E	Up to date - Results of detailed calculations and of the acoustic colored maps (§7.1 & 7.2) given	29/07/2016	
D1	Mitigations to reach a calculated noise at ESR1 of 31,1dB(A) night time. 6 coolers instead of 8 coolers - coolers move by 2,4m on the roof- Decrease LP in tipping hall and bunker hall to 76dB(A) - fast acting doors for the tipping hall - decrease the step up transformer PWL by 4dB(A)- take into account the direction change at the bottom of the stack -Reached 32,3 dB(A) instead of 31,1dB(A)	02/04/2015	
C	Walls at site boundary to protect from plant noise ESR1 deleted. ESR1 elevation is higher than the EfW Plant elevation.	12/02/2015	
B	New model to take into account the new boiler (vertical one).	11/02/2015	
A	First emission	28/01/2015	
REV.	OBJET	DATES	ENR
Un trait dans la marge signale une évolution du texte depuis l'indice précédent.			

DESIGNATION DE L'AFFAIRE :

Keighley

Acoustic study

Ce document dans son statut BPE reste applicable pendant toute la phase de réalisation

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Date :12/02/2015	Date :	Date :12/02/2015
Visa :	Visa :	Visa :

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INDEX

1 Data and calculation hypothesis

1.1 Air cooled condensers

PWL 2 modules = 91dBA Fans altitude 10m

Preliminary associated acoustic power spectrum

Frequency Hz	31,50	63	125	250	500	1000	2000	4000	8000	A
PWL power level	92,3	92,3	90,3	87,8	86,1	83,2	78,4	71,7	62,9	88,0

1.2 Tipping hall and refuse bunker

Acoustic pressure in the hall

Frequency Hz	31,5	63	125	250	500	1000	2000	4000	8000	A
Lp reverberant	80	80	80	73	70	70	70	61	67	75,9
Door attenuation 0,7mm steel	1	3	8	14	20	24	28	32	37	
PWL emitted per steel 0,7mm m^2	73	71	66	53	44	40	36	23	24	52,7
Fast acting doors	9	11	14	21	15	19	23	23	23	
	65	63	60	46	49	45	41	32	38	51,1
Roof in Kingspan KS1000/RW27 40mm	5	13	16	20	25	26	25	41	30	
PWL emitted per roof KS1000RW m^2	69	61	58	47	39	38	39	14	31	46,8
Walls Kingspan KS1000 R/W 40 (9W)	*8*	12	16	30	40	44	51	64	*45*	
PWL emitted walls KS1000 RW40 (9W)m^2	66	62	58	37	24	20	13	-9	16	43,2
Concrete attenuation	34	38	38	44	48	52	56	60	64	
PWL emitted per concrete m^2	40	36	36	23	16	12	8	-5	-3	22,6

Tipping hall height 13,9m Bunker height 30m

All the doors in steel 0,7mm Six doors h=6m l=5m

Roofs in KS1000RW27 40mm and walls in KS1000R/W 40 (9W)

1.3 Turbine Air coolers

fitting of the fans at 14m

we assume 6 cells. PWL 6 cells = 90,7dBA

Frequency Hz	31,5	63	125	250	500	1000	2000	4000	8000	A
PWL per module	84	84	84	79	78	81	72	63	53	83,0
Total acoustic power level	91,8	91,8	91,8	86,8	85,8	88,8	79,8	70,8	60,8	90,7

On South East and on South West bottom ash walls, an acroter height 4,5 m is necessary.

1.4 Turbine hall

Acoustic pressure in the hall

Frequency Hz	32	63	125	250	500	1000	2000	4000	8000	A
Lp reverberant	87,5	84,5	89,5	87,5	89	90	89,9	84,5	79	95,0
Concrete attenuation	34	38	38	44	48	52	56	60	64	
PWL emitted per concrete m^2	47,5	40,5	45,5	37,5	35	32	27,9	18,5	9	37,5
Acoustic Louvers Slimshield 600mm	3	7	9	12	24	31	33	29	30	
PWL emitted Louvers m^2	78,5	71,5	74,5	69,5	59	53	50,9	49,5	43	64,5
Acoustic door	5	10	15	20	25	30	35	35	40	
PWL emitted per acoustic door m^2	76,5	68,5	68,5	61,5	58	54	48,9	43,5	33	60,3

Hall height H=13,9m Turbine hall door Width =4m Height = 4m (NE wall)

Walls and roof concrete 16cm thickness

Air inlet with 2 Louvers Slimshield IAC SL600 length 2,5m height 3m on NE and SE walls

Air outlet through 2 air extractors with a silencer downstream air extractor

Acoustic doors

1.5 Stack

Height of the stack =60 m the directivity of the stack has been taken into account in the calculations

Frequency Hz	31,5	63	125	250	500	1000	2000	4000	8000	A
PWL downstream fan	120,4	120,2	122,1	116,6	114,2	110	103,8	97	90,1	116
Silencer Attenuation	5,4	11,2	27,1	37,6	49,2	45	38,8	32	15,1	
PWL downstream silencer	115	109	95	79	65	65	65	65	75	85,5
PWL stack outlet (bend bottom of stack)	112	106	92	76	62	62	62	62	72	82,5

Special silencer with very low noise at stack outlet.

1.6 Furnace Boiler Flue gas treatment Hall

Acoustic pressure in furnace-boiler- FGT hall between levels 0-10m

Frequency Hz	31,5	63	125	250	500	1000	2000	4000	8000	A
Lp reverberant	86	86	83	83	82	78	78	77	71	85,2
Slimshield IAC SL150 Louvers	3	6	6	8	10	14	18	16	15	
PWL emitted Louvers m^2	77	74	71	69	66	58	54	55	50	66,8
Walls Kingspan KS1000 R/W 40 (9W)	*8*	12	16	30	40	44	51	64	*45*	
PWL emitted walls KS1000 RW40 (9W)m^2	72	68	61	47	36	28	21	7	20	47,6
Door attenuation 0,7mm steel	1	3	8	14	20	24	28	32	37	
PWL emitted per steel 0,7mm m^2	79	77	69	63	56	48	44	39	28	59,5

For the natural ventilation of boiler & FGT hall, all the louvers are acoustic louvers Slimshield IAC SL150
Roofs in KS1000RW27 40mm and walls in KS1000R/W 40 (9W)
Boiler room height 35m Door on Boiler NE wall h=3m l=3m
All the doors in steel 0,7mm
Air intake, on NE wall, for the ventilation are through acoustic louvers Slimshield IAC SL150
L= 12+9=21m and H=5m S air inlet = 105m^2
Air outlet through louvers top of building S=34,6x2=69,2m2 on SE boiler wall
Air outlet through louvers top of building S=34,8x2=69,6m2 on NW boiler wall

Acoustic pressure in furnace-boiler- FGT hall between levels 10m to roof

Frequency Hz	31,5	63	125	250	500	1000	2000	4000	8000	A
Lp reverberant	81	81	78	78	77	73	73	72	66	80,2
Slimshield IAC SL150 Louvers	3	6	6	8	10	14	18	16	15	
PWL emitted Louvers m^2	72	69	66	64	61	53	49	50	45	61,8
Roof in Kingspan KS1000/RW27 40mm	5	13	16	20	25	26	25	41	30	
PWL emitted per roof KS1000RW m^2	70	62	56	52	46	41	42	25	30	49,6
Walls Kingspan KS1000 R/W 40 (9W)	*8*	12	16	30	40	44	51	64	*45*	
PWL emitted walls KS1000 RW40 (9W)m^2	67	63	56	42	31	23	16	2	15	42,6
attenuation 0,7mm steel	1	3	8	14	20	24	28	32	37	
PWL emitted per steel 0,7mm m^2	74	72	64	58	51	43	39	34	23	54,5

1.7 Electrical room

Frequency Hz	31,5	63	125	250	500	1000	2000	4000	8000	A
Lp reverberant	40	53	76	84	77	76	67	65	60	80,4
Door attenuation 0,7mm steel	1	3	8	14	20	24	28	32	37	
PWL emitted per steel 0,7mm m^2	33	44	62	64	51	46	33	27	17	56,9
Walls Kingspan KS1000 R/W 40 (9W)	*8*	12	16	30	40	44	51	64	*45*	
PWL emitted walls KS1000 RW40 (9W)m^2	26	35	54	48	31	26	10	-5	9	42,0
Roof in Kingspan KS1000/RW27 40mm	5	13	16	20	25	26	25	41	30	
PWL emitted per roof KS1000RW m^2	29	34	54	58	46	44	36	18	24	51,6
Slimshield IAC SL100 Louvers	*2*	5	4	5	6	9	13	14	13	
PWL emitted per Louvers m^2	32	42	66	73	65	61	48	45	41	67,6

Rooms for transformers TR11 and TR12- MV electrical room Roof height 6m
Walls in KS1000R/W 40 (9W)
All the doors in steel 0,7mm 3 doors h=3m l=2,5m on NE wall
Air inlet through louvers IAC SL100 S=1m^2 (3 louvres)
Forced air extraction on air outlet 3 air extractors

1.8 Step up transformer

Frequency Hz	31,5	63	125	250	500	1000	2000	4000	8000	A
Lp reverberant	28	41	64	72	65	64	55	53	48	68,4
Concrete attenuation	34	38	38	44	48	52	56	60	64	
PWL emitted per concrete m^2	-12	-3	20	22	11	6	-7	-13	-22	15,4

PWL emitted through the fence section (5x12=60m2) = 72,4-6+10LOG(60)=84,4dB(A)

1.9 Water treatment room

Acoustic pressure in the hall

Frequency Hz	32	63	125	250	500	1000	2000	4000	8000	A
Lp reverberant	86	86	83	83	82	78	78	77	71	85,2
Slimshield Louvers IAC SL-100	2	5	4	5	6	9	13	14	13	
PWL emitted by 1m^2 of Louvers	78	75	73	72	70	63	59	57	52	70,5
Roof in Kingspan KS1000/RW27 40mm	5	13	16	20	25	26	25	41	30	
PWL emitted per roof KS1000RW m^2	75	67	61	57	51	46	47	30	35	54,6
Walls Kingspan KS1000 R/W 40 (9W)	*8*	12	16	30	40	44	51	64	*45*	
PWL emitted walls KS1000 RW40 (9W)m^2	72	68	61	47	36	28	21	7	20	47,6
Attenuation 0,7mm steel	1	3	8	14	20	24	28	32	37	
PWL emitted per door m^2	79	77	69	63	56	48	44	39	28	59,5

Roofs in KS1000RW27 40mm and walls in KS1000R/W 40 (9W)
All the doors in steel 0,7mm door h=3m l=2,5m on the NE wall
Water treatment room height 15m
Air inlet through louvers slimshield IAC SL-100 l=3m h=2m on the NE wall
Air exhaust through an air extractor

1.10 Bottom ash hall

Acoustic pressure in the hall

Frequency Hz	31,5	63	125	250	500	1000	2000	4000	8000	A
Lp reverberant	86	85	77	71	71	69	68	68	59	75,4
Door attenuation steel 0,7mm	1	3	8	14	20	24	28	32	37	
PWL emitted per steel 0,7mm m^2	79	76	63	51	45	39	34	30	16	53,0
Walls Kingspan KS1000 R/W 40 (9W)	*8*	12	16	30	40	44	51	64	*45*	
PWL emitted walls KS1000 RW40 (9W)m^2	72	67	55	35	25	19	11	-2	8	43,5
Roof in Kingspan KS1000/RW27 40mm	5	13	16	20	25	26	25	41	30	
PWL emitted per roof KS1000RW m^2	75	66	55	45	40	37	37	21	23	46,2

Roofs in KS1000RW27 40mm and walls in KS1000R/W 40 (9W)
All the doors in steel 0,7mm Door on the SW wall l=15m h=5m
Bottom ash hall height 10,5m

1.11 Compressor room

Acoustic pressure in the hall

Frequency Hz	32	63	125	250	500	1000	2000	4000	8000	A
Lp reverberant	80	86	91	84	82	80	77	71	62	85,1
Slimshield IAC SL150 Louvers	3	6	6	8	10	14	18	16	15	
PWL emitted Louvers m^2	71	74	79	70	66	60	53	49	41	68,2
Walls Kingspan KS1000 R/W 40 (9W)	*8*	12	16	30	40	44	51	64	*45*	
PWL emitted walls KS1000 RW40 (9W)m^2	66	68	69	48	36	30	20	1	11	53,5
Roof in Kingspan KS1000/RW27 40mm	5	13	16	20	25	26	25	41	30	
PWL emitted per roof KS1000RW m^2	69	67	69	58	51	48	46	24	26	56,7
Door attenuation steel 0,7mm	1	3	8	14	20	24	28	32	37	
PWL emitted per 0,7mm steel m^2	73	77	77	64	56	50	43	33	19	63,1

Roofs in KS1000RW27 40mm and walls in KS1000R/W 40 (9W)
Door in steel 0,7mm h=3m l=2,5m
Compressor room height 15m Louvers on air inlet Slimshield IAC SL150 on SE wall S=2x1m2

1.12 Air extractors

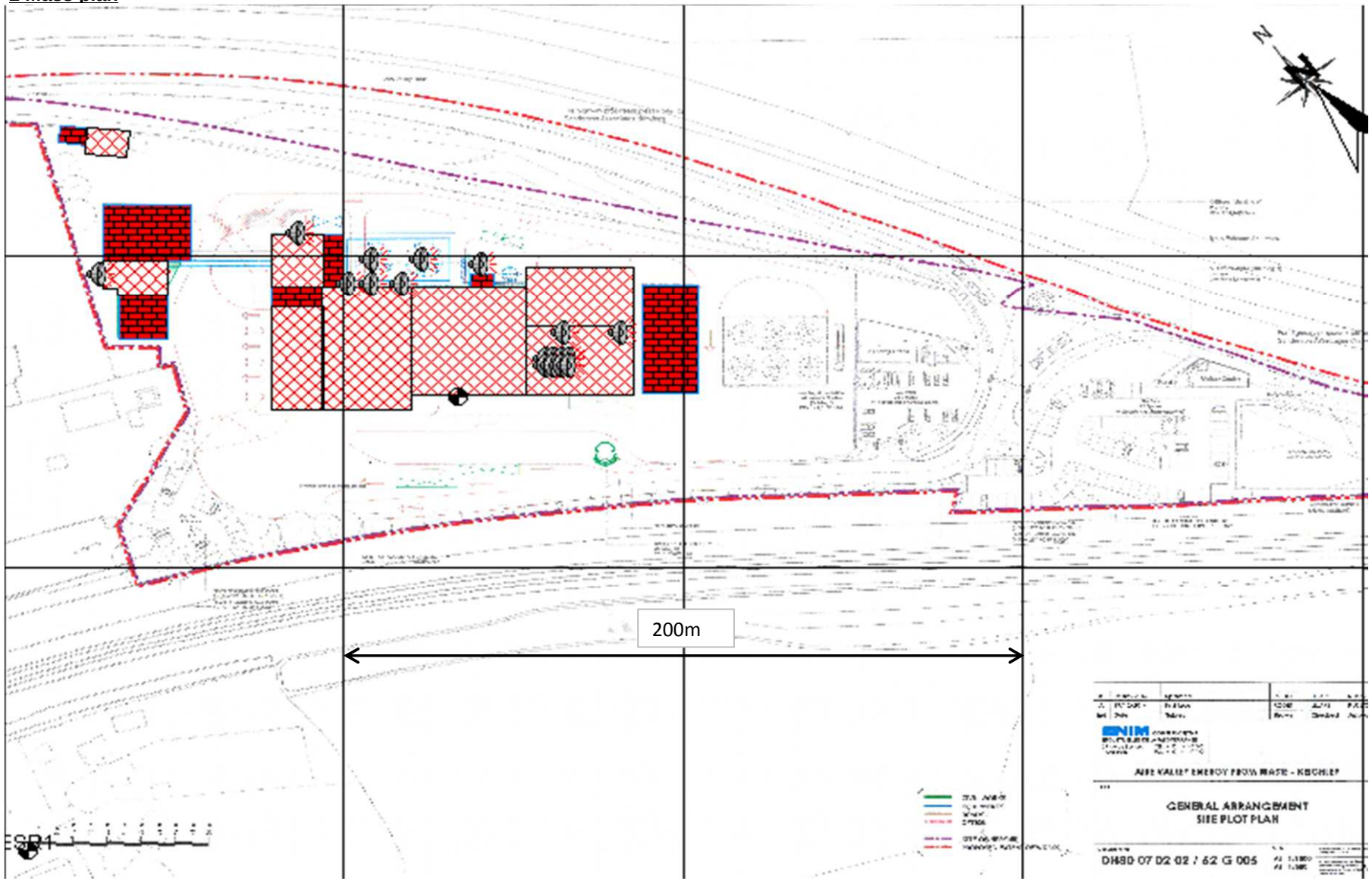
All these information are hypothesis to confirm later.

Electrical rooms

Transformers rooms and	3 air extractors	on NE wall
MV distribution room	Estimated PWL downstream silencer = 77,5dB(A)	
	Height of the three noise sources 8m	
Turbine hall	2 air extractors on the roof	**direction of the outlet of the pipe south east**
	Estimated PWL downstream silencer = 88,8dB(A)	
	Height of the noise source 12m	
Air compressor room	1 air extractor on north west wall	
	Estimated PWL downstream silencer = 80,3dB(A)	
	Height of the noise source 6m	
Water treatment hall	1 air extractor on the NE wall	
	Estimated PWL downstream silencer = 89,9dB(A)	
	Height of the noise source 10m	

Frequency Hz	31,5	63	125	250	500	1000	2000	4000	8000	A
PWL downstream silencer compressor	100	98	89	80	67	59	66	73	75	80,3
PWL downstream silencer water hall	101	89	89	80	82	87	83	78	72	89,9
PWL downstream silencer turbine hall	87	88	93	80	71	85	82	80	77	88,8
PWL downstream silencer elec room	65	65	74	77	67	68	71	72	66	77,5

2 Mass plan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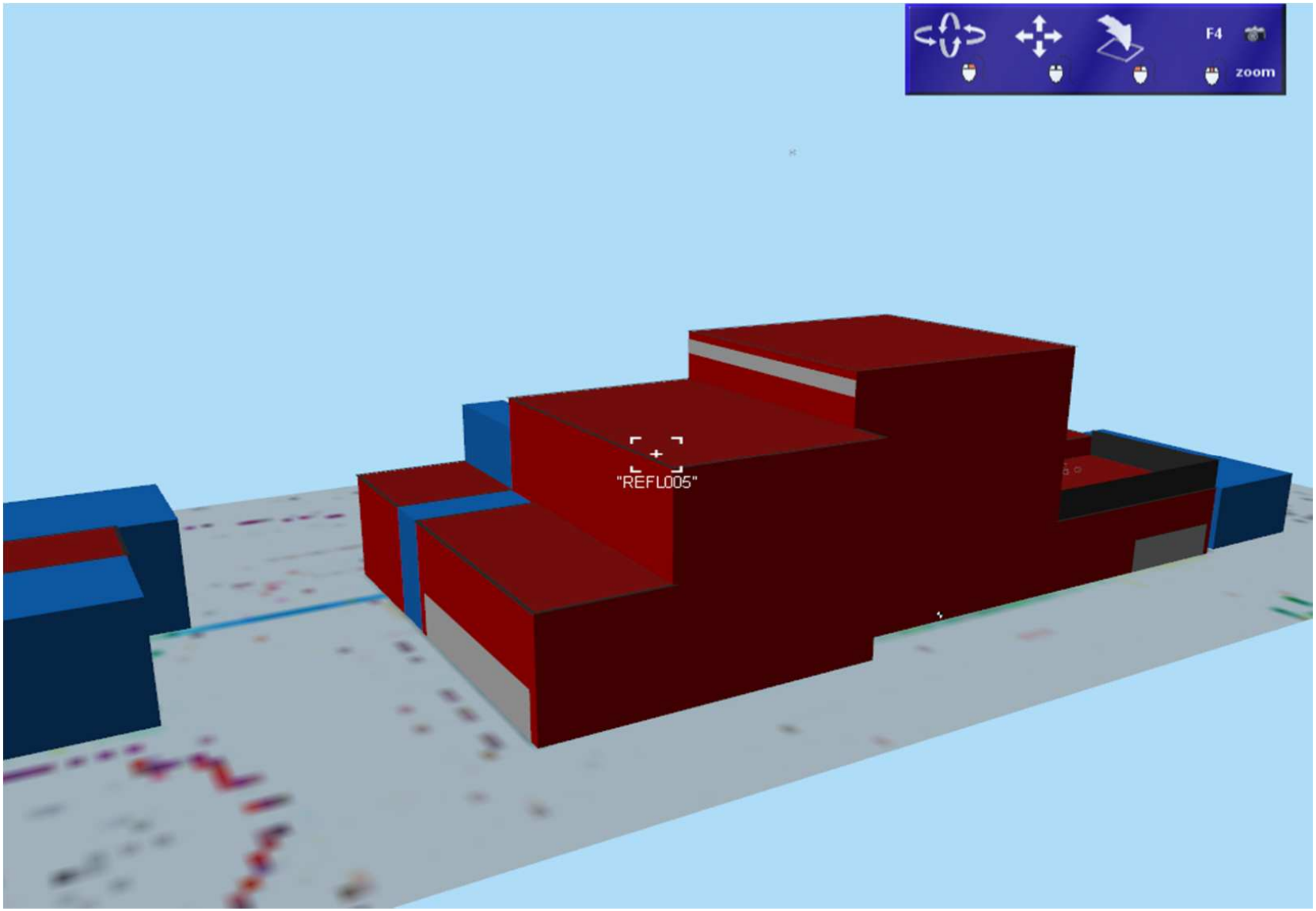
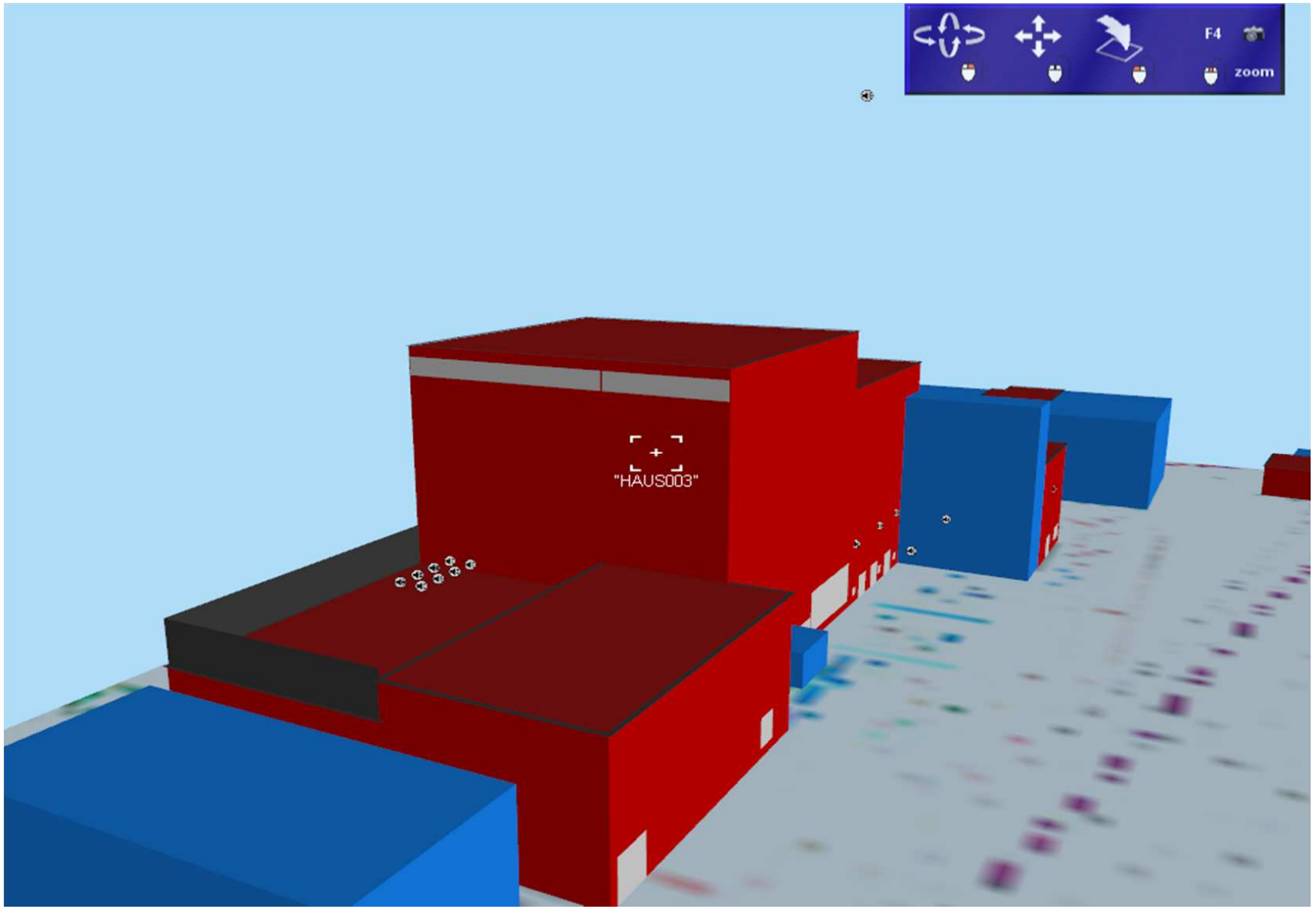
200m
GENERAL ARRANGEMENT
SITE PLOT PLAN
DH80 07 02 02 / 62 G 005

3 Plant model

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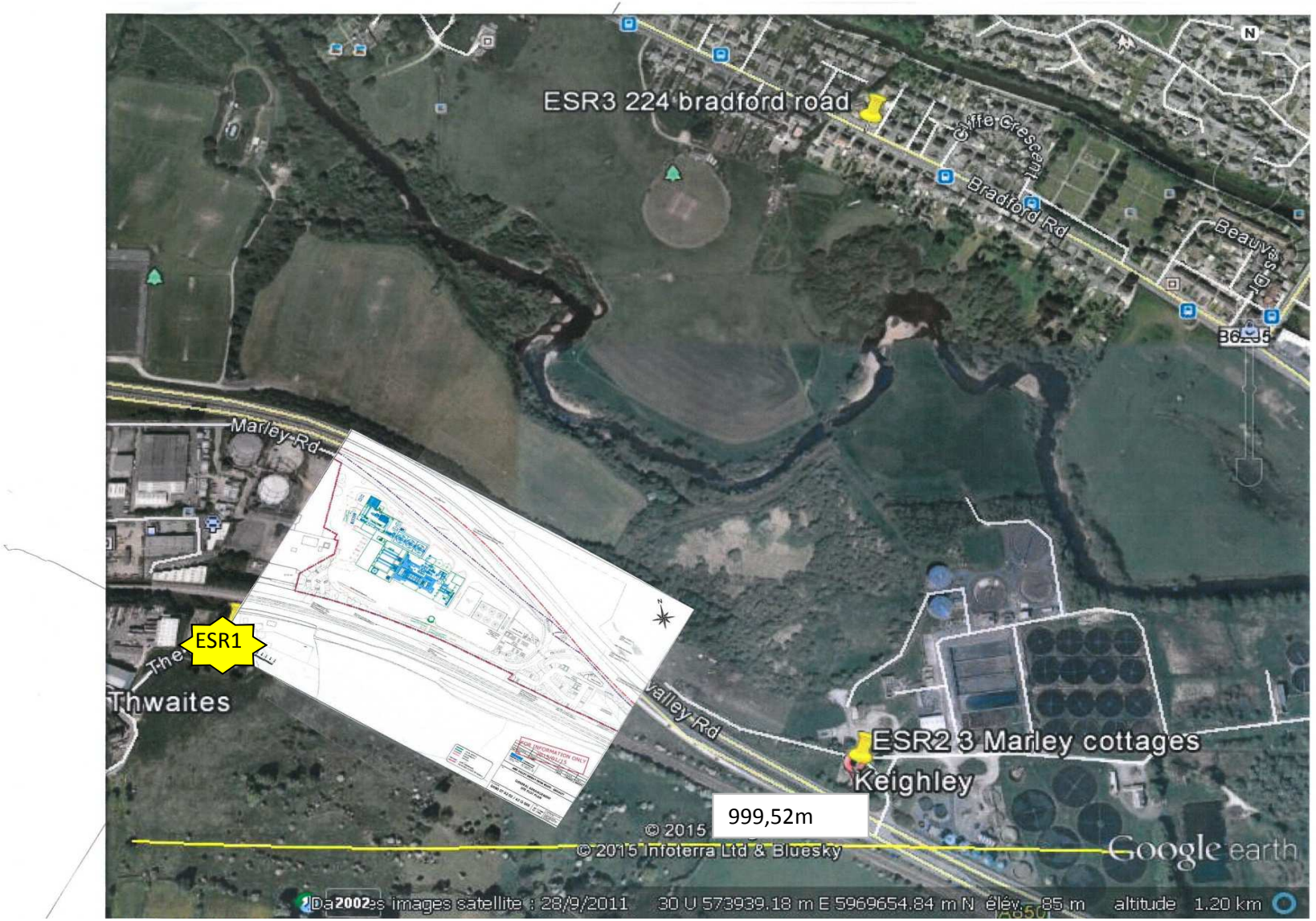
4 Receptors position



5 Attenuation of different materials

Sound reduction index	31,5	63	125	250	500	1000	2000	4000	8000
Type of materials									
Concrete 16cm	34	38	38	44	48	52	56	60	64
Acoustic door	5	10	15	20	25	30	35	35	40
0,7mm steel (steel 5,5kg/m^2)	1	3	8	14	20	24	28	32	37
Slimshield IAC SL100 Louvers	2	5	4	5	6	9	13	14	13
Slimshield IAC SL150 Louvers	3	6	6	8	10	14	18	16	15
Slimshield IAC SL300 Louvers	*3*	6	7	10	12	18	18	14	13
Slimshield IAC SL600 Louvers	3	7	9	12	24	31	33	29	30
Roof in Kingspan KS1000/RW27 40mm	5	13	16	20	25	26	25	41	30
Walls Kingspan KS1000 R/W 40 (9W)	*8*	12	16	30	40	44	51	64	*45*

6 Acoustic pressure to receivers detailed calculations - Night time calculations

Calculation file Keighley E.IPR

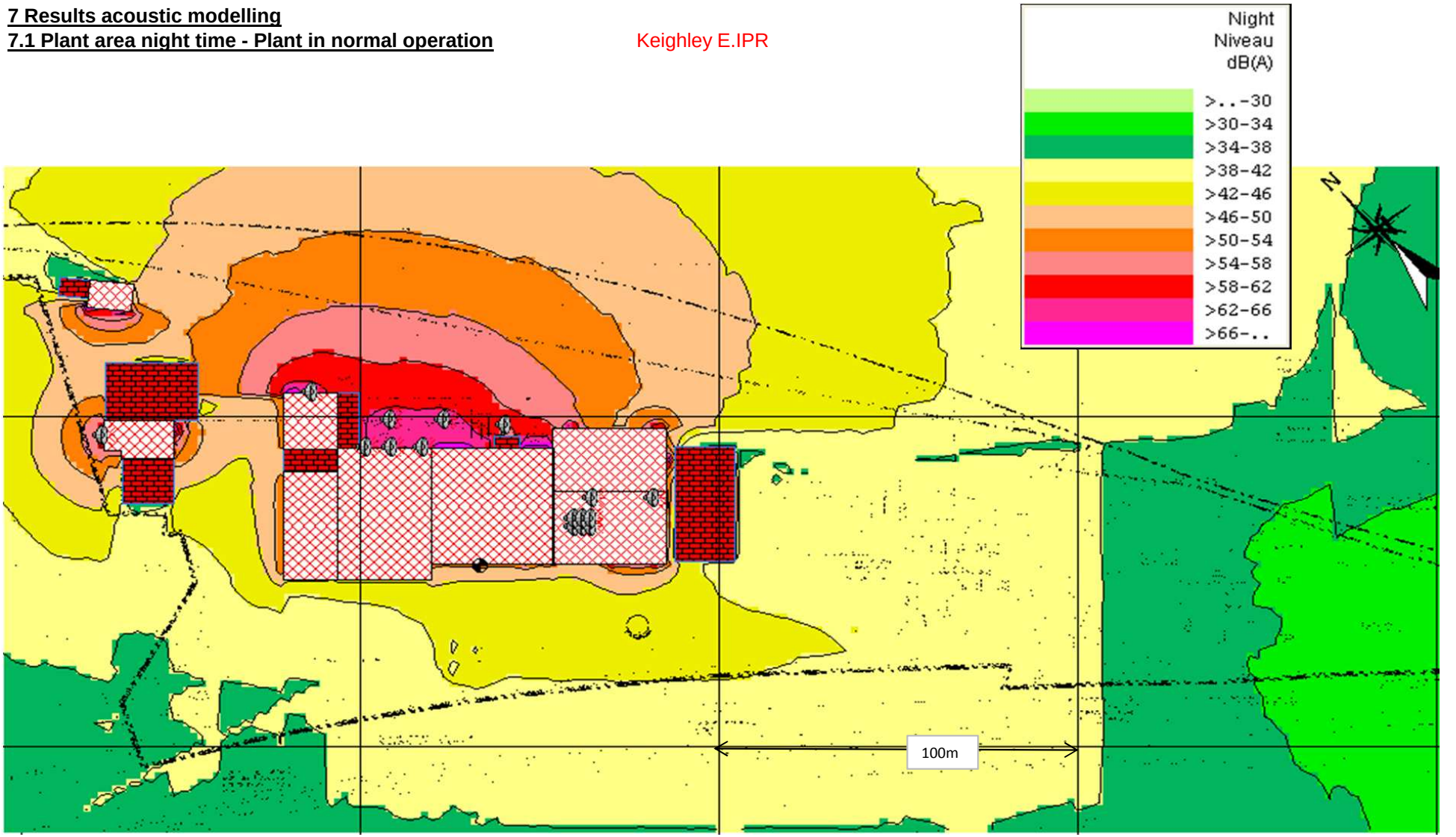
IPkt001 »	ESR1	x = 7,00 m y = 9,00 m z = 1,50 m	
		L r,i,A	L r,A
EZQi013 »	extractor Compressor	22,324	22,324
EZQi016 »	Extractor turbine 2	20,68	24,589
EZQi007 »	Cooler 3	20,332	25,973
EZQi001 »	Stack	19,881	26,928
FLQi225 »	Boiler louvres out3	19,868	27,708
FLQi204 »	Step up transf/WAND3	19,182	28,279
FLQi179 »	Compressor /WAND6	18,795	28,742
FLQi180 »	Compressor /DACH	18,079	29,1
FLQi045 »	Water treatment/DACH	17,905	29,418
FLQi207 »	Tipping hall doors	17,754	29,704
FLQi026 »	Waste bunker /WAND6	17,365	29,95
FLQi088 »	Boiler SW low	17,163	30,173
EZQi011 »	Cooler 7	16,743	30,366
FLQi219 »	Bottom ash door	16,473	30,54
FLQi082 »	Boiler and FGT/WAND6	16,363	30,703
EZQi006 »	Cooler 2	16,152	30,852
FLQi178 »	Compressor /WAND5	16,126	30,996
EZQi014 »	extractor water hall	15,966	31,13
FLQi044 »	Water treatmen/WAND4	15,602	31,25
FLQi005 »	Tipping hall /DACH	15,2	31,357
FLQi177 »	Compressor /WAND4	15,147	31,46
EZQi015 »	Extractor turbine 1	14,208	31,541
FLQi084 »	Boiler and FGT /DACH	14,03	31,617
FLQi028 »	Waste bunker /DACH	13,85	31,689
FLQi004 »	Tipping hall /WAND4	13,72	31,758
EZQi010 »	Cooler 6	13,415	31,821
EZQi002 »	ACC 1	12,98	31,877
FLQi003 »	Tipping hall /WAND3	12,467	31,927
FLQi027 »	Waste bunker /WAND7	12,449	31,975
EZQi005 »	Cooler 1	12,384	32,023
FLQi175 »	Compressor /WAND2	12,239	32,068
FLQi063 »	Bottom ash /DACH	11,545	32,107
EZQi003 »	ACC 2	10,701	32,138
EZQi009 »	Cooler 5	10,591	32,168
FLQi060 »	Bottom ash /WAND3	10,268	32,196
FLQi221 »	Boiler NE1 louvres	8,351	32,214
FLQi226 »	Compressor door	7,292	32,228
FLQi217 »	Water louvres	6,637	32,24
FLQi061 »	FGT SW bottomashconv	5,836	32,25
FLQi224 »	Boiler louvres out2	5,784	32,26
FLQi222 »	Boiler NE3 louvres	4,241	32,267
FLQi227 »	Compressor louvres	4,232	32,273
FLQi083 »	Boiler and FGT/WAND7	3,71	32,279
FLQi041 »	Water treatmen/WAND1	3,501	32,285
FLQi059 »	Bottom ash /WAND2	2,9	32,29
FLQi025 »	Waste bunker /WAND5	2,553	32,295
FLQi081 »	Boiler and FGT/WAND5	2,143	32,299
FLQi223 »	Boiler louvres out1	1,489	32,303
EZQi017 »	Extractor elec 1	0,5	32,305
EZQi018 »	Extractor elec 2	0,355	32,308
EZQi019 »	Extractor elec 3	0,193	32,311
FLQi210 »	Turbine Louvres SE	-0,955	32,313
FLQi218 »	Water door	-1,766	32,315
FLQi022 »	Waste bunker /WAND2	-2,201	32,316
FLQi077 »	Boiler and FGT/WAND1	-3,359	32,317
FLQi080 »	Boiler and FGT/WAND4	-3,881	32,318
FLQi085 »	Boiler NE1 low	-5,048	32,319
FLQi220 »	Boiler NE1 door	-5,377	32,32
FLQi023 »	Waste bunker /WAND3	-5,86	32,321
FLQi209 »	Turbine louvres NE	-5,982	32,321
FLQi208 »	Turbine door	-7,142	32,322
FLQi213 »	Elec louvres1	-7,711	32,322
FLQi010 »	Turbine hall /WAND4	-7,735	32,323
FLQi079 »	Boiler and FGT/WAND3	-7,8	32,323
FLQi214 »	Elec louvres 2	-7,828	32,323
FLQi078 »	Boiler and FGT/WAND2	-7,965	32,324
FLQi216 »	Elec louvres 3	-7,967	32,324
FLQi013 »	Turbine hall /DACH	-8,503	32,325
	Somme		32,327

IPkt002 »	ESR2	x = 623,00 m	y = 191,00 m	z = 1,50 m
		L r,i,A	L r,A	
EZQi003 »	ACC 2	24,406	24,406	
EZQi002 »	ACC 1	24,383	27,405	
EZQi015 »	Extractor turbine 1	24,028	29,047	
EZQi016 »	Extractor turbine 2	18,88	29,446	
EZQi014 »	extractor water hall	18,007	29,747	
EZQi001 »	Stack	16,59	29,952	
EZQi009 »	Cooler 5	15,386	30,101	
EZQi010 »	Cooler 6	15,359	30,245	
EZQi005 »	Cooler 1	15,341	30,383	
EZQi011 »	Cooler 7	15,326	30,516	
EZQi006 »	Cooler 2	15,318	30,646	
EZQi007 »	Cooler 3	15,29	30,77	
FLQi224 »	Boiler louvres out2	11,374	30,82	
FLQi084 »	Boiler and FGT /DACH	9,295	30,851	
FLQi223 »	Boiler louvres out1	9,02	30,879	
FLQi221 »	Boiler NE1 louvres	8,765	30,906	
FLQi204 »	Step up transf/WAND3	8,449	30,93	
FLQi063 »	Bottom ash /DACH	7,633	30,95	
FLQi208 »	Turbine door	7,467	30,97	
FLQi219 »	Bottom ash door	6,068	30,984	
FLQi222 »	Boiler NE3 louvres	5,995	30,998	
FLQi217 »	Water louvres	5,81	31,011	
FLQi081 »	Boiler and FGT/WAND5	4,439	31,02	
FLQi088 »	Boiler SW low	3,646	31,028	
FLQi209 »	Turbine louvres NE	3,481	31,036	
FLQi180 »	Compressor /DACH	3,322	31,043	
FLQi082 »	Boiler and FGT/WAND6	3,081	31,05	
FLQi077 »	Boiler and FGT/WAND1	2,819	31,057	
FLQi026 »	Waste bunker /WAND6	2,255	31,062	
FLQi022 »	Waste bunker /WAND2	1,741	31,067	
FLQi041 »	Water treatmen/WAND1	1,54	31,072	
FLQi175 »	Compressor /WAND2	1,43	31,077	
FLQi080 »	Boiler and FGT/WAND4	1,41	31,082	
EZQi017 »	Extractor elec 1	0,929	31,086	
EZQi018 »	Extractor elec 2	0,864	31,09	
FLQi060 »	Bottom ash /WAND3	0,769	31,094	
EZQi019 »	Extractor elec 3	0,736	31,098	
FLQi079 »	Boiler and FGT/WAND3	0,698	31,102	
FLQi078 »	Boiler and FGT/WAND2	-0,866	31,105	
FLQi085 »	Boiler NE1 low	-0,921	31,107	
FLQi023 »	Waste bunker /WAND3	-1,19	31,11	
FLQi045 »	Water treatment/DACH	-1,679	31,112	
FLQi218 »	Water door	-2,03	31,114	
EZQi013 »	extractor Compressor	-2,075	31,117	
FLQi013 »	Turbine hall /DACH	-2,153	31,119	
FLQi025 »	Waste bunker /WAND5	-2,752	31,12	
FLQi028 »	Waste bunker /DACH	-3,055	31,122	
FLQi225 »	Boiler louvres out3	-3,623	31,123	
FLQi003 »	Tipping hall /WAND3	-4,134	31,125	
FLQi059 »	Bottom ash /WAND2	-4,325	31,126	
FLQi210 »	Turbine Louvres SE	-4,856	31,127	
FLQi226 »	Compressor door	-5,139	31,128	
FLQi220 »	Boiler NE1 door	-5,14	31,129	
FLQi008 »	Turbine hall /WAND2	-5,259	31,13	
FLQi061 »	FGT SW bottomashconv	-5,457	31,131	
FLQi044 »	Water treatmen/WAND4	-6,057	31,132	
FLQi086 »	Boiler NE2 low	-6,072	31,133	
FLQi007 »	FGT big bag zone NE	-6,331	31,134	
FLQi179 »	Compressor /WAND6	-6,831	31,134	
FLQi009 »	Turbine hall /WAND3	-6,896	31,135	
FLQi087 »	Boiler NE3 low	-7,014	31,136	
FLQi227 »	Compressor louvres	-9,114	31,136	
FLQi012 »	FGT big bag zone NW	-9,182	31,136	
FLQi213 »	Elec louvres1	-9,697	31,137	
FLQi214 »	Elec louvres 2	-9,786	31,137	
FLQi216 »	Elec louvres 3	-9,845	31,137	
FLQi010 »	Turbine hall /WAND4	-9,964	31,138	
FLQi211 »	Elec TR12 door	-10,225	31,138	
FLQi212 »	Elec TR11 door	-10,319	31,138	
FLQi215 »	Elec MVdis door	-10,348	31,139	
	Somme		31,141	

IPkt003 »	ESR3	x = 281,00 m	y = 805,00 m	z = 1,50 m
		L r,i,A	L r,A	
EZQi003 »	ACC 2	22,519	22,519	
EZQi002 »	ACC 1	22,456	25,498	
EZQi014 »	extractor water hall	21,169	26,862	
FLQi221 »	Boiler NE1 louvres	15,837	27,192	
FLQi222 »	Boiler NE3 louvres	14,671	27,429	
EZQi001 »	Stack	14,448	27,642	
EZQi011 »	Cooler 7	10,777	27,731	
EZQi010 »	Cooler 6	10,77	27,817	
EZQi007 »	Cooler 3	10,768	27,902	
EZQi009 »	Cooler 5	10,763	27,985	
EZQi006 »	Cooler 2	10,761	28,067	
EZQi005 »	Cooler 1	10,753	28,146	
FLQi217 »	Water louvres	9,155	28,201	
EZQi017 »	Extractor elec 1	8,767	28,25	
FLQi180 »	Compressor /DACH	8,417	28,295	
FLQi224 »	Boiler louvres out2	8,115	28,336	
FLQi045 »	Water treatment/DACH	7,231	28,37	
FLQi084 »	Boiler and FGT /DACH	6,486	28,398	
EZQi015 »	Extractor turbine 1	6,182	28,424	
FLQi223 »	Boiler louvres out1	6,02	28,449	
EZQi019 »	Extractor elec 3	5,91	28,473	
EZQi018 »	Extractor elec 2	5,868	28,497	
EZQi016 »	Extractor turbine 2	5,725	28,52	
FLQi041 »	Water treatmen/WAND1	4,758	28,538	
FLQi209 »	Turbine louvres NE	4,249	28,554	
FLQi210 »	Turbine Louvres SE	4,171	28,57	
FLQi208 »	Turbine door	4,001	28,585	
FLQi028 »	Waste bunker /DACH	3,298	28,598	
FLQi077 »	Boiler and FGT/WAND1	2,654	28,609	
FLQi085 »	Boiler NE1 low	2,182	28,619	
EZQi013 »	extractor Compressor	1,942	28,628	
FLQi220 »	Boiler NE1 door	1,855	28,637	
FLQi022 »	Waste bunker /WAND2	1,395	28,645	
FLQi225 »	Boiler louvres out3	1,319	28,653	
FLQi218 »	Water door	1,118	28,661	
FLQi175 »	Compressor /WAND2	0,749	28,668	
FLQi081 »	Boiler and FGT/WAND5	0,502	28,675	
FLQi213 »	Elec louvres1	0,429	28,681	
FLQi079 »	Boiler and FGT/WAND3	-0,031	28,687	
FLQi063 »	Bottom ash /DACH	-0,062	28,693	
FLQi059 »	Bottom ash /WAND2	-0,181	28,699	
FLQi044 »	Water treatmen/WAND4	-0,253	28,704	
FLQi087 »	Boiler NE3 low	-0,913	28,709	
FLQi080 »	Boiler and FGT/WAND4	-1,242	28,713	
FLQi023 »	Waste bunker /WAND3	-1,527	28,717	
FLQi216 »	Elec louvres 3	-2,45	28,721	
FLQi214 »	Elec louvres 2	-2,492	28,724	
FLQi179 »	Compressor /WAND6	-2,572	28,727	
FLQi078 »	Boiler and FGT/WAND2	-2,658	28,73	
FLQi086 »	Boiler NE2 low	-4,024	28,733	
FLQi204 »	Step up transf/WAND3	-4,146	28,735	
FLQi211 »	Elec TR12 door	-4,436	28,737	
FLQi005 »	Tipping hall /DACH	-4,454	28,739	
FLQi008 »	Turbine hall /WAND2	-4,913	28,741	
FLQi215 »	Elec MVdis door	-5,138	28,743	
FLQi212 »	Elec TR11 door	-5,157	28,744	
FLQi219 »	Bottom ash door	-5,262	28,746	
FLQi027 »	Waste bunker /WAND7	-5,344	28,748	
FLQi007 »	FGT big bag zone NE	-5,52	28,749	
FLQi009 »	Turbine hall /WAND3	-6,576	28,751	
FLQi004 »	Tipping hall /WAND4	-7,501	28,752	
FLQi013 »	Turbine hall /DACH	-7,634	28,753	
FLQi083 »	Boiler and FGT/WAND7	-7,671	28,754	
FLQi207 »	Tipping hall doors	-7,956	28,755	
FLQi012 »	FGT big bag zone NW	-8,052	28,756	
FLQi088 »	Boiler SW low	-8,363	28,756	
FLQi226 »	Compressor door	-8,447	28,757	
FLQi029 »	Elec TR11 -12	-8,944	28,758	
FLQi082 »	Boiler and FGT/WAND6	-10,014	28,759	
FLQi178 »	Compressor /WAND5	-10,104	28,759	
	Somme		28,762	

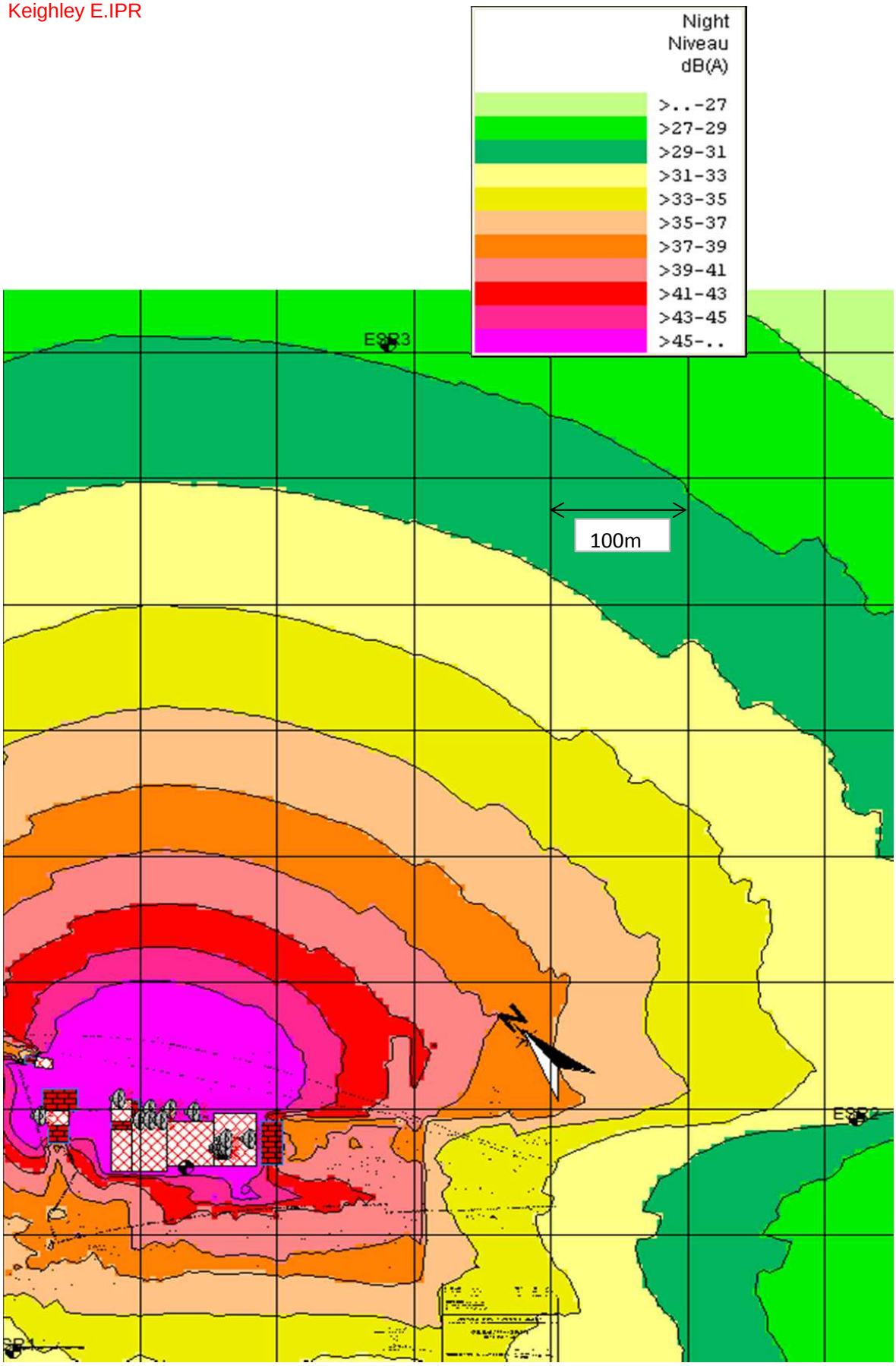
7 Results acoustic modelling
7.1 Plant area night time - Plant in normal operation

Keighley E.IPR



7.2 Results acoustic modelling in the neighbourhood night- Plant in normal operation

Keighley E.IPR



8 Calculations results - Calculated noise level summary - Night time - Plant in normal operation

Calculation hypothesis are described in chapter 1.
Calculation method following ISO 9613.
Ground effect G=0,5 ; mixed ground between absorbant and reverberant ground
Calculation file Keighley E.IPR

Acoustic power level for the outdoor equipment:
Total air cooled condenser PWL = 91dB(A)
Total turbine coolers PWL = 90,7dB(A)
One stack PWL = 82,5dB(A)

All these mitigation actions have to be done to reach the following calculated results:
On South East and on south west Bottom Ash Hall walls, an acroter height 4,5m
All the Louvers are acoustic Louvers for all the rooms
Walls in double skin - See § 5 for attenuation - Walls Kingspan KS1000 R/W 40 (9W)
Roofs in double skin - See § 5 for attenuation - Roof in Kingspan KS1000/RW27 40mm
More efficient silencer before stack outlet

Predicted plant noise level (permanent noise sources excluding road traffic modification)
Night calculation results at receptors in dB(A):

ESR1	6 The Croft, Thwaites, Keighley	BD21 4ND	32,3 dB(A)
ESR2	3 Marley Cottages, Aire Valley Road , Keighley	BD21 4LT	31,1 dB(A)
ESR3	224 Bradford Road Riddlesden , Keighley	BD20 5JT	28,8 dB(A)

At sensitive receptors:

	ACC	Boiler and FGT Hall	Bunker hall & tipping hall	Compressor room	Coolers	Air extractors	Stack	Step up transformer	Turbine hall	Rest of the Plant	Total
ESR1	15,0	23,8	23,7	23,8	23,9	25,5	19,9	19,2	2,1	22,5	32,3
ESR2	27,4	17,5	7,5	6,3	23,1	26,0	16,6	8,4	9,7	12,8	31,1
ESR3	25,5	19,8	7,3	9,6	18,5	21,9	14,4	-4,1	9,3	13,9	28,8

Predicted plant noise level (permanent noise sources excluding road traffic modification) including margin for uncertainties concerning wind direction and topography.
Night calculation results at receptors in dB(A):

ESR1	6 The Croft, Thwaites, Keighley	BD21 4ND	32,8 dB(A)
ESR2	3 Marley Cottages, Aire Valley Road , Keighley	BD21 4LT	33,1 dB(A)
ESR3	224 Bradford Road Riddlesden , Keighley	BD20 5JT	30,8 dB(A)

9 Measured background noise level

From Document 13_04217_FUL-REVISED_-_CHAPTER_13_-_NOISE__APPENDIX_7_-3871570.pdf
and
Appendix 13.1 - noise levels.pdf

Definition of the receptors:

ESR1	6 The Croft, Thwaites, Keighley	BD21 4ND
ESR2	3 Marley Cottages, Aire Valley Road , Keighley	BD21 4LT
ESR3	224 Bradford Road Riddlesden , Keighley	BD20 5JT

Results of the noise monitoring:

Night time

	LA90 30 min
ESR1	38,1
ESR2	44,6
ESR3	36,5

Day time

	Min figure for LA90 30 min
ESR1	44,3
ESR2	57,3
ESR3	46

This document also specify that :
"Environmental Health usually asks for a specific noise of 5dB(A) below existing background.

10 Conclusions

The calculation hypothesis are all described in paragraph 1.
All these mitigation actions have to be done to reach the following calculated results:

On South East and on south west Bottom Ash Hall walls, an acroter height 4,5m
All the Louvers are acoustic Louvers for all the rooms
Walls in double skin - See § 5 for attenuation - Walls Kingspan KS1000 R/W 40 (9W)
Roofs in double skin - See § 5 for attenuation - Roof in Kingspan KS1000/RW27 40mm
More efficient silencer before stack outlet

Calculation method following ISO 9613.

10.1 Plant noise level (permanent noise sources excluding road traffic modification)

Night time acoustic pressure at receptors

	Global calculated level	
Location ESR1	32,8	6 The Croft, Thwaites, Keighley
Location ESR2	33,1	3 Marley Cottages, Aire Valley Road , Keighley
Location ESR3	30,8	224 Bradford Road Riddlesden , Keighley

10.2 Night-time BS 4142

	Measured minimum residual noise LA90 Planning requirement	Predicted plant noise level	Difference	
Location ESR1	38,1	32,8	-5,3	6 The Croft, Thwaites, Keighley
Location ESR2	44,6	33,1	-11,5	3 Marley Cottages, Aire Valley Road , Keighley
Location ESR3	36,5	30,8	-5,7	224 Bradford Road Riddlesden , Keighley

10.3 Day-time BS 4142

	Measured minimum residual noise LA90 Planning requirement	Predicted plant noise level	Difference	
Location ESR1	44,3	37,8	-6	6 The Croft, Thwaites, Keighley
Location ESR2	57,3	38,1	-19	3 Marley Cottages, Aire Valley Road , Keighley
Location ESR3	46	35,8	-10	224 Bradford Road Riddlesden , Keighley

10.4 Conclusions following BS4142

BS4142 states:

"A difference of around 10dB or higher indicates that complaints are likely. A difference of around 5dB is of marginal significance. A difference of -10dB is a positive indication that complaints are unlikely".

With reference to the above, Table 10.2 details the BS4142 for fixed plant associated with the proposed EfW development during night-time.
The table indicates that noise levels generated by fixed plant will lead to:
• a situation between marginal significance and complaints unlikely at:
6 The Croft, Thwaites, Keighley and 224 Bradford Road Riddlesden , Keighley
• a situation giving a positive indication that complaints are unlikely at :
3 Marley Cottages, Aire Valley Road , Keighley

Table 11.3 details the BS4142 for fixed plant associated with the proposed EfW development during Day operations (excluding road noise traffic modification). The table indicates that noise levels generated by fixed plant will lead to:
• a situation between marginal significance and complaints unlikely at:
6 The Croft, Thwaites, Keighley
• a situation giving a positive indication that complaints are unlikely at :
3 Marley Cottages, Aire Valley Road , Keighley and 224 Bradford Road Riddlesden , Keighley