

Norfolk Boreas Offshore Wind Farm

Appendix 25.1

Baseline Noise Survey

Environmental Statement

Volume 3

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Figure 25.1.1 Noise Baseline Monitoring Locations

Glossary of Acronyms

BS	British Standard
ETG	Expert Topic Group
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
ISO	International Standards Organisation

Glossary of Terminology

Decibel (dB)	A unit of noise level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 μ Pa, the threshold of normal hearing is 0dB, and 140dB is the threshold of pain. A change of 1dB is only perceptible under controlled conditions. Under normal conditions a change in noise level of 3dB(A) is the smallest perceptible change.
$L_{A90, T}$	The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 2014 it is used to define the 'background' noise level.
$L_{Aeq, T}$	The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq, T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.
L_{Amax}	The maximum A-weighted sound pressure level recorded during a measurement.
Landfall	Where the offshore cables come ashore at Happisburgh South.
National Grid substation extension	The permanent footprint of the National Grid substation extension.
Necton National Grid substation	The grid connection location for Norfolk Boreas and Norfolk Vanguard
Onshore cable route	The up to 35m working width within a 45m wide corridor which will contain the buried export cables as well as the temporary running track, topsoil storage and excavated material during construction.
Onshore project area	The area including the Norfolk Boreas site, project interconnector search area and offshore cable corridor.
Onshore project substation	A compound containing electrical equipment to enable connection to the National Grid. The substation will convert the exported power from HVDC to HVAC, to 400kV (grid voltage). This also contains equipment to help maintain stable grid voltage.
R_w	The weighted sound reduction index, R_w , is a single figure description of sound reduction index which is defined in BS EN ISO 717-1: 1997. The R_w is calculated from measurements in an acoustic laboratory to BS EN ISO 140-3:1997 and ratings to BS EN ISO 717-1:1997. Sound insulation ratings derived from site (which are invariably lower than the laboratory figures) are referred to as the R'_w ratings (apparent weighted sound reduction index) and measured to BS EN ISO 140-4:1998
The project	Norfolk Boreas Wind Farm including the onshore and offshore infrastructure.

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1 Introduction

1. In order to characterise the existing noise climate within the Norfolk Boreas study area a baseline noise survey was undertaken at agreed sensitive receptor locations in the vicinity of the site and across the onshore project area (shown on Figure 25.1.1) between 27th April and 24th May 2017.
2. Some amendments to the methodology as agreed as part of consultation at the Expert Topic Group (ETG) meetings (held for Norfolk Vanguard) were necessary. This appendix to Chapter 25 Noise and Vibration quantifies the differences between the agreed methodology and the actual survey approach as well as quantifying the existing acoustic environment within the vicinity of the study area.

2 Measured Baseline Noise Data

3. Baseline noise measurements were conducted at agreed identified sensitive noise receptors within the following study areas:
 - Landfall;
 - Onshore cable route; and
 - Onshore project substation / National Grid substation extension.
4. Since these measurements were taken, the onshore cable corridor has been refined to a narrower onshore cable route, from a 200m (Norfolk Boreas and Norfolk Vanguard) to a 45m width.

2.1 Landfall

5. At the time the methodology was produced, three landfall search areas were being considered. These were located at:
 - Bacton Green;
 - Walcott Gap; and
 - Happisburgh South.
6. Happisburgh South has since been selected as the location of the landfall for both Norfolk Boreas and Norfolk Vanguard. There have been no other amendments to the baseline noise survey approach at the landfall. Noise measurements at the landfall were conducted on a fully attended basis.
7. Landfall measurement locations are detailed within Table 2.1 and shown on Figure 25.1.1a (map 1).

Table 2.1 Baseline noise monitoring locations - landfill

Receptor identifier	Parish/ location	X	Y	Nearest postcode
LFR1H	Happisburgh	638487	330860	NR12 OPR
LFR2H	Happisburgh	638426	330620	NR12 OPY
LFR3H	Happisburgh	638512	329817	NR12 OAJ
LFR4H	Happisburgh	639335	330243	NR12 OQL

8. Table 2.2 and Table 2.3 contain a summary of the measured baseline noise data at the Happisburgh South landfill during both daytime and night time respectively.

Table 2.2 Baseline noise data – Happisburgh south landfill zone DAYTIME

Receptor identifier	Date	Start time	End Time	L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}
LFR1H	10/05/2017	14:51:00	15:21:00	53.2	71.2	55.0	47.9
		17:34:44	17:49:44	46.0	64.1	46.8	43.2
LFR2H	10/05/2017	15:28:30	15:58:30	48.8	67.0	49.8	46.5
		17:56:13	18:11:13	47.6	69.8	44.3	39.9
LFR3H	10/05/2017	15:46:52	16:16:52	52.2	74.4	45.1	39.0
		17:34:25	17:54:35	50.1	74.3	45.9	40.5
LFR4H	10/05/2017	15:08:28	15:38:28	46.7	70.7	46.7	41.8
		18:02:34	18:17:34	50.9	74.8	45.7	39.1

Table 2.3 Baseline noise data – Happisburgh south landfill zone NIGHT-TIME

Receptor identifier	Date	Start time	End Time	L _{Aeq}	L _{AMax}	L _{A10}	L _{A90}
LFR1H	11/05/2017	00:13:01	00:33:01	43.3	55.5	45.0	41.0
LFR2H	11/05/2017	00:39:40	00:59:40	36.0	57.3	37.2	33.5
LFR3H	11/05/2017	00:37:01	00:57:01	34.0	38.4	35.0	32.8
LFR4H	11/05/2017	00:05:57	00:25:57	39.2	43.8	40.7	37.3

2.2 Onshore Cable Route

9. The onshore cable route measurement locations are detailed within Table 2.4 and shown on Figure 25.1.1a (maps 1 to 9).
10. Following the commitment by Norfolk Boreas Limited in February 2018 to use the HDVC export system the cable relay station is no longer required. However, the measurement locations in this area are still considered representative of the sensitive receptors in the vicinity of the onshore cable route and are therefore have

been included as locations for the onshore cable route. A separate methodology was applied at these locations and therefore is presented separately below.

Table 2.4 Baseline noise monitoring locations – onshore cable route

Receptor identifier	Parish/ location	X	Y	Nearest postcode
CRR1E*	Walcott	635949	331285	NR12 OPB
CRR2E	Walcott	636275	330859	NR12 ONU
CRR3E	Walcott	635628	330631	NR12 OPA
CRR4E	Walcott	634739	330870	NR28 9NU
CRR1F*	Walcott	636233	330633	NR12 ONX
CRR2F	Walcott	636378	330155	NR12 ORG
CRR3F	Walcott	637451	330256	NR12 ORA
CRR1G	Walcott	635919	330534	NR12 OPA
CRR2G	Walcott	636313	330189	NR12 ORG
CRR3G*	Walcott	635265	330525	NR28 9NX
CRR4G*	Walcott	635380	329807	NR12 9HZ
CRR1	North Walsham	629198	331553	NR28 ORB
CRR2	North Walsham	628589	331706	NR28 ORE
CRR3	North Walsham	626854	331810	NR28 ONE
CRR4	North Walsham	624030	330724	NR11 7EP
CRR5	Colby	622827	330294	NR11 7EB
CRR6	Banningham	621546	330310	NR11 7ED
CRR7	Banningham	621542	329521	NR11 7DY
CRR8	Aylsham	621064	328818	NR11 6LS
CRR9	Aylsham	620121	328664	NR11 6LR
CRR10	Aylsham	617483	327683	NR11 6NN
CRR11	Aylsham	616336	326789	NR11 6UL
CRR12	Cawston	614711	325473	NR10 4HT
CRR13	Cawston	613563	324840	NR10 4HZ
CRR14	Cawston	612394	324575	NR10 4EP
CRR15	Reepham	610616	323759	NR10 4FJ
CRR16	Reepham	610373	324059	NR10 4RZ
CRR17	Reepham	607770	323244	NR10 4RS
CRR18	Reepham	606953	322777	NR10 4RJ
CRR19	Reepham	607207	321427	NR10 4RQ

Receptor identifier	Parish/ location	X	Y	Nearest postcode
CRR20	Sparham	606512	319757	NR9 5QU
CRR21	Bylaugh	604276	318184	NR20 4QF
CRR22	Bylaugh	604088	317164	NR20 3EP
CRR23	Swanton Morley	601847	315633	NR20 4NT
CRR24	Swanton Morley	602288	316063	NR20 4NX
CRR25	Swanton Morley	601167	315515	NR20 4PT
CRR26	Dereham	599455	315130	NR19 2DQ
CRR27	Dereham	598878	314731	NR19 2SU
CRR28	Dereham	596691	315085	NR19 2QD
CRR29	Dereham	595122	313967	NR19 2PA
CRR30	Dereham	594861	312828	NR19 2QN
CRR31	Dereham	594423	312613	NR19 2QN
CRR32	Dereham	594847	312215	NR19 2PF
CRR33	Dereham	593102	311688	NR19 2LU

*Long term monitoring was conducted at these locations.

11. At the locations in the area of the former cable relay station (CRR1E, 2E, 3E, 4E, 1F, 3F, 1G 2G, 3G) it was noted within the methodology presented to and agreed with the ETG that where land access and security constraints allow, continuous logging equipment would be installed for up to one week and would measure five minute records of the noise level. If logging equipment could not be left unmanned (for example if land access was not agreed), multiple short-term attended measurements would be taken at various times throughout the daytime and night-time reference periods.
12. Samples of L_{A90} were cross referenced against weather data recorded on site during the measurement period. Representative environmental noise measurements should be undertaken during favourable weather conditions, i.e. with windspeed <5m/s and no precipitation. All samples influenced by adverse weather conditions (and therefore unsuitable for noise monitoring due to noise interference) have been removed from the final results. This is evident in the disparity between samples collected against total possible samples within the measurement analysis tables.
13. Statistical analysis methods have been applied to the resulting data sets in order to assess the background noise levels with a greater degree of scrutiny.
14. Table 2.5 to Table 2.8 contain a summary of the long term measured baseline noise data within the relevant locations.

Table 2.5 Baseline noise data analysis – CRR1E (LONG TERM)

Period	Total possible samples	Samples collected	% of potential samples	LA90 analytics (dB)			
				Mode	Average	Average – 1 standard deviation	Average + 1 standard deviation
Day 10/05/17 to 17/05/17	448	305	68.1	>40.0, <41.0	40.8	37.3	44.2
Night 10/05/17 to 17/05/17	224	196	87.5	>30.0, <31.0	33.7	29.8	37.6

Table 2.6 Baseline noise data analysis – CRR1F (LONG TERM)

Period	Total possible samples	Samples collected	% of potential samples	LA90 analytics (dB)			
				Mode	Average	Average – 1 standard deviation	Average + 1 standard deviation
Day 28/04/17 to 03/05/17	448	163	36.4	>46.0, <47.0	43.3	36.8	49.8
Night 28/04/17 to 03/05/17	224	94	42.0	>29.0, <30.0	31.6	25.3	38.0

Table 2.7 Baseline noise data analysis – CRR3G (LONG TERM)

Period	Total possible samples	Samples collected	% of potential samples	LA90 analytics (dB)			
				Mode	Average	Average – 1 standard deviation	Average + 1 standard deviation
Day 28/04/17 to 03/05/17	448	154	34.4	>29.0, <30.0	32.3	27.0	37.5
Night 28/04/17 to 03/05/17	224	93	41.5	>32.0, <33.0	26.3	20.8	31.9

Table 2.8 Baseline noise data analysis – CRR4G (LONG TERM)

Period	Total possible samples	Samples collected	% of potential samples	LA90 analytics (dB)			
				Mode	Average	Average – 1 standard deviation	Average + 1 standard deviation
Day 27/04/17 to 03/05/17	448	166	37.1	>34.0, <35.0	34.9	30.7	39.1
Night 27/04/17 to 03/05/17	224	94	42.0	>24.0, <25.0	29.7	23.8	35.6

15. Table 2.9 to Table 2.10 contain a summary of the short term attended measured baseline noise data at the relevant locations.

Table 2.9 Baseline noise data – CRR2E, CRR4E, CRR2F, CRR3F DAYTIME

Receptor identifier	Date	Start time	End time	LAeq	LAm _{ax}	LA10	LA90
CRR2E	12/05/2017	11:45:00	12:45:00	44.2	73.0	43.1	36.6
CRR4E	12/05/2017	10:25:42	10:55:42	41.3	58.6	41.3	35.1
	12/05/2017	10:56:29	11:26:59	46.2	66.1	44.4	39.1
CRR2F	12/05/2017	10:34:25	11:34:25	42.4	57.5	43.8	39.1
CRR3F	12/05/2017	11:35:24	12:35:24	46.1	78.0	45.6	36.1

Table 2.10 Baseline noise data – CRR4E, CRR2F, CRR3F NIGHT TIME

Receptor identifier	Date	Start time	End time	LAeq	LAm _{ax}	LA10	LA90
CRR4E	12/05/2017	02:03:39	02:23:39	30.2	43.7	31.7	28.2
CRR2F	12/05/2017	02:33:19	02:53:19	33.0	55.4	33.4	31.8
CRR3F	12/05/2017	02:34:07	02:53:57	36.9	43.1	37.4	36.0

16. For the remaining onshore cable route receptor locations there have been no amendments to the proposed approach for the baseline noise survey. Measurements were conducted on a fully attended basis at all locations detailed within Table 2.11 and Table 2.12, which contain a summary of the measured baseline noise data.

Table 2.11 Baseline noise data – onshore cable route DAYTIME

Receptor identifier	Date	Start time	End time	L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}
CRR1	04/05/2017	17:56:13	18:26:13	47.8	73.4	45.9	42.9
CRR2	04/05/2017	17:24:09	17:54:09	68.8	83.6	68.7	50.9
CRR3	04/05/2017	17:15:37	17:45:37	51.0	74.0	48.5	43.8
CRR4	04/05/2017	16:27:51	16:57:21	48.2	74.4	42.5	38.7
CRR5	04/05/2017	16:29:20	16:59:20	52.2	77.4	51.2	45.4
CRR6	04/05/2017	15:52:09	16:17:29	47.8	61.8	47.9	44.5
CRR7	04/05/2017	15:41:28	16:11:28	53.9	76.8	52.4	46.7
CRR8	04/05/2017	15:03:45	15:33:45	63.6	82.8	62.3	49.9
CRR9	04/05/2017	15:03:23	15:33:23	52.9	80.3	50.5	46.2
CRR10	04/05/2017	14:19:43	14:49:43	45.4	63.3	46.3	41.1
CRR11	04/05/2017	14:19:23	14:49:23	49.5	68.5	49.4	46.3
CRR12	04/05/2017	13:31:46	14:01:36	57.6	77.3	57.3	49.9
CRR13	04/05/2017	13:09:58	13:39:58	50.9	72.4	49.7	44.7
CRR14	04/05/2017	12:50:43	13:20:43	51.5	76.6	48.7	44.5
CRR15	04/05/2017	12:44:13	12:59:13	46.8	66.7	47.3	43.9
	04/05/2017	13:47:40	14:02:40	48.8	65.1	49.6	42.9
CRR16	03/05/2017	16:29:16	16:59:16	53.2	74.0	51.6	44.0
CRR17	03/05/2017	16:20:15	16:50:15	48.8	73.8	46.9	40.9
CRR18	03/05/2017	15:48:11	16:06:41	47.7	62.2	48.1	43.9
CRR19	03/05/2007	15:41:11	16:11:11	48.9	67.7	50.9	41.9
CRR20	03/05/2017	14:55:47	15:25:47	51.0	78.7	47.8	43.7
CRR21	03/05/2017	14:48:16	15:18:16	48.4	77.9	45.7	41.1
CRR22	03/05/2017	14:13:17	14:43:17	43.0	60.8	41.6	36.4
CRR23	03/05/2017	14:05:42	14:35:42	50.4	77.7	44.4	39.6
CRR24	03/05/2017	13:03:46	13:33:46	51.6	75.3	49.4	45.3
CRR25	03/05/2017	13:17:41	13:47:41	60.2	79.5	57.9	44.3
CRR26	03/05/2017	12:24:39	12:54:39	49.8	72.7	50.7	40.4
CRR27	03/05/2017	12:31:34	13:01:34	60.1	77.4	58.9	47.4
CRR28	03/05/2017	11:44:35	12:14:35	57.0	80.3	49.6	40.5
CRR29	03/05/2017	11:45:20	12:15:20	49.9	68.6	51.1	38.6
CRR30	03/05/2017	11:04:32	11:34:32	67.7	83.0	68.7	52.3
CRR31	03/05/2017	11:04:28	11:34:28	58.9	82.0	59.2	51.2

Receptor identifier	Date	Start time	End time	L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}
CRR32	03/05/2017	10:28:07	10:58:07	58.6	76.7	57.9	51.3
CRR33	03/05/2017	10:24:20	10:54:20	56.5	84.6	50.9	44.1

Table 2.12 Baseline noise data – onshore cable route NIGHT-TIME

Receptor identifier	Date	Start time	End time	L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}
CRR1	05/05/2017	02:27:30	02:42:30	33.3	59.8	33.1	30.4
CRR2	05/05/2017	02:23:34	02:38:34	53.1	81.5	33.5	29.9
CRR3	05/05/2017	02:55:00	03:10:00	30.7	52.8	30.7	28.4
CRR4	05/05/2017	01:56:13	02:11:13	29.4	49.3	29.9	27.1
CRR5	05/05/2017	02:04:05	02:19:05	31.1	55.9	31.2	29.6
CRR6	05/05/2017	01:30:32	01:45:32	36.9	50.9	37.8	34.8
CRR7	05/05/2017	01:33:03	01:48:03	35.1	64.2	34.9	32.3
CRR8	05/05/2017	01:09:52	01:24:52	32.1	54.3	31.9	26.1
CRR9	05/05/2017	01:07:16	01:22:16	37.5	51.0	37.9	34.9
CRR10	05/05/2017	00:44:53	00:59:53	27.6	43.5	27.9	25.5
CRR11	05/05/2017	00:38:17	00:53:17	33.1	54.1	33.5	30.9
CRR12	05/05/2017	00:15:22	00:30:22	45.5	70.7	33.2	29.8
CRR13	05/05/2017	00:15:50	00:30:50	29.6	54.7	28.8	25.6
CRR14	04/05/2017	23:45:59	00:00:49	32.4	47.1	31.9	28.4
CRR15	04/05/2017	23:51:20	00:06:20	31.8	52.9	31.8	28.0
CRR16	04/05/2017	00:08:53	00:23:53	35.0	49.7	35.8	31.5
CRR17	04/05/2017	00:08:40	00:23:40	32.3	57.5	32.9	26.8
CRR18	04/05/2017	00:32:44	00:47:34	31.5	60.5	31.2	28.1
CRR19	04/05/2017	00:36:18	00:51:18	30.1	54.5	30.7	27.5
CRR20	04/05/2017	00:58:33	01:13:33	29.4	49.9	28.6	25.4
CRR21	04/05/2017	01:07:04	01:22:04	32.7	59.4	31.6	28.3
CRR22	04/05/2017	01:24:28	01:39:28	26.4	46.1	26.0	23.2
CRR23	04/05/2017	01:34:02	01:49:02	30.6	58.4	28.9	26.1
CRR24	04/05/2017	01:48:11	02:06:21	27.2	36.6	27.4	25.4
CRR25	04/05/2017	01:54:08	02:09:08	46.6	74.6	30.5	23.2
CRR26	04/05/2017	02:17:23	02:32:33	29.0	48.6	29.4	26.3
CRR27	04/05/2017	02:16:14	02:31:14	28.7	90.1	33.0	29.7
CRR28	04/05/2017	02:44:59	02:59:59	27.5	55.4	27.4	22.3

Receptor identifier	Date	Start time	End time	L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}
CRR29	04/05/2017	02:45:46	03:00:46	31.0	62.2	25.7	22.2
CRR30	04/05/2017	03:08:48	03:23:48	59.9	80.6	40.8	32.9
CRR31	04/05/2017	03:07:19	03:22:19	40.3	53.4	39.3	34.5
CRR32	04/05/2017	03:29:04	03:44:04	41.0	54.8	40.6	37.0
CRR33	04/05/2017	03:27:28	03:42:28	33.1	52.9	33.8	29.1

2.3 Onshore Project Substation / National Grid Substation Extension

17. Since the methodology was agreed, amendments to the survey approach within the onshore project substation study area were necessary. Namely receptor locations SSR1 – SSR4 were moved due to issues with access rights. These are highlighted in the table below.
18. Onshore project substation measurement locations are detailed within Table 2.13 and are shown on Figure 25.1.1b and 25.1.1c.

Table 2.13 Baseline noise monitoring locations – onshore project substation

Receptor identifier	Parish/ location	X	Y	Nearest postcode
SSR1*	Necton	588486	309896	PE37 8HY
SSR2*	Necton	589787	309564	PE37 8JB
SSR3*	Bradenham	592046	310041	NR19 2JY
SSR3 ALT**	Bradenham	592331	310051	IP25 7RQ
SSR4*	Little Fransham	590955	311011	PE37 8JB
SSR5	Little Fransham	588826	311107	PE37 8DL
SSR6	Little Fransham	591717	311554	NR19 2JY
SSR7	Little Fransham	589770	311296	NR19 2RQ
SSR8	Little Fransham	589914	311696	NR19 2JW
SSR9	Little Fransham	591060	311805	NR19 2JU
SSR10	Bradenham	590741	309382	IP25 7QZ
SSR11	Necton	588478	310811	PE37 8DL

*Amended since methodology agreed due to access rights.

**Additional measurement position added as it was more representative of the identified receptor location within the previously agreed methodology.

19. At SSR1, long term noise monitoring was conducted over a period of 24 hours (23/05/17 to 24/05/17) consisting of one-minute samples in order to gain a better spread of data throughout the period as a one week profile of 5 minute samples wasn't possible due to land access issues.

20. Short-term attended measurements were taken at the other aforementioned monitoring locations.
21. Table 2.14 to Table 2.16 contain a summary of the long term measured baseline noise data within the onshore project substation zone at baseline locations SSR1, SSR2 and SSR7.

Table 2.14 Baseline noise data – SSR1 (LONG TERM – 24hrs)

Period	Total possible samples	Samples collected	% of potential samples	LA90 analytics (dB)			
				Mode	Average	Average – 1 standard deviation	Average + 1 standard deviation
Day 23/05/17 to 24/05/17	960	960	100	>38.0, <39.0	37.7	34.2	41.1
Night 23/05/17 to 24/05/17	480	480	100	>39.0, <40.0	33.8	25.9	41.6

Table 2.15 Baseline noise data – SSR2 (LONG TERM)

Period	Total possible samples	Samples collected	% of potential samples	LA90 analytics (dB)			
				Mode	Average	Average – 1 standard deviation	Average + 1 standard deviation
Day 28/04/17 to 05/05/17	448	262	58.5	>34.0, <35.0	32.2	27.1	37.3
Night 28/04/17 to 05/05/17	224	218	97.3	>29.0 <30.0	28.4	22.3	34.5

Table 2.16 Baseline noise data – SSR7 (LONG TERM)

Period	Total possible samples	Samples collected	% of potential samples	LA90 analytics (dB)			
				Mode	Average	Average – 1 standard deviation	Average + 1 standard deviation
Day 03/05/17	448	277	61.8	>45.0, <46.0	46.3	42.6	50.0

Period	Total possible samples	Samples collected	% of potential samples	LA90 analytics (dB)			
				Mode	Average	Average – 1 standard deviation	Average + 1 standard deviation
to 10/05/17							
Night 03/05/17 to 10/05/17	224	196	87.5	>36.0, <37.0	39.4	33.6	45.1

22. Table 2.17 to Table 2.18 contain a summary of the short term attended measured baseline noise data within the onshore project substation zone.

Table 2.17 Baseline noise data – onshore project substation DAYTIME

Receptor identifier	Date	Start time	End time	LAeq	LAmx	LA10	LA90
SSR1	18/05/2017	12:48:30	13:48:30	48.5	78.9	46.5	36.6
SSR3	18/05/2017	15:48:56	16:48:56	55.2	80.2	48.0	39.3
	24/05/2017	11:05:36	12:05:36	59.1	83.4	52.2	39.4
SSR3 ALT	18/05/2017	13:22:30	14:22:30	35.0	61.4	36.7	29.8
	24/05/2016	12:13:56	13:13:56	45.3	70.4	41.7	34.1
SSR4	18/05/2017	15:17:06	16:17:06	37.9	61.7	37.3	29.1
	24/05/2017	11:05:42	12:05:42	35.5	59.6	36.3	32.8
SSR5	18/05/2017	10:52:20	11:52:20	56.7	72.0	57.8	50.7
	24/05/2017	14:23:07	15:23:07	55.5	78.9	56.2	50.3
SSR6	18/05/2017	14:27:43	15:27:43	46.6	66.5	47.8	35.6
	24/05/2017	13:22:41	14:02:41	41.7	61.3	42.9	36.3
SSR8	18/05/2017	11:36:10	12:36:10	68.8	87.9	69.9	58.4
	24/05/2017	14:56:25	15:36:25	69.3	83.7	70.9	58.4
SSR9	18/05/2017	12:15:48	13:15:48	52.0	77.4	51.2	35.8
	24/05/2017	14:08:06	14:48:06	47.3	73.9	43.6	37.2
SSR10	18/05/2017	13:57:54	14:57:54	52.6	71.3	53.4	35.0
	24/05/2017	12:11:35	13:11:35	46.2	69.6	43.7	33.0
SSR11	18/05/2017	10:32:57	11:32:57	67.3	80.7	69.1	57.7
	24/05/2017	13:20:03	14:20:03	65.2	76.4	66.4	55.2

Table 2.18 Baseline noise data – onshore project substation NIGHT-TIME

Receptor identifier	Date	Start time	End time	L _{Aeq}	L _{Amax}	L _{A10}	L _{A90}
SSR1	24/05/2017	00:21:07	00:36:07	34.4	48.6	32.5	27.5
	24/05/2017	02:12:40	02:27:40	36.2	47.8	35.2	31.1
SSR3	24/05/2017	00:59:01	01:14:11	26.3	48.1	26.9	24.4
	24/05/2017	02:50:59	03:05:59	27.5	52.1	27.4	24.8
SSR3 ALT	24/05/2017	00:37:32	00:52:32	30.5	52.4	30.6	26.1
	24/05/2017	02:29:32	02:44:32	32.3	56.0	32.5	26.9
SSR4	23/05/2017	23:37:59	23:52:59	28.4	44.1	28.9	24.8
	24/05/2017	01:30:20	01:47:20	27.0	48.1	25.6	20.9
SSR5	24/05/2017	01:00:09	01:15:09	45.5	63.4	35.2	29.7
	24/05/2017	02:52:08	03:07:08	48.7	67.9	36.7	30.0
SSR6	24/05/2017	00:17:11	00:32:11	33.7	49.5	32.1	27.4
	24/05/2017	02:10:32	02:25:32	24.2	52.5	35.2	29.8
SSR8	23/05/2017	23:35:27	23:50:27	59.2	80.6	47.1	38.7
	24/05/2017	01:28:26	01:43:26	57.4	80.3	39.8	34.9
SSR9	23/05/2017	23:57:14	00:12:14	37.1	53.1	36.4	32.3
	24/05/2017	01:50:01	02:05:01	36.4	51.5	36.9	32.0
SSR10	24/05/2017	00:00:02	00:15:02	24.6	36.9	25.4	21.9
	24/05/2017	01:52:58	02:07:58	24.1	41.6	24.6	21.7
SSR11	24/05/2017	00:41:17	00:56:17	55.9	72.8	38.8	31.1
	24/05/2017	02:33:16	02:48:16	54.4	75.6	38.7	31.4

3 Conclusion

23. In order to characterise the existing noise climate within the Norfolk study area a baseline noise survey was undertaken at agreed sensitive receptor locations in the vicinity of the site and across the onshore project area (see Figure 25.1) between 27th April and 24th May 2017.
24. Amendments to the agreed methodology were made at the onshore project substation and in the area of the former cable relay station due to access restrictions. Where this affected long term unattended measurements, short term measurements were taken.
25. Measured data were collated for each location with L_{Aeq}, L_{A90}, L_{A10}, L_{AFmax} levels determined from each specific measurement period. Background noise levels used in the assessment were obtained from the baseline measurements. The background

noise levels for the unattended measurement periods were assessed using statistical analysis of the measured L_{A90} values.

26. Assessment values for receptor locations at the onshore project substation have been derived from long term and short-term measurements.
27. The baseline noise surveys were considered representative of the project study area and were undertaken at the landfall (Happisburgh South), within the onshore cable route and the onshore project substation areas. The receptor locations identified for the Norfolk Boreas onshore project substation were also considered as being representative for the National Grid substation extension works.

4 References

BSI (2003). *British Standards Institution [BS] 7445-1:2003 - Description and measurement of environmental noise. Guide to quantities and procedure.* BSI, London.

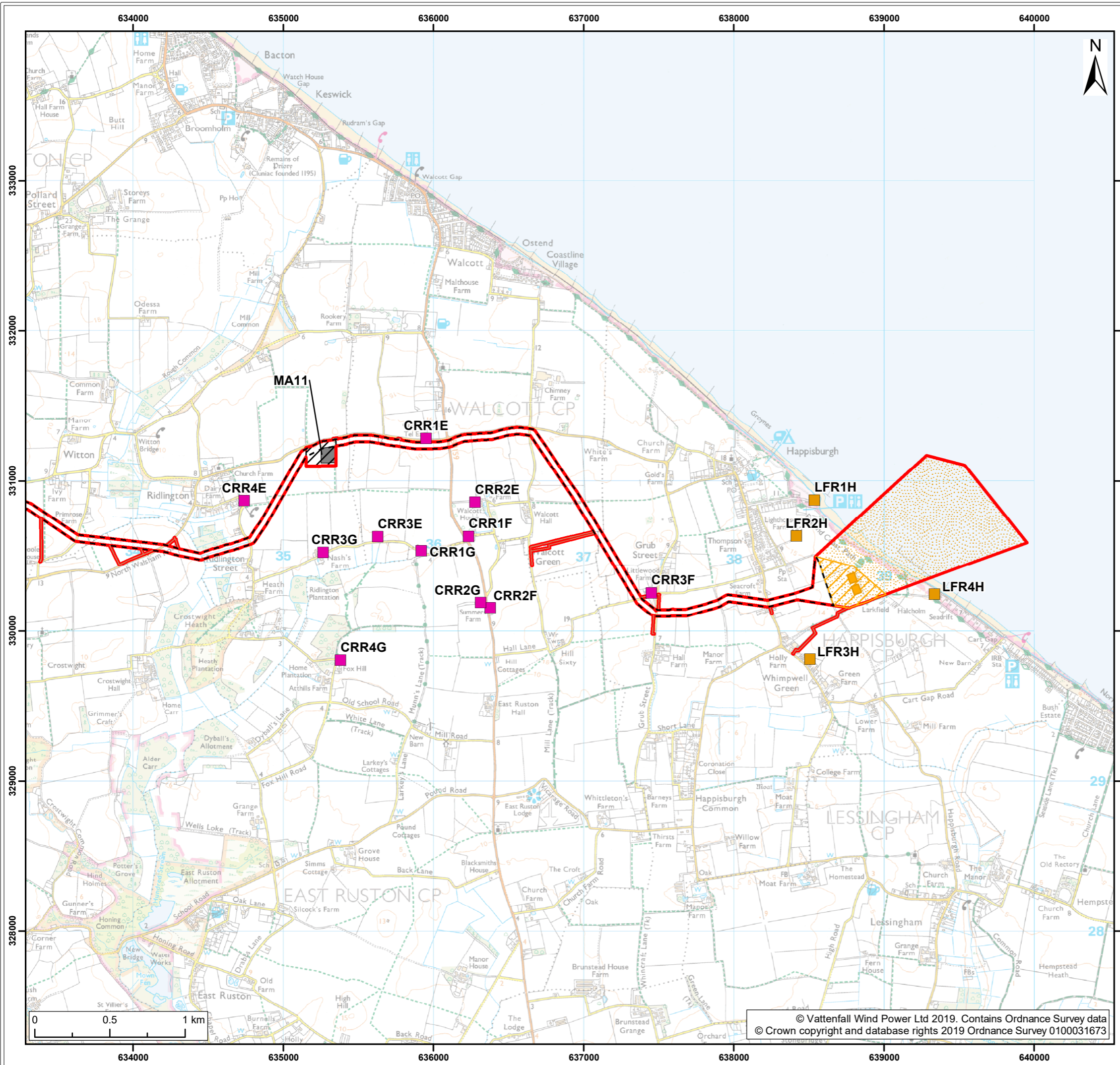
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BSI, (2014). *British Standards Institution [BS] 4142:2014 Methods for rating and assessing industrial and commercial sound.* BSI, London.

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5 Annex 1 Figures

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
 - Landfall zone
 - Landfall compound zone
 - Indicative landfall compound
 - Onshore cable route
 - Construction access
 - Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
 - Mobilisation zone
 - Indicative mobilisation area compound
- Noise monitoring location**
 - Onshore cable route noise monitoring location
 - Landfall noise monitoring location

Project:	Report:
Norfolk Boreas	Baseline Noise Survey

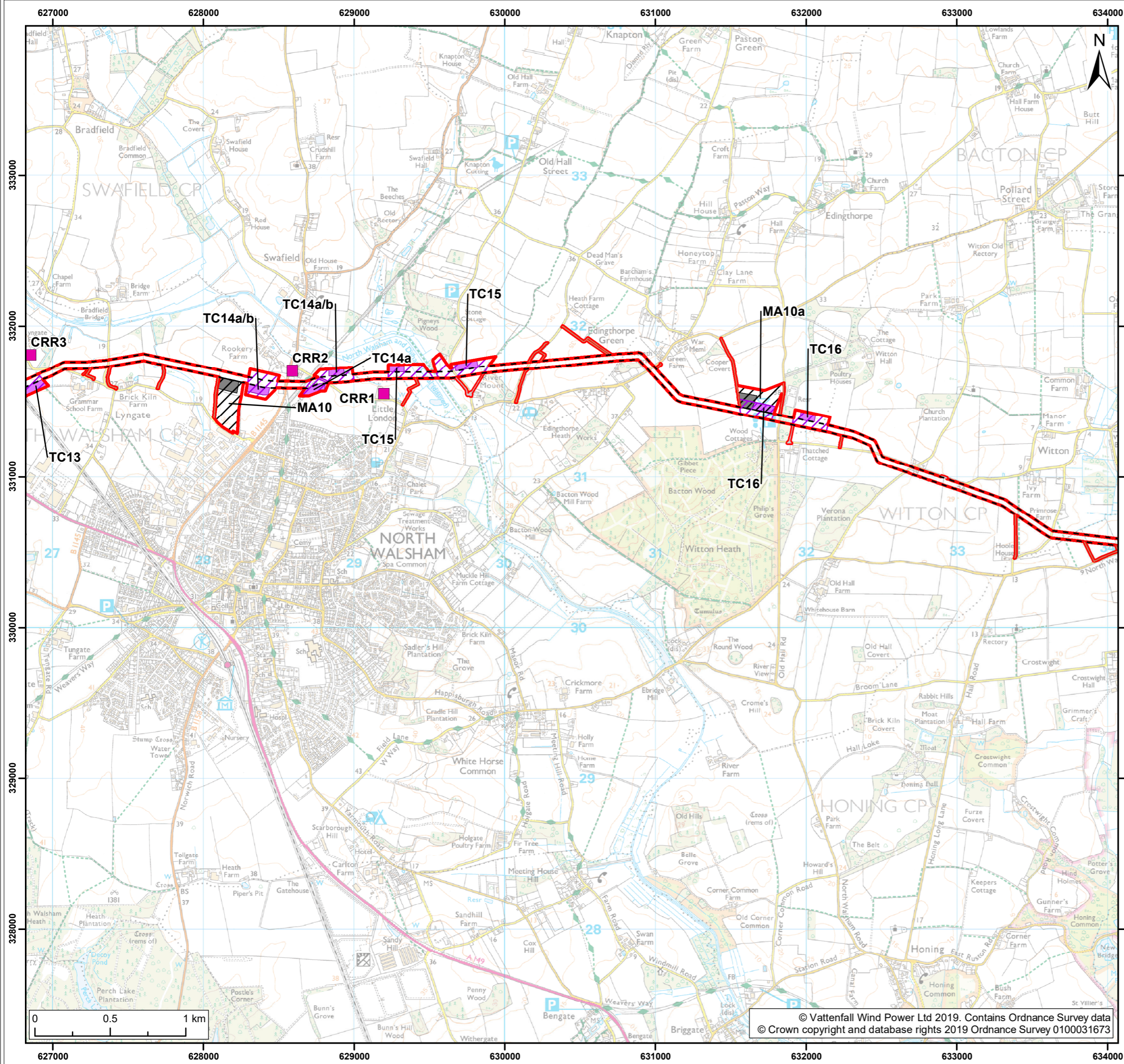
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Noise baseline monitoring locations
(Map 1 of 9)

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
 - Onshore cable route
 - Construction access
 - Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
 - Trenchless crossing zone (e.g. HDD)
 - Indicative trenchless crossing compound
 - Mobilisation zone
 - Indicative mobilisation area compound
- Noise monitoring location**
 - Onshore cable route noise monitoring location

Project: Norfolk Boreas	Report: Baseline Noise Survey
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Title:
Noise baseline monitoring locations
(Map 2 of 9)

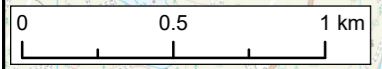
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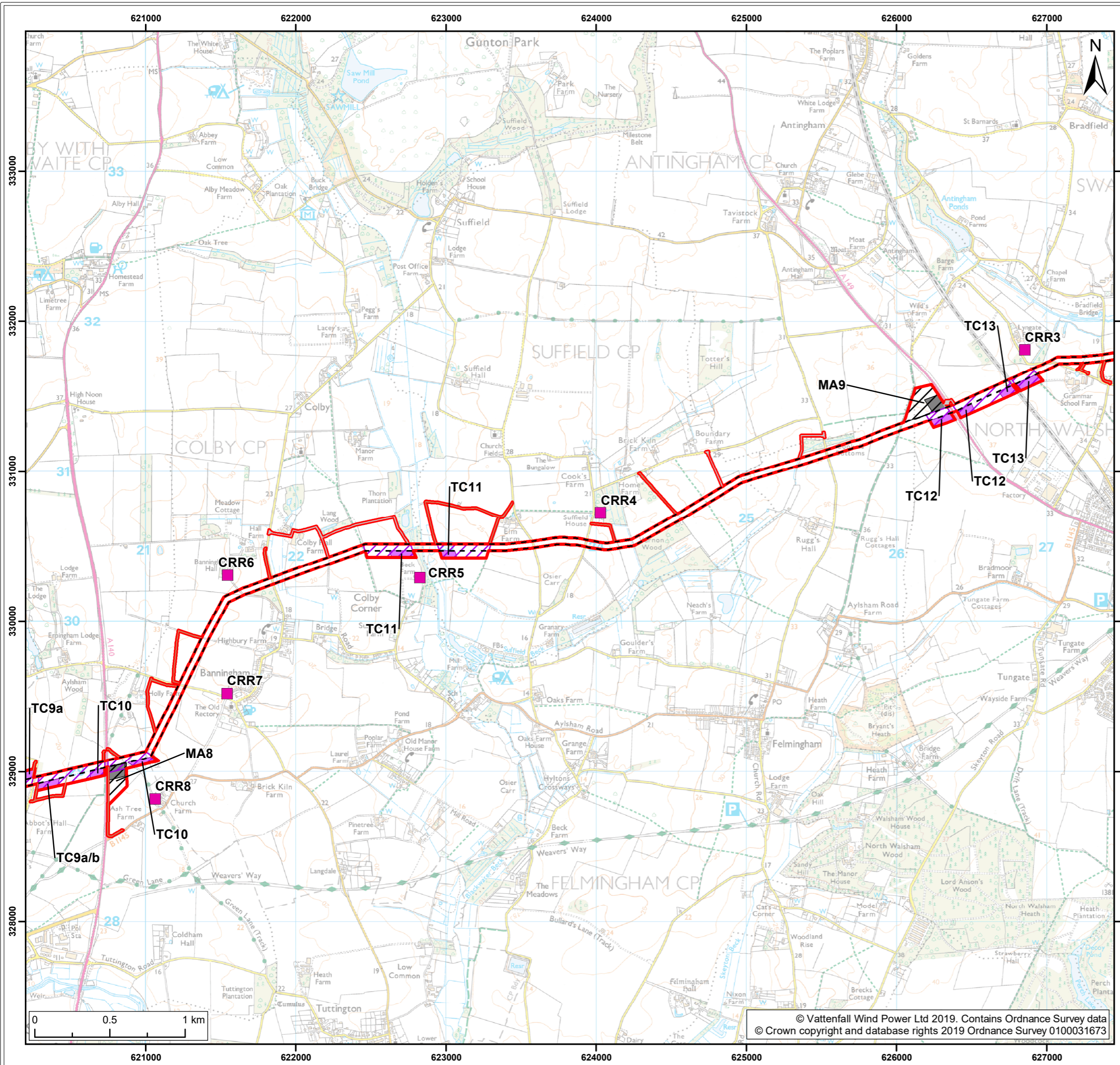
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound
- Noise monitoring location**
- Onshore cable route noise monitoring location

Project: Norfolk Boreas	Report: Baseline Noise Survey
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Title:
Noise baseline monitoring locations
(Map 3 of 9)

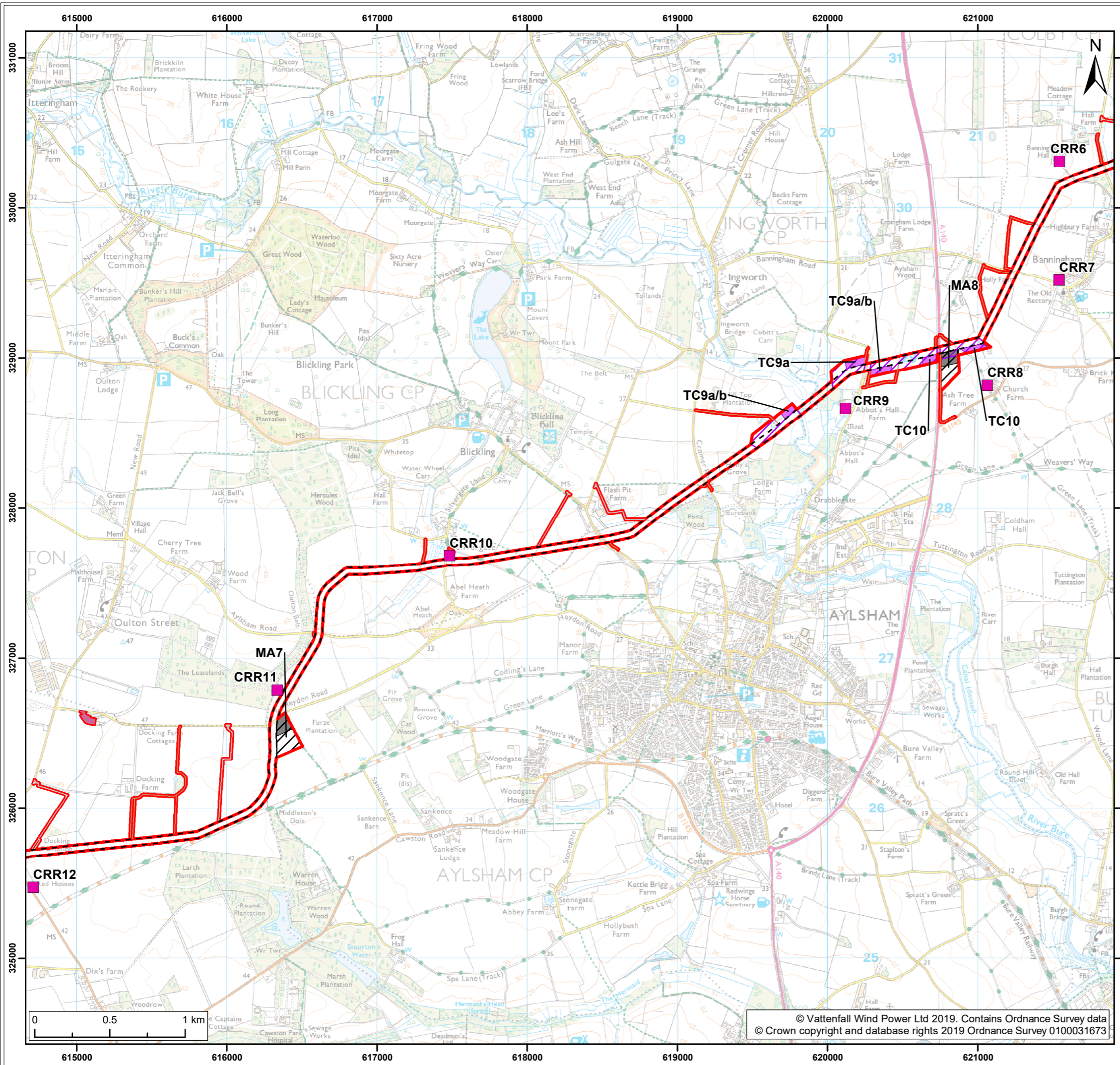
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
 - Onshore cable route
 - Cable logistics area
 - Construction access
 - Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
 - Trenchless crossing zone (e.g. HDD)
 - Indicative trenchless crossing compound
 - Mobilisation zone
 - Indicative mobilisation area compound
- Noise monitoring location**
 - Onshore cable route noise monitoring location

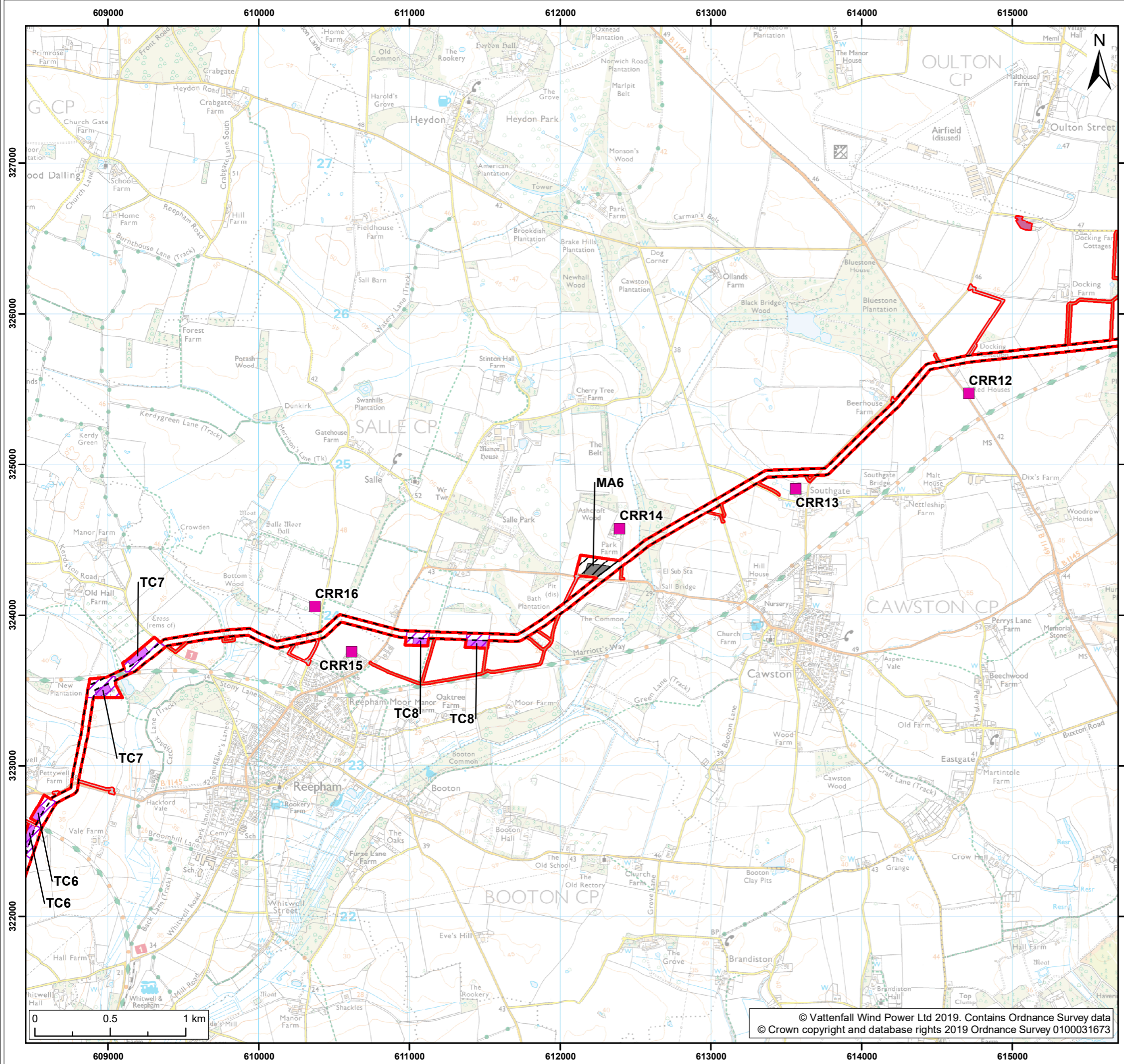
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Norfolk Boreas	Baseline Noise Survey

Title:
Noise baseline monitoring locations
(Map 4 of 9)

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
 - Onshore cable route
 - Cable logistics area
 - Construction access
 - Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
 - Trenchless crossing zone (e.g. HDD)
 - Indicative trenchless crossing compound
 - Mobilisation zone
 - Indicative mobilisation area compound
- Noise monitoring location**
 - Onshore cable route noise monitoring location

Project:	Report:
Norfolk Boreas	Baseline Noise Survey

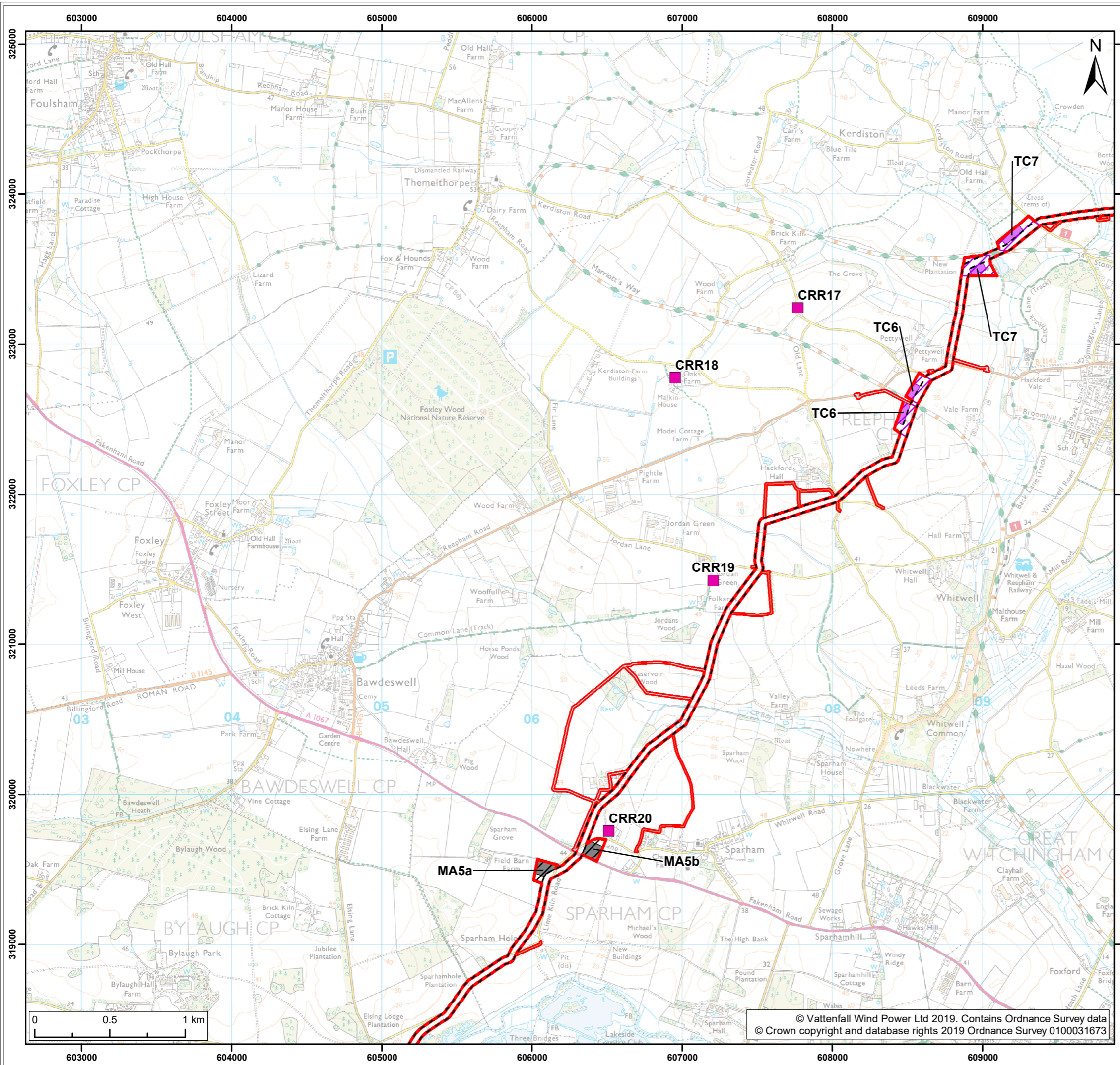
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(Map 5 of 9)

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Co-ordinate system: British National Grid EPSG: 27700

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound
- Noise monitoring location**
- Onshore cable route noise monitoring location

Project: Norfolk Boreas	Report: Baseline Noise Survey
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Title:
Noise baseline monitoring locations
(Map 6 of 9)

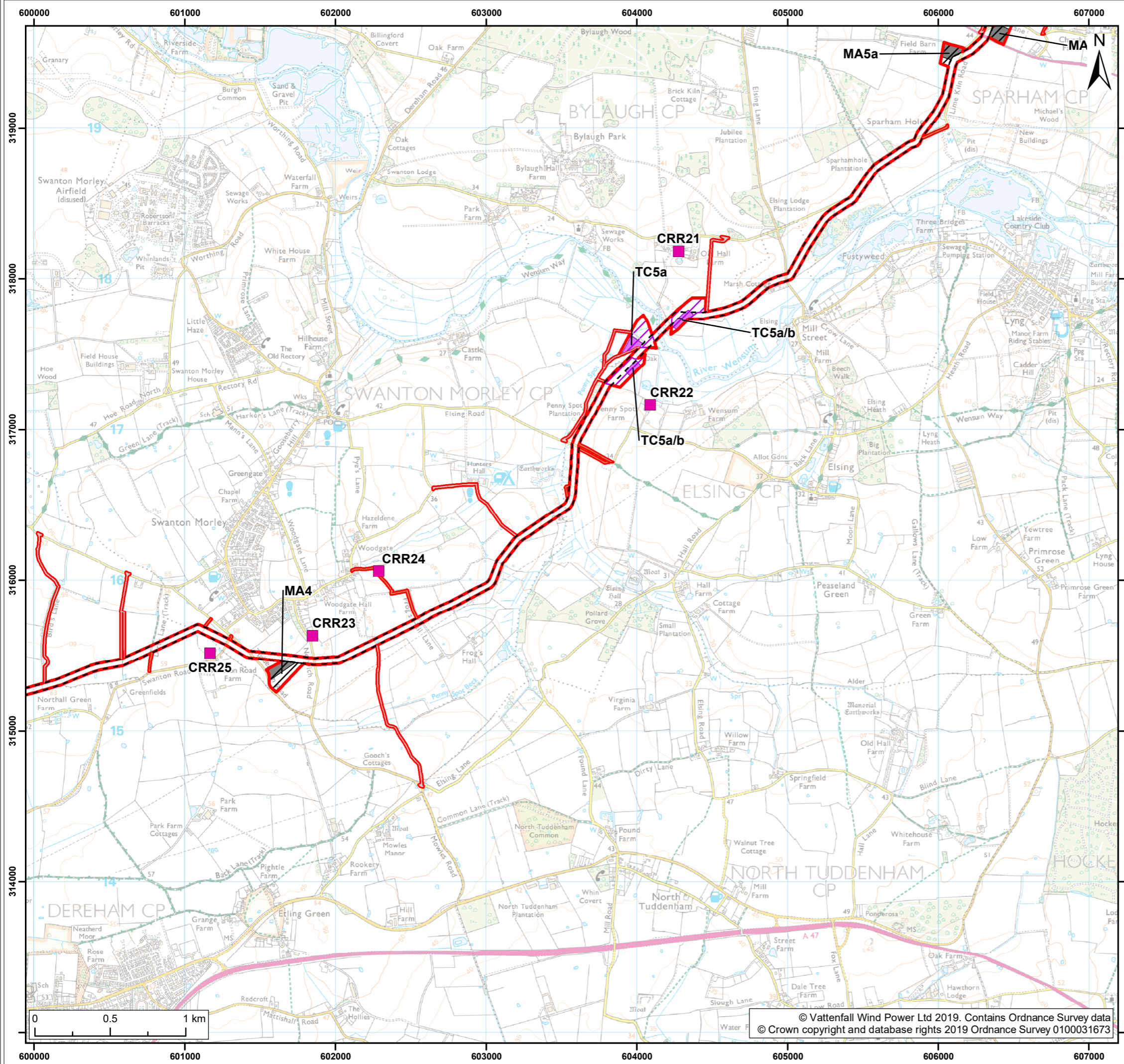
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
 - Onshore cable route
 - Construction access
 - Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
 - Trenchless crossing zone (e.g. HDD)
 - Indicative trenchless crossing compound
 - Mobilisation zone
 - Indicative mobilisation area compound
- Noise monitoring location**
 - Onshore cable route noise monitoring location

Project: Norfolk Boreas	Report: Baseline Noise Survey
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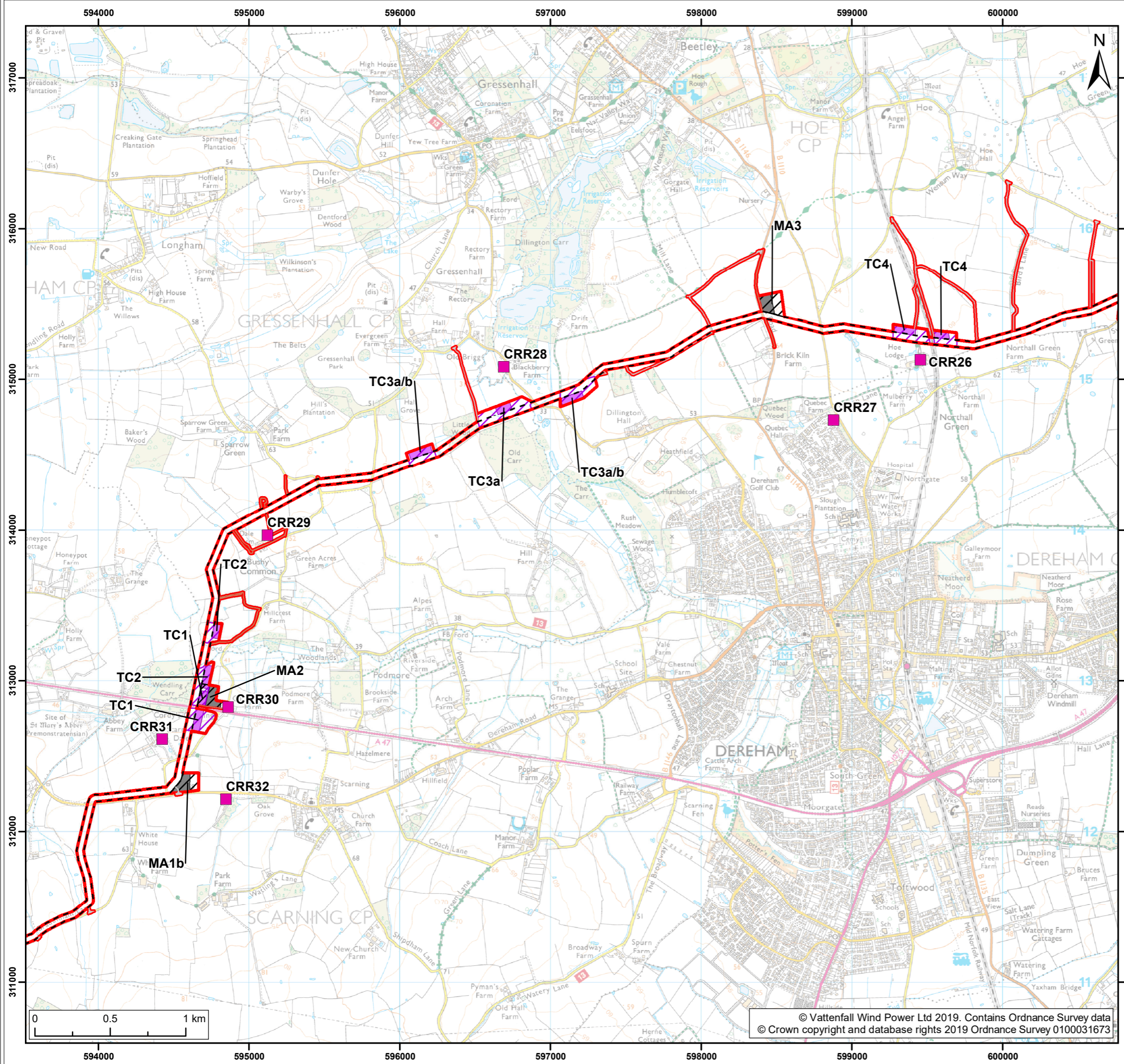
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Noise baseline monitoring locations
(Map 7 of 9)

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Construction access
- Operational access
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)**
- Trenchless crossing zone (e.g. HDD)
- Indicative trenchless crossing compound
- Mobilisation zone
- Indicative mobilisation area compound
- Noise monitoring location**
- Onshore cable route noise monitoring location

Project:	Report:
Norfolk Boreas	Baseline Noise Survey

Title:

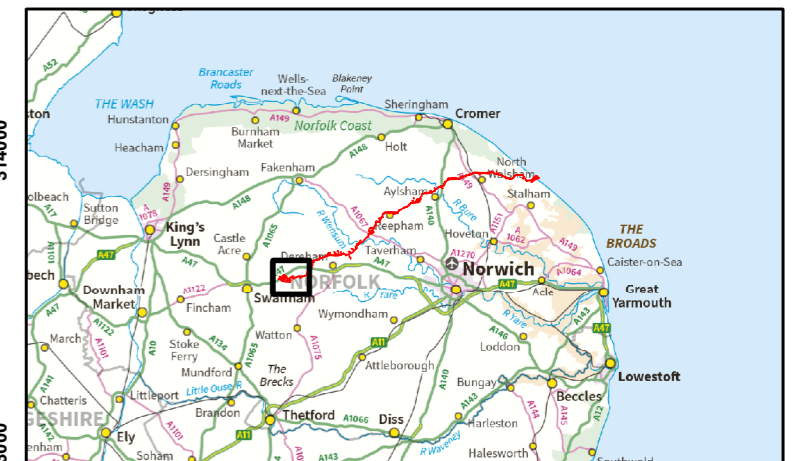
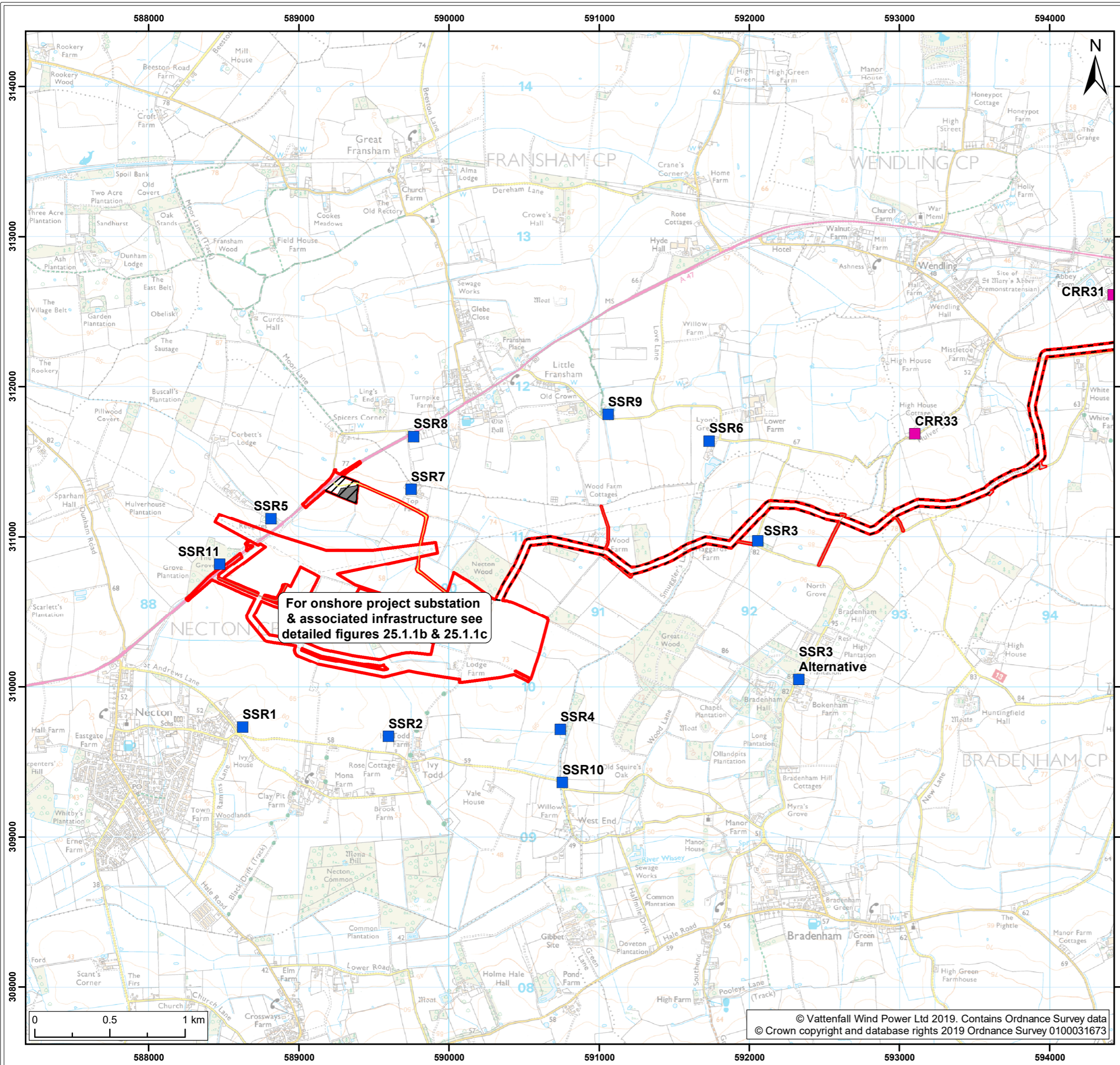
Noise baseline monitoring locations
(Map 8 of 9)

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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 1 & 2)**
- Onshore cable route
- Mobilisation zone
- Indicative mobilisation area compound
- Construction access
- Operational access
- Permanent access
- Noise monitoring location**
- Onshore cable route noise monitoring location
- Substation noise monitoring location

Project: Norfolk Boreas	Report: Baseline Noise Survey
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Title: Noise baseline monitoring locations (Map 9 of 9)

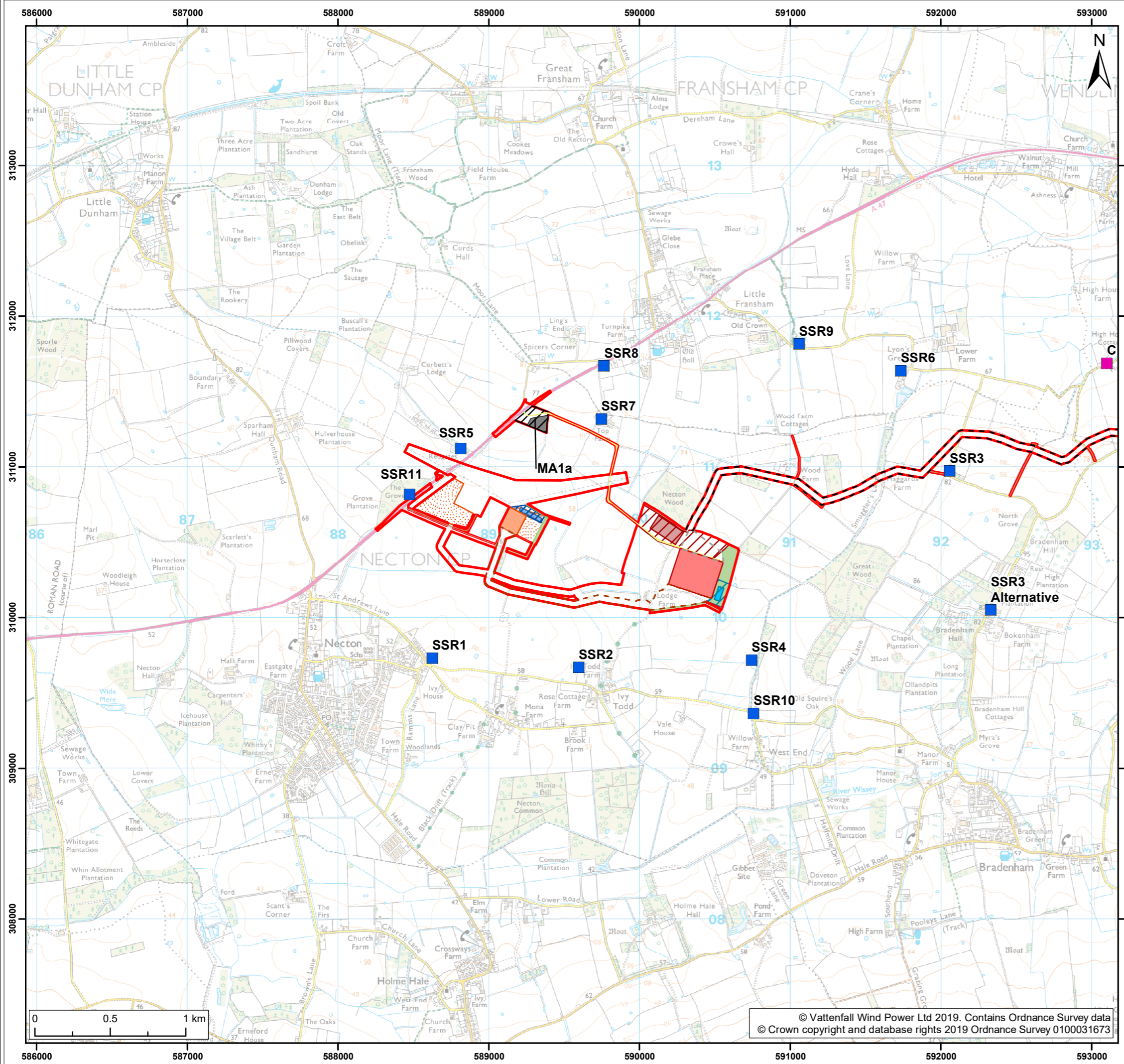
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Legend:

- Norfolk Boreas red line boundary
- Indicative onshore project substation temporary construction compound
- Attenuation pond zone
- Indicative attenuation pond
- Indicative mitigation planting
- National Grid substation extension
- Onshore 400kV cable route
- Mobilisation zone
- Indicative mobilisation area compound
- Construction access
- Operational access
- Permanent access
- Onshore project substation
- Onshore project substation temporary construction compound zone
- National Grid temporary works
- National Grid attenuation pond location search area
- Indicative National Grid attenuation pond
- Noise monitoring location**
- Onshore cable route noise monitoring location
- Substation noise monitoring location

Project:	Report:
Norfolk Boreas	Baseline Noise Survey

Title:
Noise baseline monitoring locations

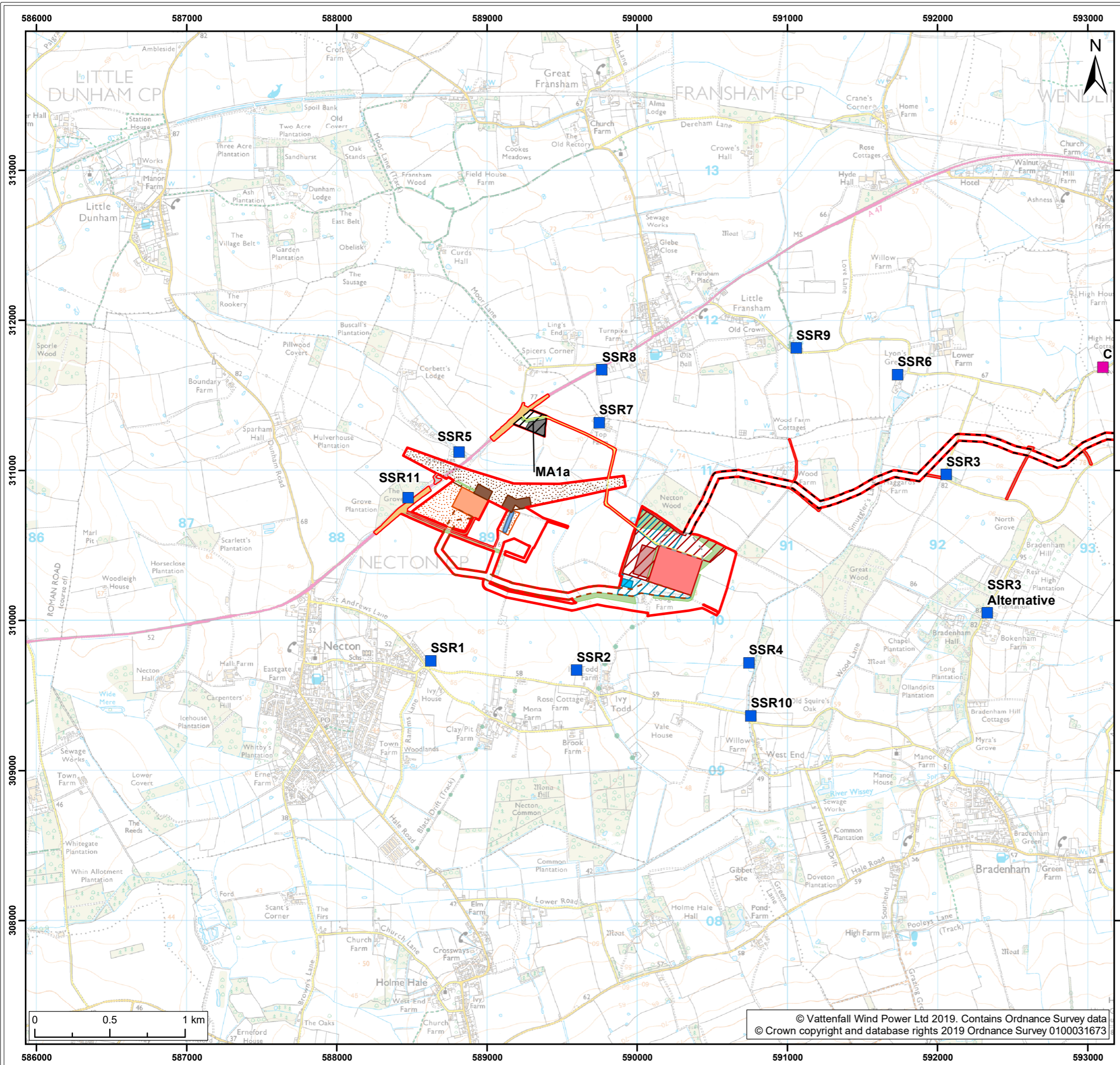
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Legend:

- Norfolk Boreas red line boundary
- Norfolk Boreas Onshore Project Infrastructure (Scenario 2)
- Onshore cable route
- Cable route entry to substation
- Onshore 400kV cable route
- Mobilisation zone
- Indicative mobilisation area compound
- Highways temporary works area
- Construction access
- Operational access
- Permanent access
- Onshore project substation
- Onshore project substation temporary construction compound zone
- Indicative onshore project substation temporary construction compound
- Attenuation pond zone
- Indicative attenuation pond
- Indicative mitigation planting
- National Grid substation extension
- National Grid new / replacement OHL tower search area
- National Grid temporary works
- Overhead line temporary works
- National Grid attenuation pond
- Noise monitoring location
- Onshore cable route noise monitoring location
- Substation noise monitoring location

Project:	Report:
Norfolk Boreas	Baseline Noise Survey

Title:
Noise baseline monitoring locations

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