly average of L_{den}.

As the weather conditions varies during a normal year, weather parameters according to standard noice calculationsmethods are used, which are also identical to the values given in the ISA-Standard (International Standard Atmosphere) for air pressure and temperature. The applied relative humudity 70% and temperature 15°C is also recommended in the new Finish guidelines for calculation of wind turbine noise with Nord2000 as well as in the danish regulations on industrial noise. In the nordic calculation method for external industrial noise report DAL-32, which is usually used in Sweden for industrial noise calculations, the relative humidity 70% and temereature 15°C is used for planning purposes.

It shall be noted that the calculations are performed for a positive temperature gradient which is comparable to moderate inversion. The used value 0,05 °C/m is also the highest approved value according to the measurement method for noise immission from wind turbines Elforsk 98:24 as recommended for measuements bin Veileder til retningslinje for behandling av støy i arealplanlegging (T-1442/2012). The noise level at a positive temperature gradient in usually higher compared to a negative temperature gradient.

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Noise Data

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Turbine type	Noise setting	Wind speed at hh [m/s]	Noise emission [dBA]	20Hz	25Hz	31Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz
Siemens SWT-DD-130	Mode 1	3-4	92,3	45,6	49,7	54,9	58,4	64,9	63,6	67,5	72,1	74,3	74,9
				200Hz	**250Hz**	**315Hz**	**400Hz**	**500Hz**	**630Hz**	**800Hz**	**1kHz**	**1.25kHz**	**1.6kHz**
				76,6	76,6	76,6	79,1	79,1	79,1	81,6	81,6	81,6	82,6
				2kHz	**2.5kHz**	**3.15kHz**	**4kHz**	**5kHz**	**6.3kHz**	**8.0kHz**	**10 kHz**		
				82,6	82,6	79,0	79,0	79,0	66,1	66,1	66,1		

Turbine type	Noise setting	Wind speed at hh [m/s]	Noise emission [dBA]	20Hz	25Hz	31Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz
Siemens SWT-DD-130	Mode 1	5	95,3	48,6	52,7	57,9	61,4	67,9	66,6	70,5	75,1	77,3	77,9
				200Hz	**250Hz**	**315Hz**	**400Hz**	**500Hz**	**630Hz**	**800Hz**	**1kHz**	**1.25kHz**	**1.6kHz**
				79,6	79,6	79,6	82,1	82,1	82,1	84,6	84,6	84,6	85,6
				2kHz	**2.5kHz**	**3.15kHz**	**4kHz**	**5kHz**	**6.3kHz**	**8.0kHz**	**10 kHz**		
				85,6	85,6	82,0	82,0	82,0	69,1	69,1	69,1		

Turbine type	Noise setting	Wind speed at hh [m/s]	Noise emission [dBA]	20Hz	25Hz	31Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz
Siemens SWT-DD-130	Mode 1	6	98,3	51,6	55,7	60,9	64,4	70,9	69,6	73,5	78,1	80,3	80,9
				200Hz	**250Hz**	**315Hz**	**400Hz**	**500Hz**	**630Hz**	**800Hz**	**1kHz**	**1.25kHz**	**1.6kHz**
				82,6	82,6	82,6	85,1	85,1	85,1	87,6	87,6	87,6	88,6
				2kHz	**2.5kHz**	**3.15kHz**	**4kHz**	**5kHz**	**6.3kHz**	**8.0kHz**	**10 kHz**		
				88,6	88,6	85,0	85,0	85,0	72,1	72,1	72,1		

Turbine type	Noise setting	Wind speed at hh [m/s]	Noise emission [dBA]	20Hz	25Hz	31Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz
Siemens SWT-DD-130	Mode 1	7	102,3	55,6	59,7	64,9	68,4	74,9	73,6	77,5	82,1	84,3	84,9
				200Hz	**250Hz**	**315Hz**	**400Hz**	**500Hz**	**630Hz**	**800Hz**	**1kHz**	**1.25kHz**	**1.6kHz**
				86,6	86,6	86,6	89,1	89,1	89,1	91,6	91,6	91,6	92,6
				2kHz	**2.5kHz**	**3.15kHz**	**4kHz**	**5kHz**	**6.3kHz**	**8.0kHz**	**10 kHz**		
				92,6	92,6	89,0	89,0	89,0	76,1	76,1	76,1		

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Noise Data

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Turbine type	Noise setting	Wind speed at hh [m/s]	Noise emission [dBA]	20Hz	25Hz	31Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz
Siemens SWT-DD-130	Mode 1	8	105,6	58,9	63,0	68,2	71,7	78,2	76,9	80,8	85,4	87,6	88,2
				200Hz	**250Hz**	**315Hz**	**400Hz**	**500Hz**	**630Hz**	**800Hz**	**1kHz**	**1.25kHz**	**1.6kHz**
				89,9	89,9	89,9	92,4	92,4	92,4	94,9	94,9	94,9	95,9
				2kHz	**2.5kHz**	**3.15kHz**	**4kHz**	**5kHz**	**6.3kHz**	**8.0kHz**	**10 kHz**		
				95,9	95,9	92,3	92,3	92,3	79,4	79,4	79,4		

Turbine type	Noise setting	Wind speed at hh [m/s]	Noise emission [dBA]	20Hz	25Hz	31Hz	40Hz	50Hz	63Hz	80Hz	100Hz	125Hz	160Hz
Siemens SWT-DD-130	Mode 1	≥9	107,0	60,3	64,4	69,6	73,1	79,6	78,3	82,2	86,8	89,0	89,6
				200Hz	**250Hz**	**315Hz**	**400Hz**	**500Hz**	**630Hz**	**800Hz**	**1kHz**	**1.25kHz**	**1.6kHz**
				91,3	91,3	91,3	93,8	93,8	93,8	96,3	96,3	96,3	97,3
				2kHz	**2.5kHz**	**3.15kHz**	**4kHz**	**5kHz**	**6.3kHz**	**8.0kHz**	**10 kHz**		
				97,3	97,3	93,7	93,7	93,7	80,8	80,8	80,8		

Reference noise data: Frequency spectrum for wind speed 6 m/s and 8 m/s at hub height in octave bands between 63 Hz and 8 kHz and in 1/3-octave bands between 20 Hz and 160 Hz has been taken from the turbine manufacturer document WP ON PLM&EN EN GS-40-0000-001AA12-00 dated 2017-04-26 supplied by the client. The noise emission is given for wind speeds from 3 m/s upp to cut in wind speed. The octave band spectrum for 6 m/s and 8 m/s has been scaled linearly to a 1/3-octave band spectrum between 50 Hz to 10 kHz, for frequencies between 20-160 Hz the given values are used resulting in av 1/3-octave band spectrum with frequencies between 20 Hz to 10 kHz. For wind speeds 3-5 m/s the 1/3-octave band spectrum for 6 m/s is scaled linearly to the coresponding noise emission and in the same way the frequency spectrum for 8 m/s is used for the wind speeds 7 m/s and ≥9 m/s. No uncertainty is given by the document.

The calculations are valid for the used noise emission and frequency spectrum. Akustikkonsulten gives no warranty on the actual noise emission level.

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Wind Data

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Wind speed at hh [m/s]	Annual [Jan-Dec] [%]	Annual 0° [%]	Annual 30° [%]	Annual 60° [%]	Annual 90° [%]	Annual 120° [%]
0-2	7,76	0,60	0,52	0,48	0,62	0,84
3-4	15,58	1,51	1,01	0,65	1,25	1,92
5	9,56	1,26	0,55	0,33	0,97	1,47
6	9,67	1,40	0,37	0,29	1,06	1,66
7	9,62	1,25	0,22	0,17	1,14	1,79
8	9,43	1,15	0,14	0,10	1,16	1,95
9-31	38,37	2,83	0,11	0,08	4,95	11,51

Wind speed at hh [m/s]	Annual 150° [%]	Annual 180° [%]	Annual 210° [%]	Annual 240° [%]	Annual 270° [%]	Annual 300° [%]
0-2	0,81	0,63	0,60	0,74	0,71	0,62
3-4	1,53	1,40	1,03	1,37	1,27	1,14
5	0,87	0,80	0,44	0,50	0,60	0,65
6	0,93	0,74	0,46	0,40	0,49	0,62
7	1,04	0,71	0,49	0,38	0,44	0,60
8	1,05	0,73	0,49	0,38	0,36	0,53
9-31	4,02	3,69	1,91	1,02	1,19	2,01

Wind speed at hh [m/s]	Annual 330° [%]
0-2	0,55
3-4	1,53
5	1,12
6	1,25
7	1,40
8	1,40
9-31	5,01

Reference wind data: The wind speed distribution is from document L2C118857_Skinansfjellet_FDs.xcls supplied by the the client.

The calculations are valid for the used wind speed distribution. Akustikkonsulten gives no warranty that the real wind speeds are the same.

Wind distribution used in calcualtion

F02: Both wind speed and wind direction distribution is used for wind speed 8 m/s and 9-31 m/s. For lower wind speeds downwind for all wind directions is used. The influence of wind direction distribution compared to the normal downwind conditions for lower wind speeds is marginal as the sound power is low. This case represents the most accurate yearly average of L_{den}.

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Turbine Data

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Wind Farm Bjerkreim							
WTG	**X [m]**	**Y [m]**	**Hub height [m]**	**Hub height level [mas]**	**Ground level [mas]**	**Noise emission [dBA]**	**Noise setting**
E16	319300	6497649	125	374	249	92,3-107,0	Mode 1
E20	319520	6498087	125	340	215	92,3-107,0	Mode 1
E21	319928	6498138	125	370	245	92,3-107,0	Mode 1
E22	320454	6498524	125	393	268	92,3-107,0	Mode 1
E23	320460	6497883	125	405	280	92,3-107,0	Mode 1
E24	320369	6497490	125	430	305	92,3-107,0	Mode 1
E25	320087	6497238	125	376	251	92,3-107,0	Mode 1
E41	320935	6497321	125	398	273	92,3-107,0	Mode 1
E42	321319	6496749	125	355	230	92,3-107,0	Mode 1
E43	321111	6499025	125	425	300	92,3-107,0	Mode 1
E44	321623	6499035	125	434	309	92,3-107,0	Mode 1
E45	321695	6499425	125	464	339	92,3-107,0	Mode 1
E46	322264	6498980	125	425	300	92,3-107,0	Mode 1
E47	321932	6499756	125	414	289	92,3-107,0	Mode 1
E48	321430	6500372	125	460	335	92,3-107,0	Mode 1
E49	321731	6500564	125	475	350	92,3-107,0	Mode 1
E50	321982	6500810	125	470	345	92,3-107,0	Mode 1
E51	322417	6500859	125	410	285	92,3-107,0	Mode 1
E52	321242	6500072	125	400	275	92,3-107,0	Mode 1
E53	320664	6500602	125	410	285	92,3-107,0	Mode 1
E54	320891	6500877	125	437	312	92,3-107,0	Mode 1
E55	321415	6498191	125	415	290	92,3-107,0	Mode 1
E56	321856	6498558	125	412	287	92,3-107,0	Mode 1
E57	321675	6497692	125	385	260	92,3-107,0	Mode 1
E58	322209	6497960	125	375	250	92,3-107,0	Mode 1
E59	322466	6498259	125	368	243	92,3-107,0	Mode 1
E60	323076	6498707	125	405	280	92,3-107,0	Mode 1
E61	322885	6499198	125	420	295	92,3-107,0	Mode 1
E62	323554	6499080	125	405	280	92,3-107,0	Mode 1

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Turbine Data

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Wind Farm Bjerkreim							
WTG	**X [m]**	**Y [m]**	**Hub height [m]**	**Hub height level [mas]**	**Ground level [mas]**	**Noise emission [dBA]**	**Noise setting**
E63	323546	6500023	125	415	290	92,3-107,0	Mode 1
E64	322845	6500252	125	445	320	92,3-107,0	Mode 1
E65	323126	6500466	125	434	309	92,3-107,0	Mode 1
E66	323118	6500908	125	415	290	92,3-107,0	Mode 1
E67	323878	6500572	125	400	275	92,3-107,0	Mode 1
E68	322512	6497401	125	345	220	92,3-107,0	Mode 1
E69	323113	6497733	125	346	221	92,3-107,0	Mode 1
E70	323576	6497804	125	325	200	92,3-107,0	Mode 1
G26	319688	6496853	125	360	235	92,3-107,0	Mode 1
G27	318969	6496352	125	351	226	92,3-107,0	Mode 1
G28	319082	6495863	125	355	230	92,3-107,0	Mode 1
G29	319719	6495640	125	408	283	92,3-107,0	Mode 1
G30	320104	6495691	125	371	246	92,3-107,0	Mode 1
G31	320335	6496015	125	381	256	92,3-107,0	Mode 1
G32	319315	6495310	125	371	246	92,3-107,0	Mode 1
G33	319046	6495025	125	375	250	92,3-107,0	Mode 1
G34	319291	6494325	125	343	218	92,3-107,0	Mode 1
G35	319752	6494629	125	379	254	92,3-107,0	Mode 1
G36	320098	6494023	125	330	205	92,3-107,0	Mode 1
G37	319810	6495052	125	386	261	92,3-107,0	Mode 1
G38	320327	6494855	125	355	230	92,3-107,0	Mode 1
G39	320753	6494843	125	353	228	92,3-107,0	Mode 1
G40	320902	6495205	125	350	225	92,3-107,0	Mode 1
S01	317136	6499026	125	350	225	92,3-107,0	Mode 1
S02	317511	6499063	125	340	215	92,3-107,0	Mode 1
S03	316881	6498811	125	343	218	92,3-107,0	Mode 1
S04	316892	6498383	125	345	220	92,3-107,0	Mode 1
S05	316602	6498180	125	321	196	92,3-107,0	Mode 1
S06	316423	6497647	125	307	182	92,3-107,0	Mode 1

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Turbine Data

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Wind Farm Bjerkreim							
WTG	**X [m]**	**Y [m]**	**Hub height [m]**	**Hub height level [mas]**	**Ground level [mas]**	**Noise emission [dBA]**	**Noise setting**
S07	317173	6497851	125	325	200	92,3-107,0	Mode 1
S08	318037	6498686	125	360	235	92,3-107,0	Mode 1
S09	318202	6499115	125	375	250	92,3-107,0	Mode 1
S10	317728	6498082	125	340	215	92,3-107,0	Mode 1
S11	317743	6497453	125	325	200	92,3-107,0	Mode 1
S12	318186	6497632	125	368	243	92,3-107,0	Mode 1
S13	318559	6497709	125	372	247	92,3-107,0	Mode 1
S14	318819	6497983	125	399	274	92,3-107,0	Mode 1
S15	318947	6498311	125	386	261	92,3-107,0	Mode 1
S17	319085	6497404	125	375	250	92,3-107,0	Mode 1
S18	318695	6497186	125	360	235	92,3-107,0	Mode 1
S19	318068	6496960	125	352	227	92,3-107,0	Mode 1

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Calculation uncertainty

The use of the prediction model Nord2000 on wind turbine noise has been evaluated and validated by a Danish research project [”PSO-07 F & U project no 7389. Noise and energy optimization of wind farms. Validation of the Nord2000 propagation model for use on wind turbine noise.”, Delta, rapport AV 1236/09 Hörsholm, Danmark 2009]. In general, the conclusion is that the calculation results of Nord2000 show good agreement with sound measurements, for simple plain terrain with simple meteorological parameters as well as for complex hilly terrain with complex meteorological conditions. In comparison with ISO 9613-2, Nord2000 is an improvement, especially for the more complex situations.

The validation measurements for downwind sound propagation from a loudspeaker over a plain field of grass shows great agreement with the Nord2000 predictions, even up to a distance of 1500 m. The average difference (predicted value minus measured value) in A-weighted sound level is -0.1 dB with a standard deviation of 0.7 dB, which must be considered very good. Also the agreement between measured and predicted frequency spectra is good. If a confidence interval is to be determined, the standard uncertainty shall be multiplied with a covering factor. Thus, a 90 % confidence interval means that if the experiment is repeated many times, 90% of the results will be within the interval. The covering factor is 1 for a 68.3% confidence interval and it is 2 (or rather 1.96) for a 95% confidence interval. For a 90% confidence interval the standard deviation shall be multiplied with 1.645. Hence, for a 90% confidence interval the sound level predicted by Nord2000 is within an interval of (-0.9, +1.1 dB) from the measured sound level. This, regarding the uncertainty of the sound propagation over a plain grass field at a distance of up to 1500 m with simple meteorological conditions.

The Danish research project also examined the sound propagation over a complex Norwegian mountain terrain, with complex meteorological conditions. The sound propagation measurements using a loudspeaker, which was placed on the turbine housing, showed that the sound levels predicted by Nord2000 was in average 0.5 dB lower than the measured sound levels with a standard deviation of 1.8 dB. Thus, with a 90% confidence interval a sound level predicted by Nord2000 is within an interval of (-3, +2 dB) from the measured sound level. This, regarding the uncertainty of the sound propagation over complex Norwegian mountain terrain at a distance of up to 1000 m with complex meteorological conditions.

Measurements and Nord2000-calculations involving 70 wind turbines (as sound sources) were performed for a wind farm located in complex mountain terrain with complex meteorological conditions. Using the wind turbine noise emission measurement standard IES 61400-11, the sound power levels were determined for two of the wind turbines. These sound power levels were then used in Nord2000 to predict the sound levels. Sound measurements, involving all 70 wind turbines, showed that the sound levels predicted by Nord2000 were in average 1.0 dB lower, with a standard deviation of 2.3 dB. With a 90% confidence interval, this corresponds to a calculated sound level in the interval of (-5, +3 dB) of the measured sound level. This, regarding the uncertainty of the sound propagation over complex Norwegian mountain terrain at a distance of up to 4000 m with complex meteorological conditions. The confidence interval also contains the uncertainty of the sound power measurement.

Based on the above information it is belived that the uncertainty for the performed calcualtions is within the intervall of (-5, +3 dB) were the uncertainty increases with the distance from the wind farm.

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Ground Absorption Map

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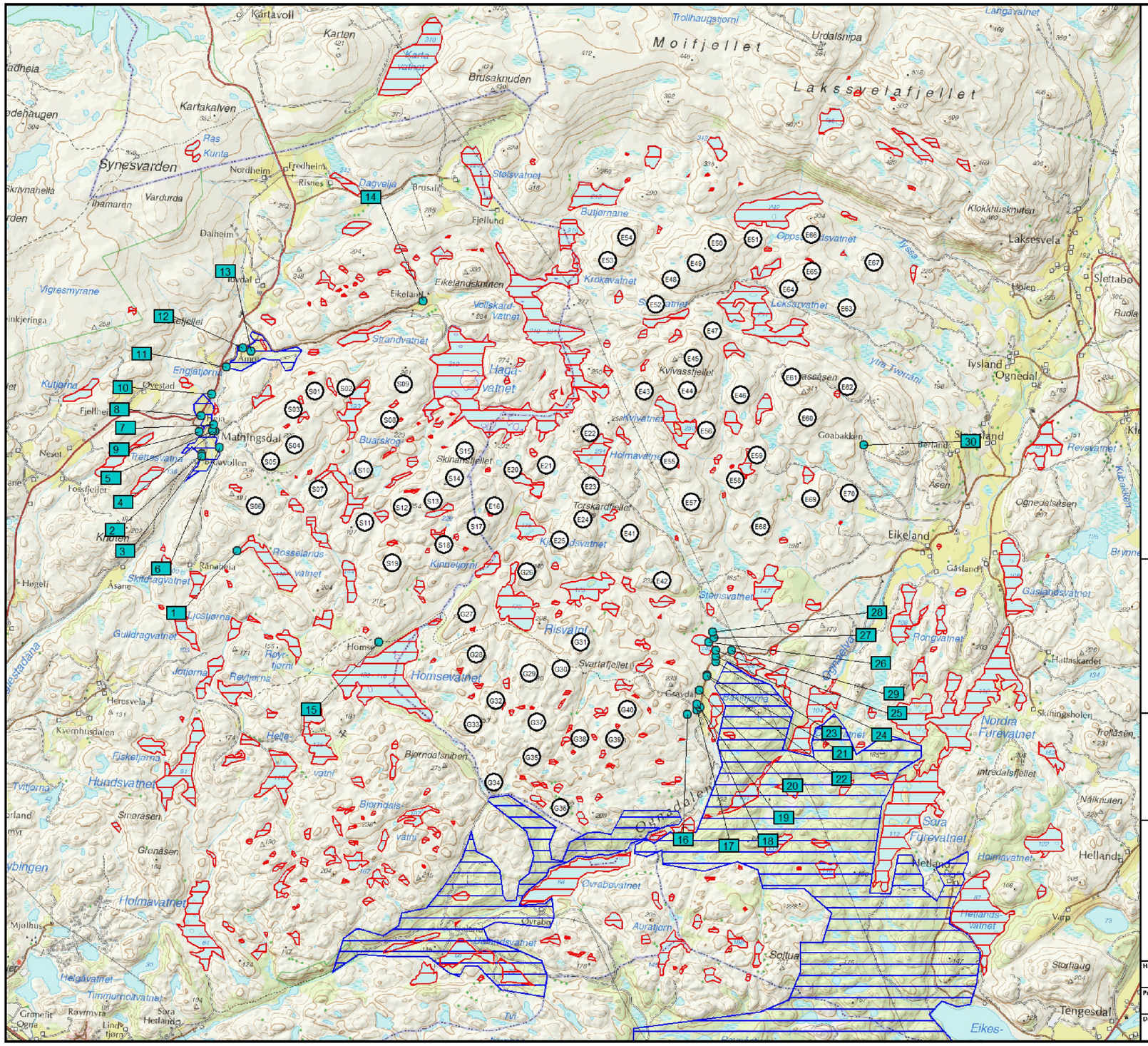

NSA
WTG
NSA Index NSA
Impedance class H 1)
Impedance class D 2)

1) Impedance class H -
Very hard and dense surface (dense asphalt, concrete, water)
2) Impedance class D -
Normal uncompacted ground (forest floors, pasture fields)
3) All other areas Impedance class E -
Compact field and gravel (compacted lawns, park area)

N

0 1000 2000 3000 m

Wind farm Bjerkreim, Norway
70 Wind Turbines (WTG) - Siemens SWT-DD-130
Nord2000 impedance classes in Nord2000

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Beräknad med SoundPLAN 7.4 uppdatering 2018-05-15 www.akustikkonsulten.se

Handläggare	Kvalitetsgranskare
Paul Appelqvist	Jens Fredriksson
Projekt nr. 10-16075	Ritning
Datum 2019-07-16	

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Ground model

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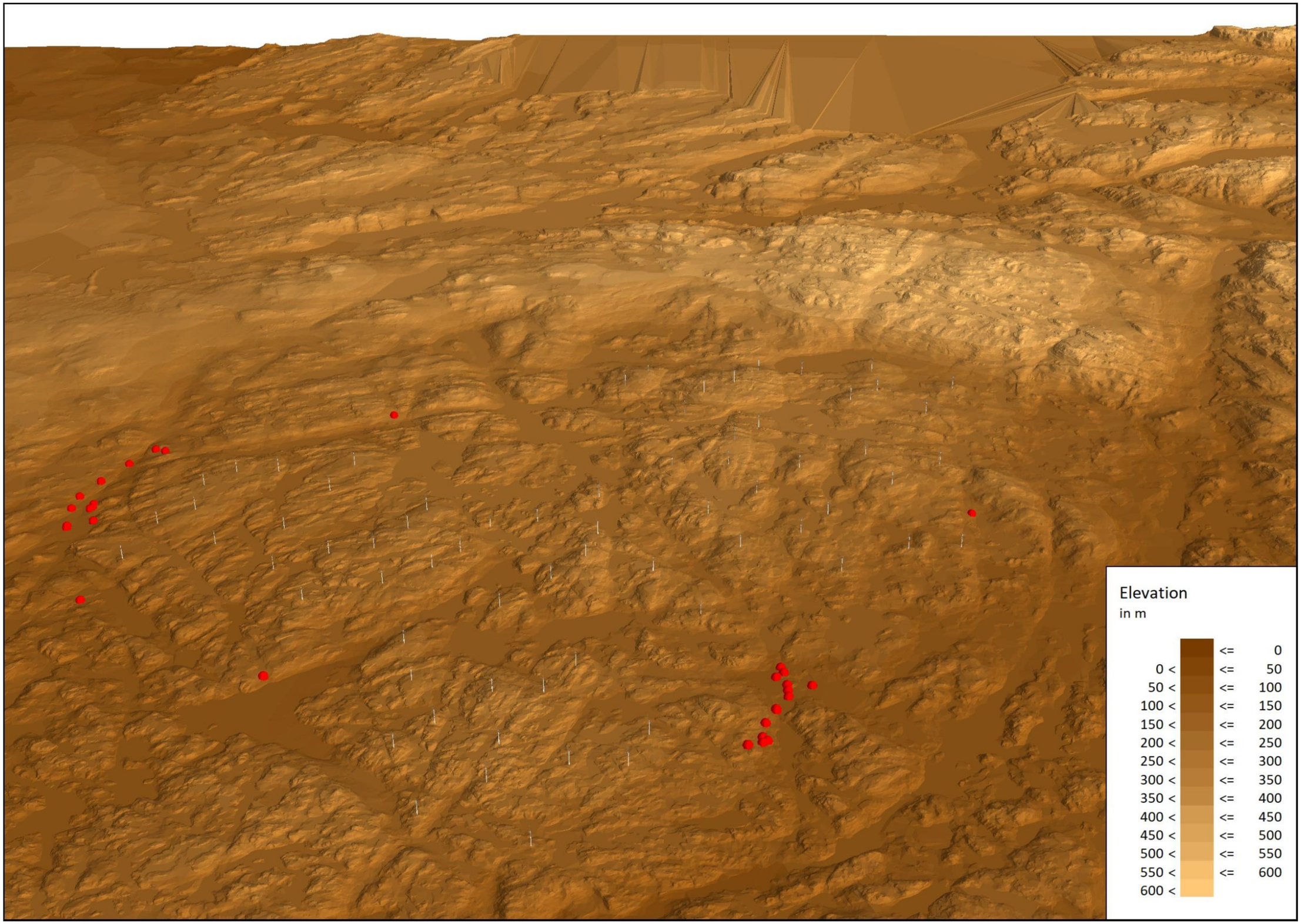

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Point Calculations

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Date of calculation:	2019-07-16					L_{den} [dBA]	
NSA	**X [m]**	**Y [m]**	**Z,ground [mas]**	**Calculation height [m]**	**Wind shielded [Yes/No]**	**Case F01**	**Case F02**
1	316198	6497107	115	1,5	-	46	44
1	316198	6497107	115	4,0	-	48	45
2	315770	6498275	111	1,5	-	46	43
2	315770	6498275	111	4,0	-	46	44
3	315776	6498243	110	1,5	-	46	43
3	315776	6498243	110	4,0	-	46	44
4	315930	6498552	126	1,5	-	43	40
4	315930	6498552	126	4,0	-	44	42
5	315906	6498549	121	1,5	-	45	42
5	315906	6498549	121	4,0	-	46	43
6	315983	6498351	115	1,5	-	47	44
6	315983	6498351	115	4,0	-	47	44
7	315918	6498628	119	1,5	-	38	34
7	315918	6498628	119	4,0	-	40	36
8	315766	6498732	136	1,5	-	46	44
8	315766	6498732	136	4,0	-	46	44
9	315740	6498544	124	1,5	-	46	43
9	315740	6498544	124	4,0	-	46	43
10	315892	6498993	141	1,5	-	46	44
10	315892	6498993	141	4,0	-	47	45
11	316071	6499319	135	1,5	-	46	43
11	316071	6499319	135	4,0	-	46	43
12	316268	6499548	159	1,5	-	45	42
12	316268	6499548	159	4,0	-	45	43
13	316366	6499509	165	1,5	-	45	42
13	316366	6499509	165	4,0	-	45	43
14	318441	6500111	219	1,5	-	46	44
14	318441	6500111	219	4,0	-	46	44
15	317910	6496012	153	1,5	-	47	44
15	317910	6496012	153	4,0	-	47	45

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Point Calculations

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Date of calculation:	2019-07-16					L_{den} [dBA]	
NSA	**X [m]**	**Y [m]**	**Z,ground [mas]**	**Calculation height [m]**	**Wind shielded [Yes/No]**	**Case F01**	**Case F02**
16	321627	6495146	170	1,5	-	47	45
16	321627	6495146	170	4,0	-	47	45
17	321739	6495198	148	1,5	-	45	41
17	321739	6495198	148	4,0	-	45	42
18	321777	6495227	143	1,5	-	45	41
18	321777	6495227	143	4,0	-	45	41
19	321743	6495262	148	1,5	-	45	40
19	321743	6495262	148	4,0	-	45	41
20	321773	6495433	146	1,5	-	44	39
20	321773	6495433	146	4,0	-	44	39
21	321863	6495617	137	1,5	-	45	41
21	321863	6495617	137	4,0	-	45	41
22	321864	6495601	137	1,5	-	45	41
22	321864	6495601	137	4,0	-	45	41
23	321967	6495773	136	1,5	-	45	42
23	321967	6495773	136	4,0	-	46	43
24	321967	6495846	140	1,5	-	46	43
24	321967	6495846	140	4,0	-	46	43
25	321966	6495913	141	1,5	-	46	43
25	321966	6495913	141	4,0	-	46	43
26	321886	6496014	140	1,5	-	46	44
26	321886	6496014	140	4,0	-	47	44
27	321949	6496067	145	1,5	-	46	43
27	321949	6496067	145	4,0	-	46	44
28	321929	6496136	142	1,5	-	46	44
28	321929	6496136	142	4,0	-	47	44
29	322158	6495911	135	1,5	-	45	42
29	322158	6495911	135	4,0	-	45	43
30	323751	6498377	173	1,5		49	46
30	323751	6498377	173	4,0		49	46

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Point Calculations

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The calculations are performed with the assumption that the noise sensitive point are 1,5 m and 4,0 m above ground. The height of 4,0 m should be considered decisive according to the wind farm permit. Although it shall be noted that sound immission measurements according to the measurement standard Elforsk 98:24, recomended in chapter 9.8.4 in Veileder til retningslinje for behandling av støy i arealplanlegging (T-1442/2012), should be performed at 1,2-1,5 m above ground. For indexing of noise sensitive points see the noise maps.

Note that if the point calculation and noise map shows contradictory results, it is primary the point calculation that should be used. The noise map should be considered as a compliment to the point calculation.

The calculation result is rounded to the nearest integer value according to the guidelines Veileder til retningslinje for behandling av støy i arealplanlegging (T-1442/2012):

Når det skal rundes av til nærmeste hele tall ser vi på første siffer rett etter kommaet.
-er sifferet 0, 1, 2, 3 eller 4 tar vi vekk alle desimalsifrene og beholder det hele tallet slik som det var
-er sifferet 5, 6, 7, 8 eller 9 tar vi vekk alle desimalsifrene og øker det hele tallet med 1

Eksempel; 54,499 = 54
54,511 = 55

L_{den} has been calculated with a penalty of 5 dB for L_e (evening 19-23) and 10 dB for L_n (night 23-07) which is resulting in an addition of 6,4 dBA to the calculated equivalent sound level. For Case F01 the wind turbines are assumed to run 290 days a year resulting in a -1,0 dB decrease of the calculated equivalent sound level. For Case F02 the real wind distribution is used which includes the real stand still time for the wind farm.

According to the permit the noise limit for wind shielded areas is L_{den}= 45 dBA and for normal areas Lden=50 dBA. Information about which NSA should be considered wind shielded is not known to Akustikkonsulten.

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Noise Map - Case F01

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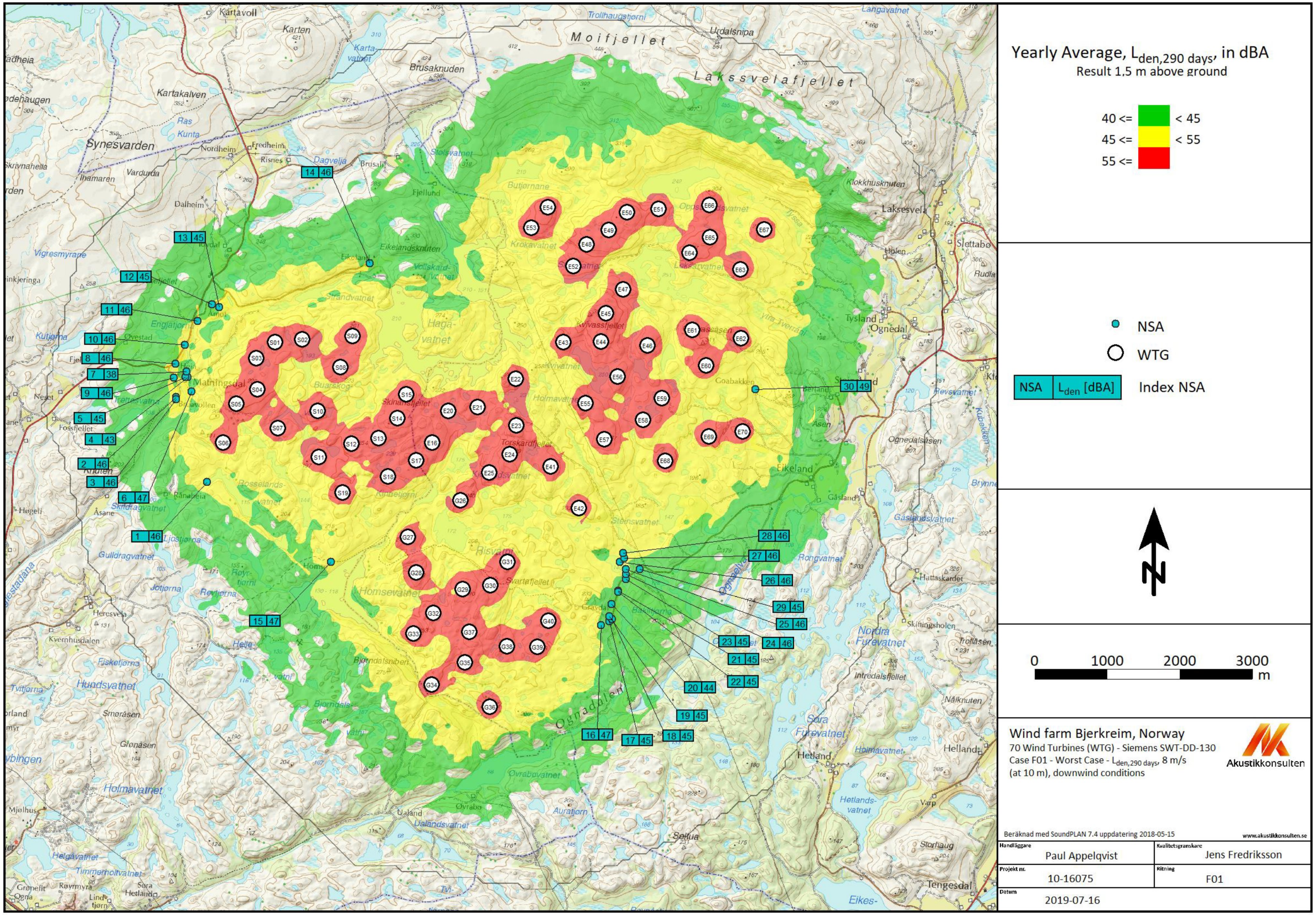
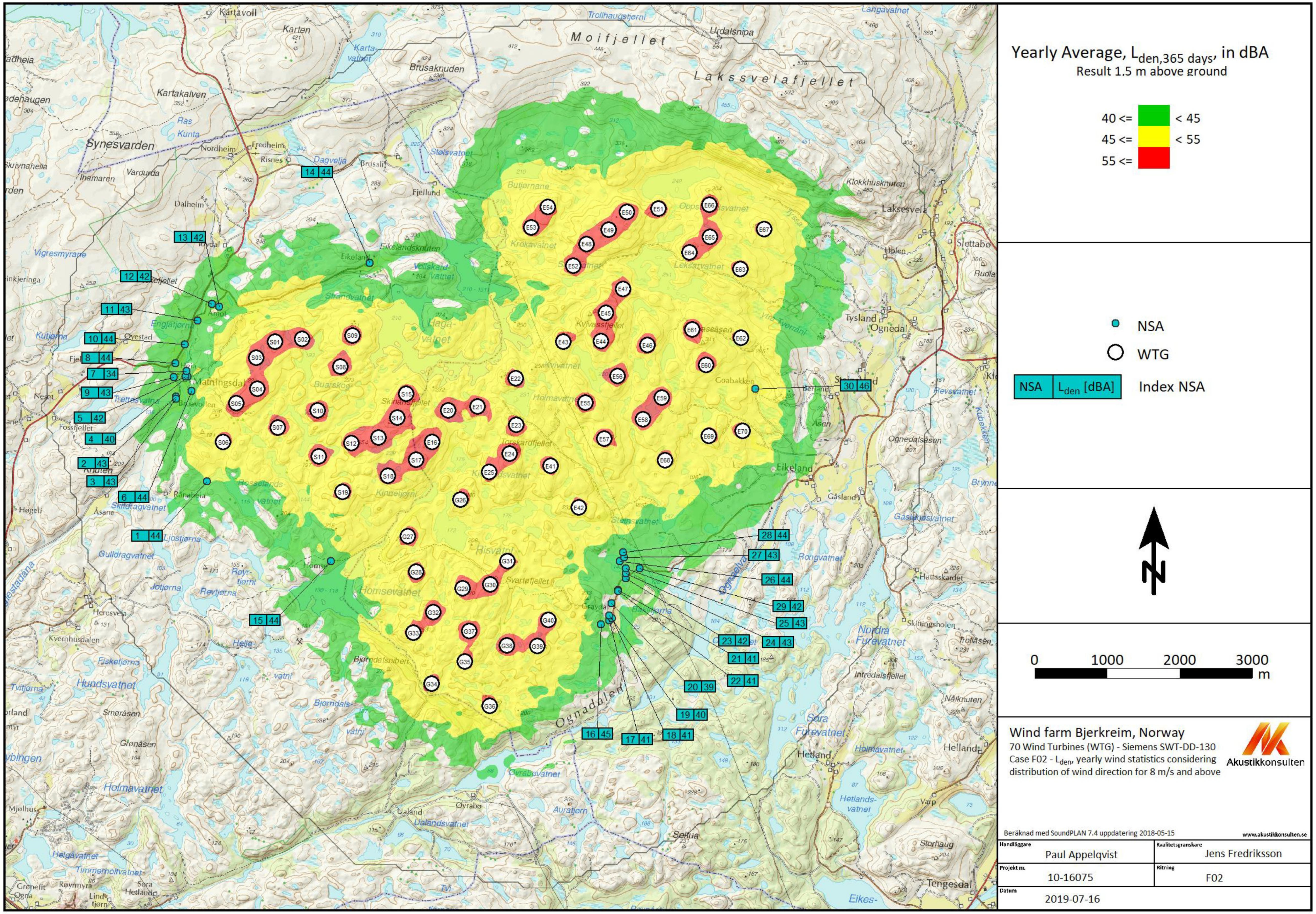


Noise Map - Case F02



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