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Lostock Sustainable Energy Plant



Lostock Sustainable Energy Plant Ltd

EIA Report for Proposed Increase to Waste Tonnage Throughput of the Lostock Sustainable Energy Plant

Appendix 5.1 - Baseline Analysis

Document approval

	Name	Signature	Position	Date
Prepared by:	Hannah Lederer		Environmental Scientist	08/07/2021
Checked by:	Rosalind Flavell		Senior Consultant	08/07/2021

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1 Introduction

This Appendix contains a review of the baseline air quality and defines appropriate baseline concentrations to describe the existing air quality conditions in the local area. The results of which are drawn upon in the Environmental Impact Assessment (EIA) Report (Main Report) Chapter 5: Air Quality and Human Health, and Appendix 5.2 [Emissions Modelling], which support the Proposal to increase the total waste tonnage of the LSEP.

As part of this review, national modelling data, local authority and national monitoring networks have been considered. This has included all pollutants covered in the EIA Report (Main Report) Chapter 5.

2 Local authority air quality review and assessment

2.1 Overview

Under Section 82 of the Environment Act (1995) (Part IV), local authorities are required to undertake an ongoing exercise to review air quality within their area of jurisdiction. The Site is located within Cheshire West and Chester Council area.

There are no Air Quality Management Areas (AQMA) which have been declared within 5 km of the Site. Therefore, no local Air Quality Action Plan has been addressed.

3 National modelling – mapped background data

In order to assist local authorities with their responsibilities under Local Air Quality Management, DEFRA provides modelled background concentrations of pollutants across the UK on a 1 km by 1 km grid. This model is based on known pollution sources and background measurements and is used by local authorities in lieu of suitable monitoring data. Mapped background concentrations have been downloaded for the grid squares containing the Site and immediate surroundings. In addition, mapped atmospheric concentrations of ammonia are available from DEFRA via the National Environment Research Council (NERC) Centre for Ecology and Hydrology (CEH) throughout the UK on a 5 km by 5 km grid.

The mapped background data is calibrated against monitoring data. For instance, the 2018 mapped background concentrations are based on 2018 meteorological data and are calibrated against monitoring undertaken in 2018. As a conservative approach where mapped background data is used the concentration for the year against which the data was validated has been used. This eliminates any potential uncertainties over anticipated trends in future background concentrations.

Concentrations will vary over the modelling domain area. Therefore, the maximum mapped background concentration from within 5 km of the Site has been calculated, as presented in Table 1, together with the concentration at the Site.

Table 1: Mapped Background Data

Pollutant	Annual mean concentration ($\mu\text{g}/\text{m}^3$)		Dataset
	At Site	Max within 5 km of Site	
Nitrogen dioxide	10.70	17.05	DEFRA 2018 Dataset
Oxides of nitrogen	14.15	23.38	DEFRA 2018 Dataset
Sulphur dioxide	7.71	14.70	DEFRA 2001 Dataset
Particulate matter (as PM_{10})	10.83	12.98	DEFRA 2018 Dataset
Particulate matter (as $\text{PM}_{2.5}$)	7.16	8.79	DEFRA 2018 Dataset
Carbon monoxide	313	345	DEFRA 2001 Dataset
Benzene	0.51	0.56	DEFRA 2001 Dataset
1,3-butadiene	0.23	0.25	DEFRA 2001 Dataset
Ammonia	2.65	4.23	DEFRA (CEH) 2014

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4 AURN and LAQM monitoring

4.1 Overview

The UK Automatic Urban and Rural Network (AURN) is a country-wide network of air quality monitoring stations operated on behalf of DEFRA. This includes automatic monitoring of oxides of nitrogen, nitrogen dioxide, sulphur dioxide, ozone, carbon monoxide and fine particulate matter. In addition, as part of their commitment local authorities undertake monitoring of nitrogen dioxide, particulate matter, carbon monoxide and sulphur dioxide if deemed necessary.

There are no AURN monitoring stations within 10 km of the Site. The closest AURN monitoring station to the Site is Crewe Coppenhall, an urban background site located approximately 16.5 km to the south. At this distance, the data from this analyser is not representative of concentrations in the vicinity of the Site. Therefore, data from this site has not been considered further in this analysis.

Cheshire West and Cheshire Council (CWCC) operate six automatic monitoring sites. The nearest to the Site is the Frodsham urban background site, located in Frodsham, approximately 16.6 km to the north west west. At this distance, the data from this automatic monitoring site is not representative of concentrations in the vicinity of the Site. Therefore, data from this site has not been considered further in this analysis.

CWCC also undertake non-automatic (diffusion tube) monitoring for nitrogen dioxide at various sites across the district. Eight of these sites lie across and around Northwich, and are within 5 km of the Site. Their locations are shown in Figure 1 of Annex A.

4.2 Review of monitoring data

A summary of monitoring data from the non-automatic (diffusion tube) monitoring sites within 5 km of the Site is provided in Table 2. Data has been taken from the CWCC 2018 LAQM Annual Status Report (June 2019) and the CWCC website, which provides more recent results. Many of the sites have only been set up in recent years and so only have data from 2018. Those values which exceed the air quality assessment level (AQAL) are marked in **bold**.

Table 2: Summary of Non-Automatic Nitrogen Dioxide Monitoring Results

Site Name	Type*	2018 Mapped Bg ($\mu\text{g}/\text{m}^3$)	Annual mean concentration ($\mu\text{g}/\text{m}^3$)				
			2015	2016	2017	2018	2019
Chester Way	Kerbside	13.3	-	-	-	33.0	31.0
Greenbank Lane	Roadside	13.3	-	-	-	17.3	16.0
Griffiths Road	Roadside	19.7	-	-	-	24.1	21.6
King Street	Roadside	19.7	33.6	35.2	33.9	32.0	32.2
London Road	Roadside	16.3	-	-	-	-	19.1
Rudheath Primary	Roadside	13.3	-	-	-	42.4	40.5
Station Road	Roadside	13.3	-	-	-	38.0	35.3

Site Name	Type*	2018 Mapped Bg ($\mu\text{g}/\text{m}^3$)	Annual mean concentration ($\mu\text{g}/\text{m}^3$)				
			2015	2016	2017	2018	2019
Winnington Hill	Roadside	13.3	-	-	-	41.5	41.7

Source: Cheshire West and Chester Council 2018 LQAM Annual Status Report (June 2019) and © Crown 2021 copyright Defra via uk-air.defra.gov.uk, licenced under the Open Government Licence (OGL).

All non-automatic monitoring sites have recorded nitrogen dioxide to be higher than the mapped background data for their locations which is expected as they are roadside or kerbside sites. Two of the sites exceeded the AQAL in 2018 and 2019. Roadside sites are predominately determined by emissions from nearby traffic and are only representative of air quality for the immediate area of the diffusion tube. Therefore, the data from the diffusion tubes is not considered to be representative of the general background conditions. As a conservative measure, the maximum mapped background concentration within the modelling domain will be used. The choice of baseline concentrations will be considered further if the impact of the LSEP with the Proposal cannot be screened out as 'negligible' irrespective of the total concentration.

4.3 Project specific monitoring

The May 2011 Environmental Statement (ES), which supported the current s36 consent, used background concentrations for oxides of nitrogen, nitrogen dioxide and sulphur dioxide based on project specific monitoring carried out in 2007. The current s36 consent used a nitrogen dioxide concentration of $29.1 \mu\text{g}/\text{m}^3$ from diffusion tube on Griffiths Road and sulphur dioxide concentration of $1.4 \mu\text{g}/\text{m}^3$ from diffusion tube on St John's Close.

The 2007 measured concentrations of nitrogen dioxide are much higher than the mapped background data from 2018. This is not unexpected, and in line with projections. The data from 2007 is over 13 years old and not considered representative of conditions at the Site now or in the future. As such the most recent mapped background value has been used for this assessment.

5 Other national monitoring networks

5.1 Hydrogen chloride

Hydrogen chloride was measured until the end of 2015 on behalf of DEFRA as part of the UK Eutrophying and Acidifying Atmospheric Pollutants (UKEAP) project. This consolidates the previous Acid Deposition Monitoring Network (ADMN), and National Ammonia Monitoring Network (NAMN). Monitoring of hydrogen chloride ceased at the end of 2015 and none of the historic sites were located within 10 km of the Site. Prior to the cessation of the monitoring concentrations were fairly constant.

The maximum annual average monitored within the UK between 2011 and 2015 was $0.71 \mu\text{g}/\text{m}^3$. In lieu of any recent representative monitoring this has been used as the baseline concentration for this assessment as a conservative estimate.

5.2 Hydrogen fluoride

Baseline concentrations of hydrogen fluoride are not measured locally or nationally, since these are not generally of concern in terms of local air quality. However, the EPAQS report 'Guidelines for halogens and hydrogen halides in ambient air for protecting human health against acute irritancy effects' contains some estimates of baseline levels, reporting that measured concentrations have been in the range of $0.036 \mu\text{g}/\text{m}^3$ to $2.35 \mu\text{g}/\text{m}^3$.

In lieu of any local monitoring, the maximum measured baseline hydrogen fluoride concentration has been used for the purpose of this assessment as a conservative estimate.

5.3 Ammonia

Ammonia is also measured as part of the UKEAP project at rural background locations. There are no UKEAP monitoring locations within 10 km of the Site. The nearest monitoring site is Little Budworth. In lieu of any local UKEAP monitoring, the maximum mapped background value from within 5 km of the Site has been used for the purpose of this assessment as set out in Table 1. This value is $4.23 \mu\text{g}/\text{m}^3$.

5.4 Volatile Organic Compounds

As part of the Automatic and Non-Automatic Hydrocarbon Network, benzene concentrations are measured at sites co-located with the AURN across the UK. In 2007, due to low monitored concentrations of 1,3-butadiene at non-automatic sites, DEFRA took the decision to cease non-automatic monitoring of 1,3-butadiene. There are no monitoring locations within 10 km of the Site. The nearest monitoring site is Liverpool Speke.

In lieu of any local monitoring of 1,3-butadiene, the maximum mapped background concentration within the modelling domain has been used as the baseline concentration for the purpose of this assessment as set out in Table 1. This value is $0.25 \mu\text{g}/\text{m}^3$.

5.5 Metals

Metals are measured as part of the Rural Metals and UK Urban/Industrial Networks (previously the Lead, Multi-Element and Industrial Metals Networks). There are no metals monitoring locations

within 10 km of the Site. The nearest monitoring site is Manchester Wythenshawe, an urban traffic site 19 km to the north east. Due to its more urban nature and distance from the Site, it is not considered representative of the conditions at the Site. A summary of the maximum annual data across all UK urban and rural background monitoring sites is presented in the following table.

Table 3: Metals Monitoring Maximum of all Background Sites – Urban and Rural

Substance	Annual mean concentration (ng/m ³)						Max (as % of AQAL)
	AQAL	2015	2016	2017	2018	2019	
Cadmium	5	0.45	0.57	0.49	0.43	0.35	11.4%
Thallium	-	-	-	-	-	-	-
Mercury	250	2.50	2.50	2.70	2.80	-	1.1%
Antimony	5,000	-	-	-	-	-	-
Arsenic	3	1.00	1.00	1.10	1.00	1.00	36.7%
Chromium	5,000	29.00	31.00	34.00	39.00	25.00	0.78%
Cobalt	-	0.62	0.60	0.84	0.92	0.56	-
Copper	10,000	20.00	33.00	20.00	26.00	22.00	0.33%
Lead	20	16.00	11.00	12.00	12.00	11.00	80.0%
Manganese	150	28.00	30.00	35.00	36.00	26.00	24.0%
Nickel	20	13.00	10.00	8.50	12.00	14.00	70.0%
Vanadium	5,000	1.50	1.40	1.30	1.70	1.50	0.03%
<p>NOTES:</p> <p>Excludes data from Sheffield Tinsley for lead and nickel – although this is a background site it is located close to industrial areas and as such has high levels of these pollutants far greater than that monitored at other sites.</p>							

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As shown, the concentrations monitored between 2015 and 2019 were significantly lower than the AQALs at all monitoring sites considered.

The area surrounding the Site is a mixture of rural, suburban and the adjacent industrial area. Review of the processes at the three sites shows that the processes are chemical processes including the production of calcium carbonate, soda ash and sodium bicarbonate, and an anaerobic digestion facility. As these processes do not involve industrial levels of metal emissions, it is deemed appropriate to use the maximum metal concentration across all urban and rural background sites (excluding Sheffield Tinsley for nickel and lead) from between 2015 and 2019 as the baseline concentration within this assessment, in lieu of any representative local monitoring.

5.6 Dioxins, furans and polychlorinated biphenyl (PCBs)

Dioxins, furans and PBCs are monitored on a quarterly basis at a number of urban and rural stations in the UK as part of the Toxic Organic Micro Pollutants (TOMPs) network. There are no monitoring locations within 10 km of the Site. The closest site is Manchester Law Courts.

A summary of dioxin and furan and PCB concentrations from all monitoring sites across the UK is presented in Table 4 and Table 5. Note that monitoring data for dioxins and furans is only available

up to the end of 2016 from the UK-Air website. For PCBs data is only available up to the end of 2018 from the UK-Air website.

Table 4: TOMPS – Dioxin and Furans Monitoring

Site	Annual mean concentration (fgTEQ/m ³)				
	2012	2013	2014	2015	2016
Auchencorth Moss	0.13	0.86	0.01	0.01	0.13
Hazelrigg	8.75	2.02	2.61	5.27	4.59
High Muffles	4.32	0.6	1.07	0.54	2.73
London Nobel House	15.42	3.47	2.89	4.34	21.27
Manchester Law Courts	32.99	10.19	16.52	5.94	12.23
Weybourne	9.3	2.34	1.61	1.42	16.32

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Table 5: TOMPS – PCB Monitoring

Site	Annual mean concentration (pg/m ³)				
	2014	2015	2016	2017	2018
Auchencorth Moss	23.23	24.27	25.32	19.09	12.31
Hazelrigg	25.84	41.68	52.58	33.15	22.22
High Muffles	26.11	33.43	37.76	31.63	8.86
London Nobel House	107.49	121.39	110.46	121.87	46.63
Manchester Law Courts	128.93	97.99	92.6	97.27	40.1
Weybourne	17	20.95	38.61	32.26	11.23

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As shown, the concentrations vary significantly between sites and years. As there are no monitoring sites located within close proximity of the Site or any mapped background datasets, the maximum monitored concentration from the past 5 years has been used as the background concentration within this assessment. These values are 32.99 fg/TEQ/m³ for dioxins and furans and 128.93 pg/m³ for PCBs.

5.7 Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic Aromatic Hydrocarbons (PAHs) are monitored at a number of stations in the UK as part of the PAH network. There are no monitoring locations within 10 km of the Site. The closest site is Liverpool Speke.

For the purpose of this assessment, benzo(a)pyrene is considered as this is the only PAH which an AQAL has been set. A summary of benzo(a)pyrene concentrations from all urban background monitoring sites within the UK is presented in Table 6.

Table 6: National Monitoring - Benzo(a)pyrene

Site Type	Quantity	AQAL (ng/m ³)	Annual mean concentration (ng/m ³)				
			2015	2016	2017	2018	2019
All Urban Background	Min	0.25	0.12	0.13	0.05	0.08	0.08
	Max		0.65	0.98	0.70	0.55	0.70
	Average		0.29	0.36	0.24	0.23	0.29

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As shown the monitored concentration exceeds the AQAL at a number of urban background sites. The AQAL goes beyond the requirement of the European Directive (Commission Decision 2004/107/EC) which sets a target value of 1 ng/m³. None of the background sites exceed this value. In lieu of any local monitoring of PAHs or any mapped background datasets, the maximum of the UK average concentration from any urban background site has been used (0.98 ng/m³ – 2016). The choice of background concentration will be investigated further if the process contribution is greater than 0.5% of the AQAL in accordance with the assessment methodology.

6 Baseline conditions at ecological sites

The Air Pollution Information System (APIS) database sets out the baseline concentrations on a grid across the UK. Atmospheric concentrations of oxides of nitrogen and sulphur dioxide are provided on a 1km x 1km grid whilst ammonia concentrations, nitrogen deposition and sulphur deposition are provided on a 5 km x 5 km grid. Data is provided for the maximum across the ecological site. This data is the from 2017 to 2019 average presented on APIS.

Table 7: APIS Data for Ecological Sites

ID	Site	Maximum concentration (µg/m ³)		
		Oxides of nitrogen	Sulphur dioxide	Ammonia
	Annual mean Critical Level	30	10 / 20	1 / 3
E1	Midland Meres and Mosses – Phase 1 (also the Mere Mere SSSI and Tatton Meres SSSI) 1	19.53	1.27	2.74
E2	Midland Meres and Mosses – Phase 1 (also the Mere Mere SSSI and Tatton Meres SSSI) 2	17.69	1.37	2.68
E3 to E5	Midland Meres and Mosses – Phase 2 (also Oak Mere SAC and West Midlands Mosses SAC) 1	10.00	1.30	2.94
E6	Rostherne Mere	29.33	1.44	2.68
E7	Witton Lime Beds	16.36	2.30	3.45
E8	Plumley Lime Beds	14.92	2.03	4.24
E9	Ashton's and Neumann's Flashes	15.36	1.83	3.45
E10	Gadbrok Valley	19.27	1.83	3.45
E11	Griffiths Park	15.00	1.83	3.45
E12	Long Wood	16.35	1.83	3.45
E13	Marston Flashes	15.11	1.51	3.11
E14	Wade Brook	15.64	1.83	3.45
E15	Wincham Brook Valley and Mill Wood	15.64	1.83	3.45
E16	Winnington Wood	14.35	1.51	3.11
E17	River Dane	14.65	1.83	3.45
E18	Marshall's Gorse	17.03	1.83	3.45
E19	Rudheath Lime Beds	15.00	1.83	3.45
E20	Lostock House Orchard	12.37	1.38	4.24

Source: APIS

As shown the baseline data presented in APIS shows that concentrations of oxides of nitrogen and sulphur dioxide are below the critical level at all sites, although at baseline oxides of nitrogen levels at Rostherne Mere are very close to the critical level. Concentrations of ammonia exceed the lower

critical level applicable for lichen sensitive communities at all sites, and exceed the higher critical level for non-lichen sensitive communities at all of the SSSIs and Local Wildlife Sites (LWS).

Table 8: APIS data for Ecological Sites - Deposition

ID	Site	Habitat type	N deposition	Acid N deposition	Acid S deposition
			kgN/ha/yr	keqN/ha/yr	keqS/ha/yr
E1	Midland Meres and Mosses – Phase 1 (also the Mere Mere SSSI and Tatton Meres SSSI) 1	Grassland	23.66	1.69	0.21
E2	Midland Meres and Mosses – Phase 1 (also the Mere Mere SSSI and Tatton Meres SSSI) 2	Grassland	23.80	1.70	0.22
E3 to E5	Midland Meres and Mosses – Phase 2 (also Oak Mere SAC and West Midlands Mosses SAC) 1	Grassland	15.60	1.80	0.20
E6	Rostherne Mere	Grassland	14.20	1.00	0.20
E7	Witton Lime Beds	Grassland	26.40	1.90	0.20
E8	Plumley Lime Beds	Woodland	52.80	3.80	0.20
		Grassland	30.50	2.20	0.20
E9	Ashton's and Neumann's Flashes	Grassland	26.46	1.89	0.21
E10	Gadbrok Valley	Woodland	45.50	3.25	0.25
		Grassland	26.46	1.89	0.21
E11	Griffiths Park	Woodland	45.50	3.25	0.25
		Grassland	26.46	1.89	0.21
E12	Long Wood	Woodland	45.50	3.25	0.25
E13	Marston Flashes	Grassland	25.76	1.84	0.22
E14	Wade Brook	Grassland	26.46	1.89	0.21
E15	Wincham Brook Valley and Mill Wood	Grassland	26.46	1.89	0.21
E16	Winnington Wood	Woodland	43.40	3.10	0.26
E17	River Dane	Woodland	45.50	3.25	0.25
E18	Marshall's Gorse	Woodland	45.50	3.25	0.25
E19	Rudheath Lime Beds	Grassland	26.46	1.89	0.21
E20	Lostock House Orchard	Grassland	30.52	2.18	0.21
		Woodland	52.92	3.78	0.25

Source: APIS

The values presented in the preceding tables are grid square averaged values based provided as a rolling 3-year mean and are derived from a mixture of interpolation from measured data, and modelled data as set out in APIS. The APIS explains that the use of a 3-year mean has been demonstrated to be a suitable time period to smooth out some of the inter-annual variations in deposition which occur due to the natural variability in annual weather patterns.

7 Summary

The preceding sections have provided a review of the local and national monitoring data and national modelled background concentrations.

The analysis has shown that there a number of nitrogen dioxide monitoring sites in the local area. However, monitoring of other pollutants is limited. All of the monitoring sites within 5 km are roadside or kerbside sites. Therefore, it is considered appropriate to use the mapped background concentrations as the general baseline concentration in the local area in lieu of any background local monitoring. For some pollutants there are no mapped background datasets. In these instances, the maximum concentration from national monitoring datasets for sites in a similar setting has been used as the baseline concentration.

The assessment methodology for annual mean impacts on air quality is based on the contribution from the Proposal in relation to a future baseline. The Predicted Environmental Concentration (PEC) will be calculated by adding the contribution from the Proposal to the baseline concentration presented in Table 9. Where the annual mean contribution from the Proposal is less than 0.5% of the long term AQAL, the magnitude of change is described as negligible irrespective of the total concentration. Where this cannot be concluded additional consideration will be given to the choice of baseline concentration.

Table 9: Summary of Baseline Concentrations

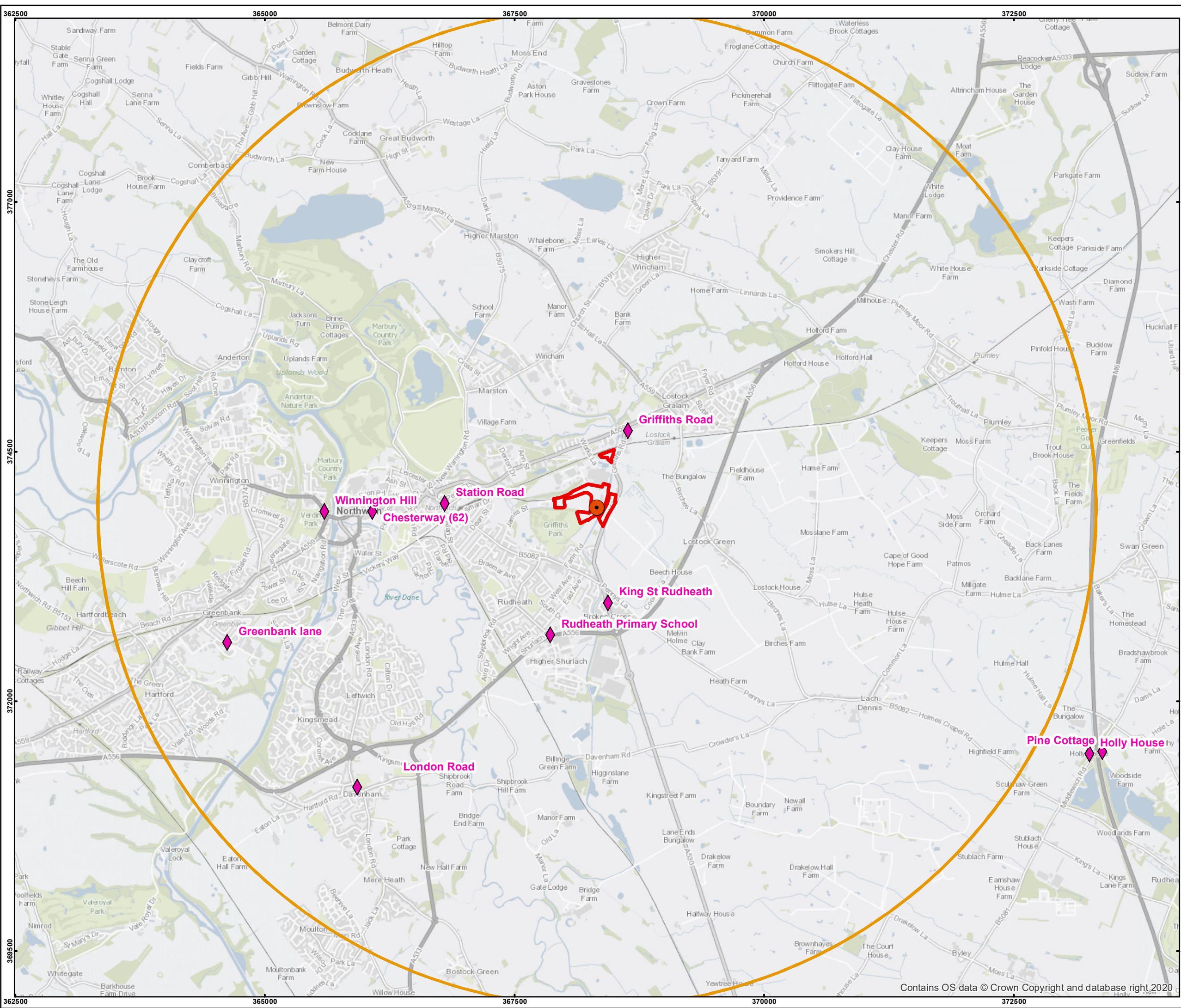
Pollutant	Concentration	Units	Justification
Nitrogen dioxide	17.05	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration from within 5 km of Site- DEFRA 2018 dataset.
Oxides of nitrogen	23.38	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration from within 5 km of Site- DEFRA 2018 dataset.
Sulphur dioxide	14.70	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration from within 5 km of Site- DEFRA 2001 dataset.
Particulate matter (as PM10)	12.98	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration from within 5 km of Site- DEFRA 2018 dataset.
Particulate matter (as PM2.5)	8.79	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration from within 5 km of Site- DEFRA 2018 dataset.
Carbon monoxide	345	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration from within 5 km of Site- DEFRA 2001 dataset.
Benzene	0.56	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration from within 5 km of Site- DEFRA 2001 dataset.
1,3-butadiene	0.25	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration from within 5 km of Site- DEFRA 2001 dataset.
Ammonia	4.23	$\mu\text{g}/\text{m}^3$	Maximum mapped background concentration from within 5 km of Site- DEFRA (CEH) 2014 dataset.
Hydrogen chloride	0.71	$\mu\text{g}/\text{m}^3$	Maximum monitored concentration across the UK 2012 to 2015
Hydrogen fluoride	2.35	$\mu\text{g}/\text{m}^3$	Maximum measured concentration from EPAQS report
Cadmium	0.57	ng/m^3	

Pollutant	Concentration	Units	Justification
Thallium	-	ng/m ³	Maximum annual concentration averaged across all urban industrial sites across the UK 2015 to 2019
Mercury	2.80	ng/m ³	
Antimony	-	ng/m ³	
Arsenic	1.10	ng/m ³	
Chromium	39.00	ng/m ³	
Cobalt	0.92	ng/m ³	
Copper	33.00	ng/m ³	
Lead	16.00	ng/m ³	
Manganese	36.00	ng/m ³	
Nickel	14.00	ng/m ³	
Vanadium	1.70	ng/m ³	
Dioxins and Furans	32.99	fgTEQ/m ³	Maximum monitored concentration across all UK sites 2012 to 2016
Dioxin-like PCBs	128.93	pg/m ³	Maximum monitored concentration across all UK sites 2014 to 2018
PaHs	0.98	ng/m ³	Maximum annual concentration averaged across all background sites across the UK 2015 to 2019

For the purpose of the assessment of the impact at ecological receptors the baseline concentrations set out in Section 6 have been used.

Annex

A Figures

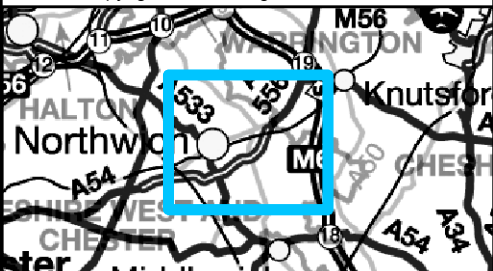


- Legend**
- Stack locations
 - Site boundary
 - 5 km buffer
 - ◆ Local monitoring sites

Client:	Lostock Sustainable Energy Plant Ltd
Site:	LSEP
Project:	3291
Title:	

Figure 1 - Local monitoring sites

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FICHTNER
Consulting Engineers Limited

Kingsgate, Wellington Road North,
Stockport, Cheshire, SK4 1LW
Tel: 0161 476 0032
Fax: 0161 474 0618

ENGINEERING  CONSULTING

FICHTNER

Consulting Engineers Limited

Kingsgate (Floor 3), Wellington Road North,
Stockport, Cheshire, SK4 1LW,
United Kingdom

t: +44 (0)161 476 0032

f: +44 (0)161 474 0618

www.fichtner.co.uk