Shotton Paper Mill

Air Emissions Risk Assessment

Shotton Mill Ltd

Prepared by:

SLR Consulting Limited

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Making Sustainability Happen

Revision Record

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Table of Contents

Tables in Text

Figures in Text

Appendices

1.0 Introduction

SLR Consulting Limited (SLR) has been commissioned by Shotton Mill Ltd to undertake an Air Emissions Risk Assessment (AERA) to support their Environmental Permit (EP) variation application for the expansion and redevelopment of the Shotton Mill site located on land at Shotton Mill, Weighbridge Road, Deeside Industrial Park, Flintshire, CH5 2LW (the 'Site').

1.1 Background

The Site comprises of an existing paper mill which has recently undergone a period of redevelopment following granting of planning permission by Flintshire County Council (FCC) and Planning and Environment Decisions Wales (PEDW). Full details of the application are contained within the Non-Technical Summary (NTS) and accompanying EP application.

The client is seeking to install the following new sources of combustion with associated emissions to atmosphere:

- Three natural-gas fired Combined Heat and Power (CHP) plants;
- Two natural-gas fired temporary / back-up boilers;
- One dryer; and
- One combined emission point serving two biogas engines.

The CHPs and back-up boilers will be regulated as Large Combustion Plant (LCP) with associated emissions limit values (ELVs). The biogas engines will be regulated as Medium Combustion Plant (MCP) and associated ELVs. The new sources at the Site will be associated with combustion emissions of oxides of nitrogen (NOx) and sulphur dioxide (SO_2).

1.2 Scope and Objective

The scope of this assessment is limited to point source combustion emissions to air from the new sources identified above.

The objective of the study is to assess, using atmospheric dispersion modelling, the impact of NOx and SO_2 emissions against the relevant Air Quality Standards for nitrogen dioxide (NO_2) and SO_2 for the protection of human health and the relevant Critical Levels (for NOx and SO_2) and Critical Loads (for nutrient nitrogen and acid deposition) for the protection of designated ecological receptors where present within the relevant screening distances. The assessment has been carried out using the Environment Agency's (EA) *Air emissions risk assessment for your environmental permit guidance*[1] (termed the 'AERA guidance' herein), as applied by Natural Resources Wales (NRW).

This report presents the approach, detailed methodology and findings of the AERA.

[1] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

2.0 Legislation and Relevant Guidance

2.1 Environmental Permitting Regulations

The Environmental Permitting (England and Wales) Amendment Regulations 2018 implements European Union Directive 2015/2193/EU (the Medium Combustion Plant Directive, MCPD) in Schedule 25A. Furthermore, Schedule 15 of the Environmental Permitting (England and Wales) Amendment Regulations 2018 implements Large Combustion Plans through the Industrial Emissions Directive (IED).

2.1.1 Permitting Guidance

Guidance Notes produced by the Department for Environment, Food and Rural Affairs (Defra) provide a framework for regulation of installations and additional technical guidance produced by the EA are used to provide the basis for permit conditions.

Of particular relevance to the assessment is the AERA guidance[1], published by the EA but as implemented by NRW. The purpose of this guidance is to assist operators to assess risks to the environment and human health when applying for a permit under the Environmental Permitting Regulations. Included in the AERA guidance are:

- An approach to screening assessment;
- Guidance on when detailed atmospheric dispersion modelling is required; and
- EALs for a range of pollutants not covered by other regulations, against which impact may be assessed.

The EA also provides specific guidance for assessing impacts on ecological sites known as AQTAG.06[2].

2.2 Air Quality Legislation and Guidance

2.2.1 Air Quality Standards Regulations

The Air Quality Standards (Wales) Regulations 2010[3] (AQSR) transpose both the European Union (EU) Ambient Air Quality Directive (2008/50/EC)[4], and the Fourth Daughter Directive (2004/107/EC)[5] within UK legislation, in order to align and bring together in one statutory instrument the Government's obligations. The AQSR includes Limit Values, Target Values, Objectives, Critical Levels and Exposure Reduction Targets for the protection of human health and the environment. Limit values are legally binding and are considered to apply everywhere with the exception of the carriageway and central reservation of roads and any location where the public do not have access (e.g. industrial sites).

In the interim period the UK has formally left the EU, however, despite this EU law and regulations referred to above have subsequently been ratified into UK law as statutory instruments and these are still of relevance.

[2] AQTAG06 – Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air. Environment Agency, March 2014.

[3] The Air Quality Standards Regulations (Wales) 2010, Statutory Instrument No 1433 (W.126), The Stationary Office Limited.

[4] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.

[5] Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004.

Following the UK's withdrawal from the EU, the Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020[6] was introduced to mirror revisions to supporting EU legislation. The fine particulate matter ($PM_{2.5}$) Limit Value is 20µg/m^3 (to be met by 2020).

2.2.2 Air Quality Strategy

Irrespective of the above, the UK Government and the devolved administrations are required under the Environment Act 1995[7] to produce a national air quality strategy to improve air quality. The latest Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland was published in 2007[8]. The AQS provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives established by the UK Government and Devolved Administrations for the protection of public health and the environment. There is no legal requirement to meet these objectives except where they mirror an equivalent legally binding Limit Value as prescribed within EU legislation, however compliance is regulated at a local level by local planning authorities.

2.2.3 Standards for Air Quality

The ambient air quality standards of relevance to human receptors in this AERA (collectively termed Air Quality Assessment Levels (AQALs) throughout this report) are provided in Table 2-1. Limit values (or objectives) have been applied in reference to the AERA guidance[1].

Table 2-1: Applied AQALs

Pollutant	AQAL (µg/m^3)	Averaging Period	Source
NO_2	40	Annual mean	UK AQS
	200	1-hour mean (not to be exceeded on more than 18 occasions per year)	UK AQS
SO_2	125	24-hour mean (not to be exceeded on more than 3 times over the calendar year)	UK AQS
	350	1-hour mean (not to be exceeded on more than 24 times over the calendar year)	UK AQS
	266	15-minute mean (not to be exceeded on more than 35 times over the calendar year)	UK AQS

Defra has published Technical Guidance for use in LAQM, referred to as LAQM.TG(22)[9]. According to LAQM.TG(22), air quality standards should only apply to locations where '*members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. Authorities should not consider exceedances of the objectives at any location where relevant public exposure would not be realistic*'. These locations are referred to as 'relevant exposure'.

[6] The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020, Statutory Instrument No. 1313, The Stationary Office Limited.

[7] UK Government, Part IV Environment Act, (1995).

[8] Defra, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, (2007).

[9] Local Air Quality Management Technical Guidance (22), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland. August 2022.

Thus, short term standards (such as the 15-minute, 1-hour and 24-hour standards) should apply to areas which may be regularly frequented by the public, even for a short period of time. Longer term standards, such as annual means, should apply at houses or other locations which the public can be expected to occupy on a continuous basis. These standards do not apply to exposure at the workplace.

Reference should be made to Table 2-2 for a summary of those locations considered as 'relevant exposure' to the short-term standards / averaging periods considered within this assessment.

Table 2-2: Human Health Relevant Exposure

Averaging Period	AQALs Should Apply At:	AQALs Should Not Apply At:
Annual mean	Building facades of residential properties, schools, hospitals etc.	Facades of offices or other places of work Hotels Gardens of residences Kerbside sites
24-hour mean	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure is expected to be short term
1-hour mean	As above together with hotels, gardens of residential properties, kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	-

2.3 Protection of Nature Conservation Sites

Sites of nature conservation importance are provided environmental protection from developments, including from atmospheric emissions. AQALs for the protection of ecological receptors are known as Critical Levels (CLe) for airborne concentrations and Critical Loads (CLo) for deposition to land from air.

EA guidance[10] as applied by NRW requires that designated ecological sites should be screened against relevant standards based upon set screening distance. As the Site includes the provision of a CHP plant with an output greater than 50MW, a 15km screening distance has been applied for European sites as required by the stated NRW guidance:

- 2km for a designated Site of Special Scientific Interest (SSSI) or local nature sites (ancient woodlands (AW), local wildlife sites (LWS) and national and local nature reserves); and
- 15km for a designated Special Protection Areas (SPA), Special Areas of Conservation (SAC) or Ramsar sites.

2.3.1 Critical Levels (CLe)

CLe are a quantitative estimate of exposure to one or more airborne pollutants in gaseous form, below which significant harmful effects on sensitive elements of the environment do

[10] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#screening-for-protected-conservation-areas.

not occur, according to present knowledge. The relevant CLe for the protection of vegetation and ecosystems are presented in Table 2-3.

Table 2-3: Critical Levels for the Protection of Vegetation and Ecosystems

Pollutant	CLe (µg/m^3)	Averaging Period and Habitat
NOx	30	Annual mean (all ecosystems)
	75 (A)	Daily mean (all ecosystems)
SO_2	10	Annual mean (where lichens or bryophytes are present)
	20	Annual mean (all ecosystems)
Note (A) The 24-hour mean NO_X Critical Level is 75µg/m^3, with the exception that 200 µg/m^3 may be applied where the ozone is below the AOT40 Critical Level (18,000 µg/m^3 over the past 5 years) and sulphur dioxide is below the lower Critical Level (10 µg/m^3).		

2.3.2 Critical Loads (CLo)

CLo are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. CLo are set for the deposition of various substances to sensitive ecosystems. In relation to combustion emissions CLo for acidification are relevant which can occur via both wet and dry deposition; however, on a local scale only dry (direct deposition) is considered significant. Deposition of nitrogen can cause eutrophication and acidification; the relevant CLo are presented in Section 3.8.

2.4 Assessment Guidance

This AERA assessment has been carried out with reference to the principles contained within the following guidance documents:

- EA AERA guidance[1];
- Defra: Local Air Quality Management Technical Guidance (LAQM.TG(22))[9];
- Defra: COVID-19: Supplementary Guidance. Local Air Quality Management Reporting in 2021[11];
- IAQM: Use of 2020 and 2021 Monitoring Datasets[12];
- EA Operational Instruction 66_12[13];
- EA Operational Instruction 67_12[14]; and
- The EA AQTAG.06[2] guidance.

[11] DEFRA and the Greater London Authority, COVID-19: Supplementary Guidance. Local Air Quality Management Reporting in 2021. April 2021.

[12] IAQM, Use of 2020 and 2021 Monitoring Datasets, v1.1, December 2023.

[13] EA Operational Instruction 66_12: Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation'.

[14] EA Operational Instruction 67_12 – Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation. Issued 08/05/2012.

3.0 Assessment Methodology

Detailed atmospheric dispersion modelling has been undertaken with due consideration to the EA's AERA guidance[1] as applied by NRW. The modelling approach is based upon the following stages:

- Review of plant specification and operational envelope to define emission sources, pollutant emission rates and characteristics;
- Identification of sensitive receptors;
- Compilation of the existing air quality baseline and review of LAQM status; and
- Calculation of process contribution (PC) to ground level concentrations (GLC) and evaluation against relevant environmental standards for both human and ecological receptors.

3.1 Process Description

The Site includes the installation of a number of new point sources with associated combustion emissions to atmosphere. These are associated with:

- 2 new gas-fired back-up boilers (Two back-up boilers are included, but these will discharge combustion emissions via a single shared stack / emission point, to be located within the CHP boiler building);
- 3 new gas-fired CHPs (to be located within the CHP boiler building);
- 1 new gas-fired dryer emission point (integral to the paper machine and to be located within the paper machine building); and
- 2 new biogas engines associated with the effluent treatment plant (ETP). Two biogas engines are included, but these will discharge combustion emissions via a single shared stack / emission point.

The CHPs will be regulated under the LCPD and associated emissions limit values (ELV). The back-up boiler and ETP biogas engines will be regulated under the MCPD and associated ELVs. The assessment of emissions from new point sources has been based upon the associated fuel type by plant i.e.:

- The back-up boiler, CHP and dryer: natural gas; and
- The ETP biogas engines: biogas.

Therefore, the relevant pollutant suite by new point source is as follows:

- The back-up boiler: NOx;
- CHP: NOx;
- The dryer: NOx; and
- The ETP biogas engines: NOx and SO_2.

3.2 Operational Envelope

The back-up boiler will provide operational resilience in the event of any downtime (associated with routine maintenance, for example) in the operation of the CHPs. The back-up boiler is anticipated to operate for <500 hours per year and, therefore, has been excluded for cumulative assessment with any of the CHP(s) due to the limited collective period of operation.

However, the back-up boiler will initially provide preliminary energy demand for the Site prior to full commissioning of the CHPs. Information provided by Shotton Mill Ltd indicates the back-up boiler will operate for a maximum of 6-months of a given calendar year prior to the CHP(s) being installed and commissioned on-site. Therefore, a scenario has been modelled which assumed the sole operation of back-up boiler to provide an assessment of short-term and corresponding operational long-term impacts on air quality based upon a 6-month annual operation (see Section 3.7.1).

The wider sources present at the Site (i.e. excluding the back-up boiler) have been modelled operating 24 hours per day 365 days per year at maximum emissions rates for point source emissions. It is noted that the CHPs will be built and become operational in a phased manner as the Site develops to the full proposed operating potential. However, to present a worst-case assessment of potential impacts on air quality, this assessment assumes all CHPs operate collectively.

3.3 Modelled Scenarios

Two scenarios have been modelled and presented as part of this AERA, as follows:

- '**Boiler Project' Scenario** – assessment impacts on air quality prior to full commissioning of the CHPs (as referenced in Section 3.2). The following new sources are considered within the 'Boiler Project' Scenario:
    - 2x back-up boiler (via single stack);
    - 1x dryer; and
    - 2x ETP biogas engines (via single stack).
- '**CHP Project' Scenario** – assessment of impacts on air quality following full commissioning of the CHPs (as referenced in Section 3.2). The following new sources are considered within the 'CHP Project' Scenario:
    - 3x CHPs;
    - 1x dryer; and
    - 2x ETP biogas engines (via single stack).

3.4 Modelled Pollutants

In reference to AERA guidance[1], the key pollutants and associated averaging periods as presented within Table 3-1 have been considered.

Table 3-1: Modelled Pollutants / Averaging Periods

Year	Modelled As	
	Short-term	Long-term
NO_2	99.79 percentile of 1-hour means	Annual mean
NOx	24-hour mean (1st high)	Annual mean
SO_2	99.9 percentile of 15-minute means 99.73 percentile of 1-hour means 99.18 percentile of 24-hour means	Annual mean

3.5 Quantification of Emissions

The emission parameters applied in the modelling for sources at the Site are provided in Table 3-2 to Table 3-5. The emission parameters have been input on the basis of manufacturer's design and specifications.

Table 3-2: Emission Parameters: CHPs

Parameter	CHP 1	CHP 2	CHP 3
No. of Emissions Points	1	1	1
NGR (x,y) (m)	x: 330401.04 y: 371479.20	x: 330426.79 y: 371484.22	x: 330449.18 y: 371488.62
Stack Height	75.0	75.0	75.0
Stack Internal Diameter (m)	2.20	2.20	2.20
Volume Flow (Nm^3/s) (A)	72.91	72.91	72.91
Emission Temperature (°C)	65	65	65
Oxygen Content (% O_2 dry gas)	12.5	12.5	12.5
Moisture content (% H_2O)	9.10	9.10	9.10
Actual Flow Rate (Am^3/s)	70.4	70.4	70.4
Emission velocity (m/s) per stack	18.5	18.5	18.5
NOx Concentration (mg/Nm^3)	30	30	30
NOx Emission (g/s)	2.187	2.187	2.187
Note: (A) Normalised to 273K, dry, 101.3kPa, 15% O_2.			

Table 3-3: Emission Parameters: Dryer

Parameter	Dryer
No. of Emissions Points	1
NGR (x,y) (m)	x:330553, y:371618
Stack Height	35.48
Stack Internal Diameter (m)	1.57
Volume Flow (Nm^3/s) (A)	3.20
Emission Temperature (°C)	285
Oxygen Content (% O_2 dry gas)	20.0
Moisture content (% H_2O)	20.0
Actual Flow Rate (Am^3/s)	32.9
Emission velocity (m/s) per stack	17.0
NOx Concentration (mg/Nm^3)	110
NOx Emission (g/s)	0.354
Note: (A) Normalised to 273K, dry, 101.3kPa, 17% O_2.	

Table 3-4: Emission Parameters: Backup Boiler

Parameter	Back-up Boiler
No. of Emissions Points	1
NGR (x,y) (m)	x: 330407.59, y: 371460.49
Stack Height	30
Stack Internal Diameter (m)	1.98
Volume Flow (Nm^3/s) (A)	37.36
Emission Temperature (^oC)	120
Oxygen Content (% O_2 dry gas)	3.5
Moisture content (% H_2O)	16.2
Actual Flow Rate (Am^3/s)	65.9
Emission velocity (m/s) per stack	21.4
NOx Concentration (mg/Nm^3)	60
NOx Emission (g/s)	2.242

Note:
(A) Normalised to 273K, dry, 101.3kPa, 3% O_2.

Table 3-5: Emission Parameters: ETP Biogas Engines

Parameter	ETP Biogas Engine 1	ETP Biogas Engine 2
No. of Emissions Points	1	
NGR (x,y) (m)	x: 330582, y: 371293	
Stack Height	24	24
Stack Internal Diameter (m)	0.508	0.508
Volume Flow (Nm^3/s) (A)	4.667	4.667
Emission Temperature (^oC)	160	160
Oxygen Content (% O_2 dry gas)	9.00	9.00
Moisture content (% H_2O)	11.0	11.0
Actual Flow Rate (Am^3/s)	4.5806	4.5806
Emission velocity (m/s) per stack	22.6	22.6
NOx Concentration (mg/Nm^3)	190	190
NOx Emission (g/s)	0.887	0.887
SO_2 Concentration (mg/Nm^3)	15	15
SO_2 Emission (g/s)	0.070	0.070

Note:
(A) Normalised to 273K, dry, 101.3kPa, 15% O_2.

3.6 Model Setup

For this assessment the AERMOD View model[15] (AERMOD) has been applied; this model is widely used and accepted by NRW for undertaking such assessments and its predictions have been validated against real-time monitoring data by the United States (US) Environmental Protection Agency (EPA). It is therefore considered a suitable model for this assessment.

3.6.1 Dispersion Coefficients

Urban locations are prone to higher temperatures, specifically during night-time periods, in comparison to surrounding rural areas. This phenonium is known as the ‘urban heat island effect’ and is largely attributed to the enhanced thermal heating capacities of urban surfaces, alongside anthropogenic sources of heat emissions prevalent in urban areas. As such, rural areas often experience stable conditions in comparison to urban locations which experience convective turbulence during night-time conditions. This can ultimately impact dispersion and subsequent ground level concentrations.

In recognition of this, AERMOD enhances the rate of turbulence for urban night-time conditions, relative to that of the adjacent rural, stable boundary layer and also defines an urban boundary layer height to account for limited mixing that may occur under these conditions. This is determined through specifying the local environment (i.e. ‘urban’ or ‘rural’). AERMOD also uses population as a surrogate to define the magnitude of the differential heating effect at urban locations.

Given the coastal / estuary setting of the Site, the ‘rural dispersion’ coefficient was selected in accordance with AERMOD guidance on land-use classifications. This remains consistent with the approach within the consented original planning application.

3.6.2 Model Domain / Receptors

The modelling has been undertaken using a receptor grid across a map of the study area. Pollutant exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the maximum ground level concentration outside the Site boundary to be assessed.

A nested receptor grid extending 10km from the Site was applied as follows:

- 200m x 200m at 20m grid resolution;
- 500m x 500m at 50m grid resolution;
- 1,000m x 1,000m at 100m grid resolution;
- 2,000m x 2,000m at 200m grid resolution; and
- 10,000m x 10,000m at 500m grid resolution.

In addition, the modelling of discrete sensitive receptor locations as described in Section 4.1 was undertaken to assess the impact at relevant exposure locations for annual mean impact and facilitate the discussion of results.

3.6.3 Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. Building downwash has been

[15] Software used: Lakes AERMOD View, (Executable Aermod_23132).

considered for buildings that have a maximum height equivalent to at least 40% of the emission height and which are within a distance defined as five times the lesser of the height or maximum projected width of the building.

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Details on modelled buildings and structures were provided by the Applicant and technology provider. Structures input to the model are represented in Figure 3-1.

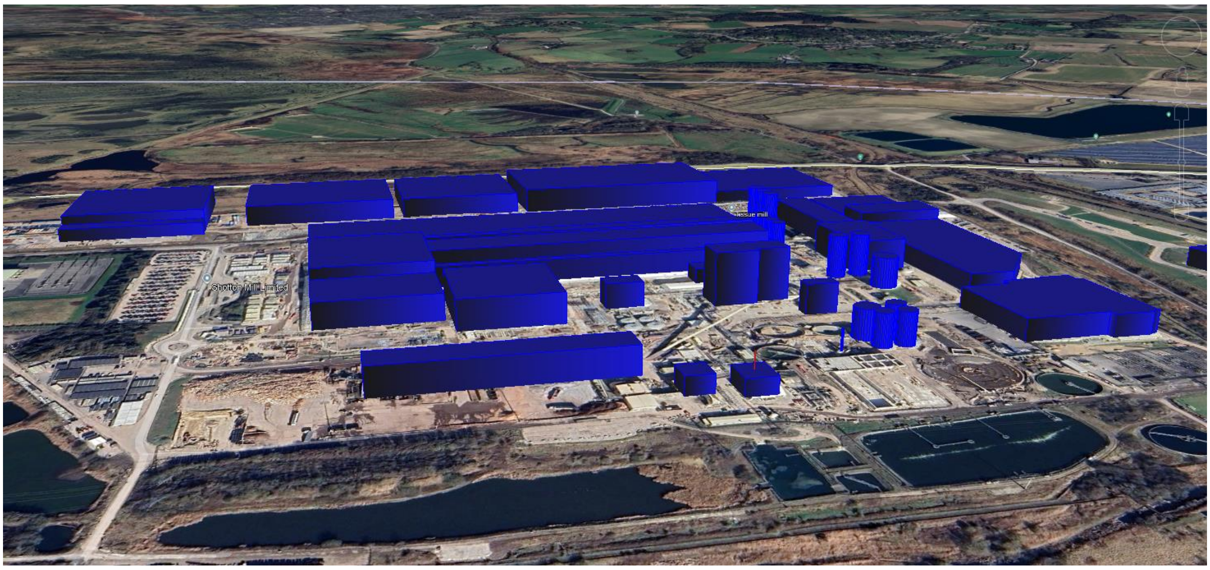

Figure 3-1: Modelled Buildings and Stacks

3.6.4 Topography

The presence of elevated terrain can significantly affect the dispersion of pollutants and the resulting ground level concentration in a number of ways. Elevated terrain reduces the distance between the plume centre line and the ground level, thereby increasing ground level concentrations. Elevated terrain can also increase turbulence and hence, plume mixing with the effect of increasing concentrations near to a source and reducing concentrations further away.

AERMOD utilises digital elevation data to determine the impact of topography on dispersion from a source. Topography was incorporated within the modelling using 30m resolution Shuttle Radar Topography Mission (SRTM) terrain data files. Data was processed by the AERMAP function within AERMOD to calculate terrain heights (see Figure 3-2).

The Site lies at approximately 15m above ordnance datum (AOD). The topography is relatively flat in a north-west to south-east direction and rises to the south-west to approximately 400m within 10km. Topography has been incorporated into the model and is illustrated in Figure 3-2.

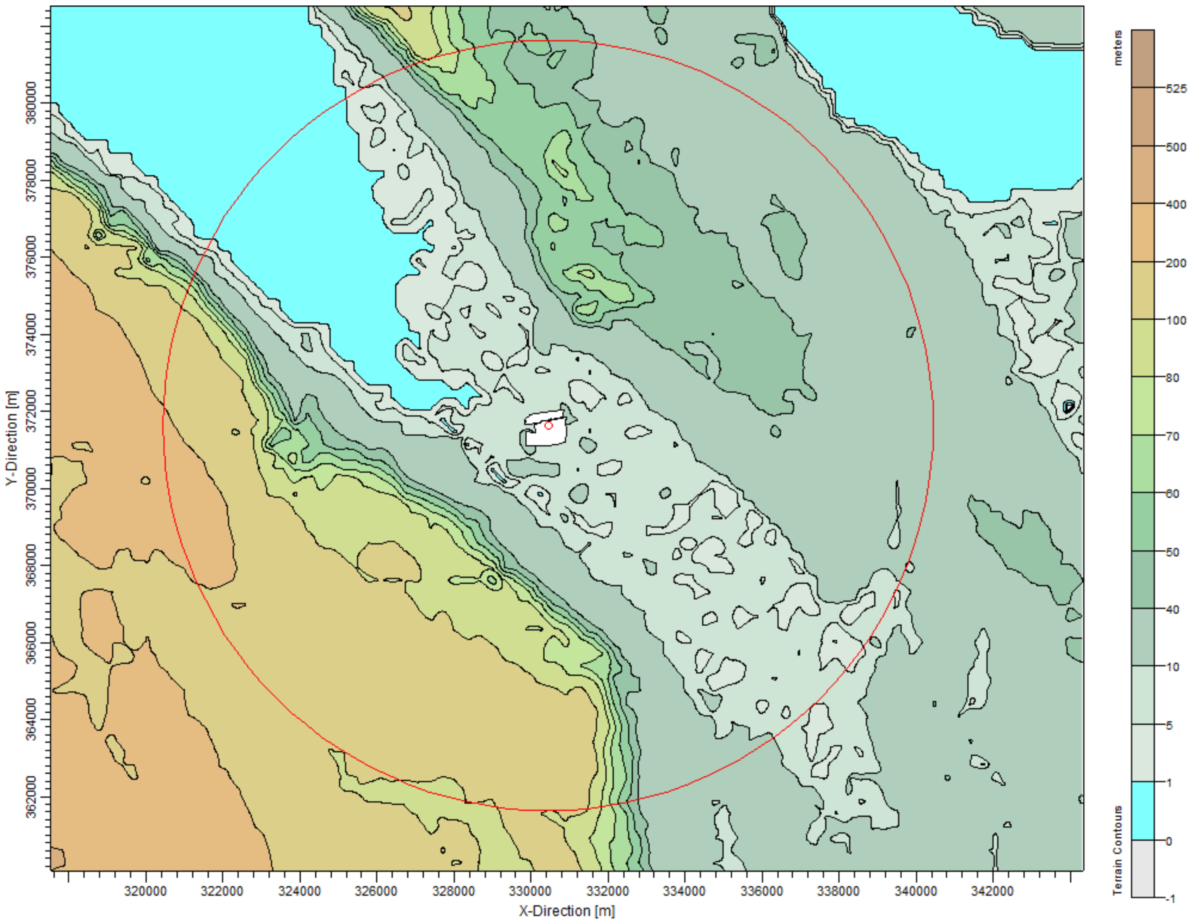

Figure 3-2: Surrounding Topography

3.6.5 Meteorological Data and Preparation

For consistency with the modelling results presented as part of the planning application for the Site, the same source and considered years' meteorological data has been applied as part of this AERA.

A site specific 5-year meteorological dataset comprising hourly sequential data from 2016 to 2020 from the Global Forecasting System (GFS) Numerical weather prediction (NWP) model was applied in the assessment. The data was converted to the required surface and profile formats for use in AERMOD using AERMET View meteorological pre-processor.

Details specific to the site location were used to define surface roughness, albedo and bowen ratio in the conversion (see Table 3-6).

Table 3-6: Applied Surface Characteristics

Zone (Start)	Zone (End)	Albedo	Bowen Ratio	Surface Roughness (m)
0	45	0.14	0.45	0.1625
45	120	0.2075	1.625	1
120	270	0.2075	1.625	1
270	0	0.14	0.45	0.1625

Table 3-7 presents statistics on the meteorological dataset illustrating the percentage of calm hours and the percentage of missing hours recorded within the 5-year period. Data capture, in terms of the percentage of calm hours and missing hours recorded are less than 10% and therefore, within acceptable limits.

Table 3-7: NWP: Meteorological Data Statistics

Year	Calm Hours (%)	Missing Hours (%)
2016	1.09	1.15
2017	0.92	1.05
2018	0.97	1.14
2019	0.81	1.00
2020	0.61	1.25

Individual wind roses for each year of the considered 2016 – 2020 dataset are presented in Figure 3-3 to Figure 3-7, and show the frequency of wind speed and direction used in the assessment. It is evident that the majority of winds are from the south-west with winds from the north-east occurring least frequently.

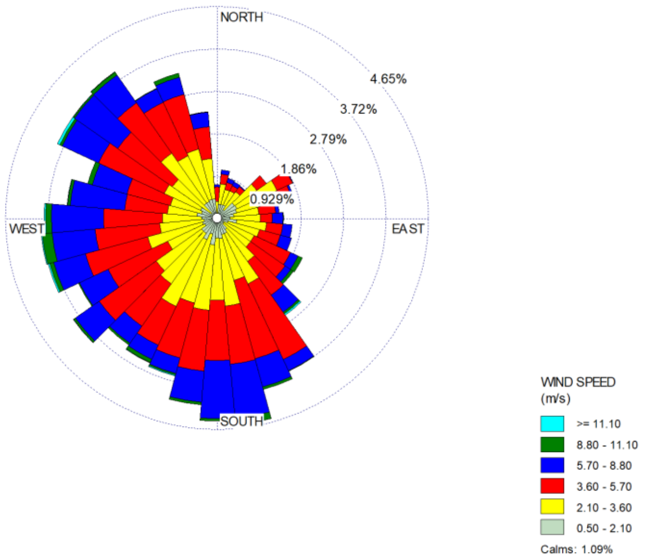

Figure 3-3: NWP Windrose 2016

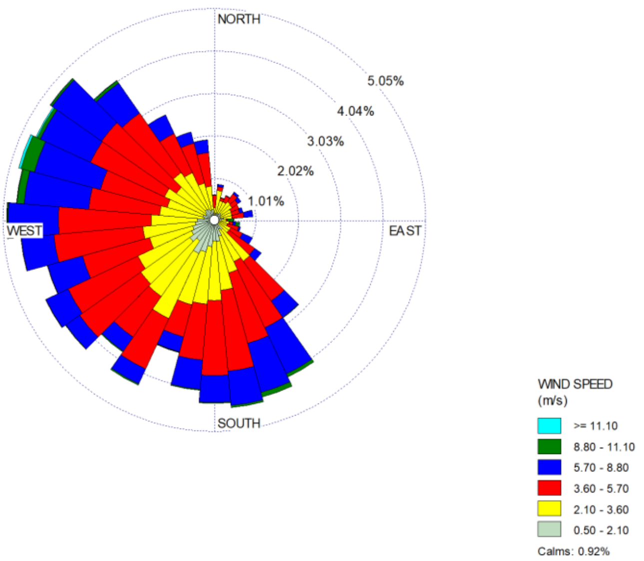

Figure 3-4: NWP Windrose 2017

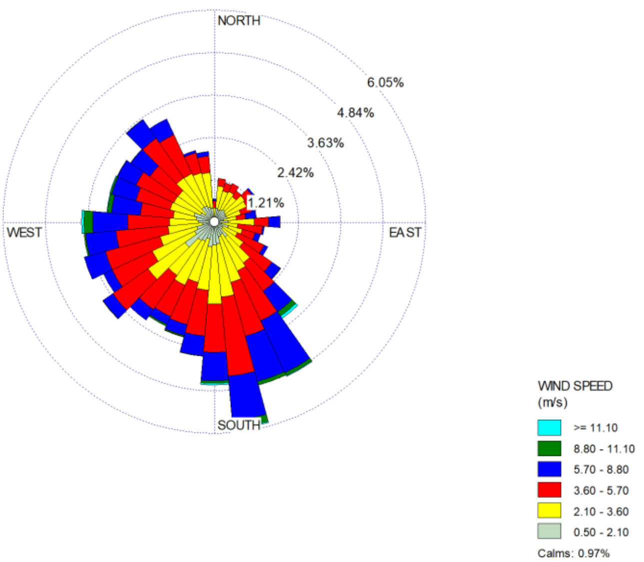

Figure 3-5: NWP Windrose 2018

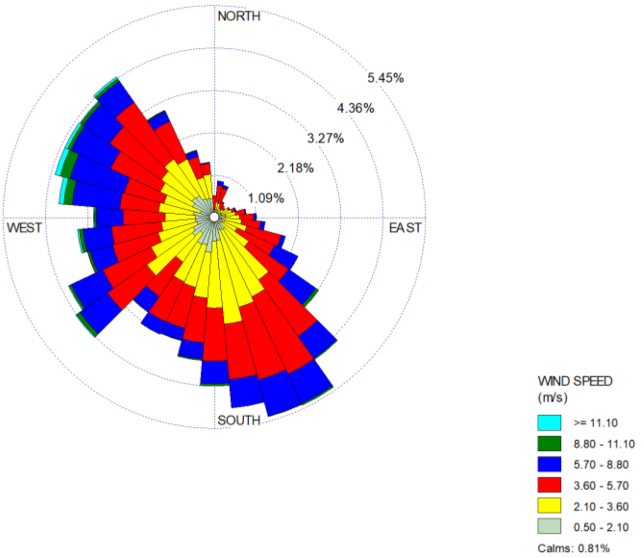

Figure 3-6: NWP Windrose 2019

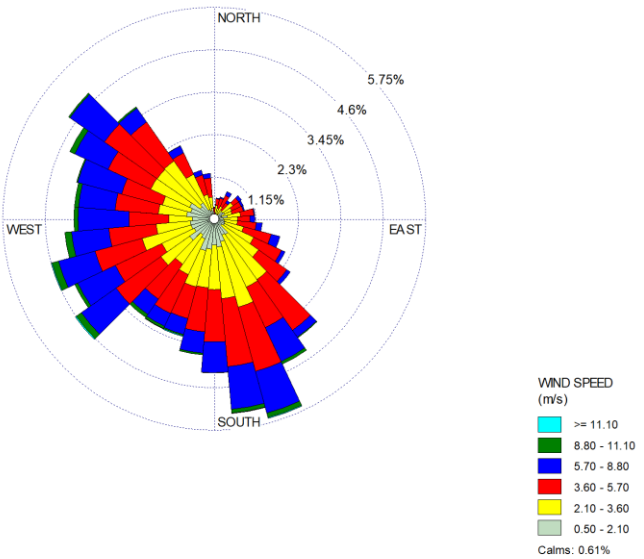

Figure 3-7: NWP Windrose 2020

3.6.6 Dispersion Model Uncertainty

Model validation studies[16] for AERMOD generally suggest that these dispersion models are for the vast majority of cases able to predict maximum short term high percentiles

[16] AERMOD: Latest Features and Evaluation Results, EPA-454/R-03-003, June 2003 (United States Environmental Protection Agency).

concentrations well within a factor of two and the latest evaluation studies for AERMOD show the composite (geometric mean) ratio of predicted to observed short-term averages from 'test sites' (where real-time monitoring data is available to validate model performance), to be between 0.96 and 1.2.

3.7 Assessment of Impacts on Air Quality

3.7.1 Treatment of Model Output

The assessment of impacts against the applied standards was undertaken using model output as described in Table 3-8.

With respect to NOx emissions, it is considered given the nature of the combustion plant and fuel that the primary NO_2 to NO_x ratio will be <10%[17]. As EA Air Quality Modelling and Assessment Unit (AQMAU) guidance[18] on conversion ratio for NOx and NO_2 it has been assumed that 70% of NO_x is present as NO_2 in relation to long term impacts and 35% of NOx is present as NO_2 in relation to short-term impacts.

As dispersion models utilise hourly average meteorological data, calculation of 15-minute averages, such as required for SO_2, requires the application of conversion factors. For the purposes of detailed modelling of SO_2, a conversion factor of 1.34 is applied to hourly average data as detailed in EA AERA guidance.

As discussed in Section 3.2, the back-up boiler will provide preliminary energy demand for the Site prior to full commissioning of the CHPs and is anticipated to operate for a maximum of 6-months of a given calendar year prior to the CHP(s) being installed and commissioned on-Site. In regard to the assessment of process emissions from sites which do not operate all the time, the EA AERA guidance states:

> *"When your site does not operate all the time*
>
> *Adjust your figures down, based on the percentage of the year that your site is not operating. For example, a site that only operates January to June should reduce its PC figures by 50%. This only applies to annual average calculations and not short term assessments."*

Therefore, whilst the back-up boiler has been modelled as an assumed 24/7 365-days per year emission rate, the modelling annual mean PC has been adjusted by 0.5 to reflect the 6-month operation. No adjustment has been made to the short-term modelled PC.

Table 3-8: Model Outputs

Averaging Period	Model Output – Process Contribution (PC)	Predicted Environmental Concentration (PEC)
15-minute mean SO_2. Not to be exceeded more than 35 times a calendar year	99.9 percentile of 15-minute means	1.34x PC + 2 x annual mean background
1-hour mean SO_2. Not to be exceeded more than 24 times a calendar year	99.73 percentile of 1-hour means for	PC + 2 x annual mean background
24-hour mean SO_2. Not to be exceeded more than 3 times a calendar year	99.18 percentile of 24-hour means	PC + 2 x annual mean background

---

[17] https://www3.epa.gov/scram001/no2_isr_database.htm
[18] Environment Agency, Air Quality Modelling and Assessment Unit, 'Conversion Ratios for NO_x and NO_2' (no date).

Averaging Period	Model Output – Process Contribution (PC)	Predicted Environmental Concentration (PEC)
1-hour mean NO_2. Not to be exceeded more than 18 times a calendar year	99.79 percentile of 1-hour means, factored by 0.35 to derive NO_2	PC + 2 x annual mean background
Calendar year	Annual Mean, factored by 0.7 to derive NO_2	PC + annual mean background

3.7.2 Assessment of Impact and Significance

To assess the potential impact on air quality, the predicted exposure is compared to the AQALs, and the results of the dispersion modelling have been presented in the form of:

- Tabulated concentrations at discrete receptor locations to facilitate the discussion of results; and
- Illustrations of the impact as isopleths (contours of concentration) for the criteria selected enabling determination of impact at any locations within the study area.

In accordance with the EA's AERA guidance, the impact is considered to be insignificant or negligible if:

- The long-term PC is <1% of the long term AQAL; and
- The short-term PC is <10% of the short term AQAL.

For PCs that cannot be considered insignificant further assessment has been undertaken and the Predicted Environmental Concentration (PEC: PC + existing background pollutant concentration) determined for comparison as a percentage of the relevant AQAL.

3.8 Assessment of Impacts on Vegetation and Ecosystems

3.8.1 Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA AQTAG06[19] and as applied by NRW. Dry deposition flux was calculated using the following equation:

Dry deposition flux ($\mu g/m^2/s$) = ground level concentration ($\mu g/m^3$) x deposition velocity (m/s)

Wet deposition occurs via the incorporation of the pollutant into water droplets which are then removed in rain or snow and is not considered significant over short distances (AQTAG06) compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered. The applied deposition velocities are as shown in Table 3-9.

Table 3-9: Applied Deposition Velocities

Chemical Species	Recommended Deposition Velocity (m/s)	
NO_2	Grassland	0.0015
	Woodland	0.0030

[19] Environment Agency, AQTAG06 – Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air, March 2014 version.

Chemical Species	Recommended Deposition Velocity (m/s)	
SO_2	Grassland	0.012
	Woodland	0.024

3.8.1.1 Critical Loads – Eutrophication

The CLo for nitrogen deposition (N) are recorded in units of kgN/ha/yr. The deposition PC is converted from µg/m^2/s to units of kgN/ha/year by multiplying the dry deposition flux by the standard conversion factor of 95.9.

3.8.1.2 Critical Loads – Acidification

The predicted deposition rates are converted to units of equivalents (keq/ha/year), which is a measure of how acidifying the chemical species can be, by multiplying the dry deposition flux (µg/m^2/s) by the standard conversion factors presented in

Table 3-10: Applied Deposition Velocities

Chemical Species	Conversion factor [µg/m2/s to keq/ha/year]
NO_2	6.84
SO_2	9.84

3.8.1.3 Calculation of PC as a percentage of Acid Critical Load Function

The calculation of the process contribution of N and S to the acid CLo function has been carried out according to the guidance on the Air Pollution Information System (APIS), which is as follows:

> "*The potential impacts of additional sulphur and/or nitrogen deposition from a source are partly determined by PEC, because only if PEC of nitrogen deposition is greater than CLminN will the additional nitrogen deposition from the source contribute to acidity. Consequently, if PEC is less that CLminN only the acidifying affects of sulphur from the process need to be considered:*
>
> *Where PEC N Deposition < CLminN*
>
> *PC as % CL function = (PC S deposition/CLmaxS)*100*
>
> *Where PEC is greater than CLminN (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the CLmaxN.*
>
> *Where PEC N Deposition > CLminN*
>
> *PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100*"

3.8.2 Significance of Effect on Ecological Receptors

In addition to the AERA guidance, the EA's Operational Instruction 66_12[20] as applied by NRW details how the air quality impacts on ecological sites should be assessed. This guidance provides risk-based screening criteria to determine whether impacts will have 'no likely significant effects (alone and in-combination)' for International sites, or 'no likely damage' for SSSIs, as follows:

[20] EA Working Instruction 66_12 – Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation.

- PC does not exceed 1% long-term CLe and/or CLo or that the PEC does not exceed 70% long-term CLe and/or CLo for International sites and SSSIs; and
- PC does not exceed 10% short-term CLe for NOx for International sites and SSSIs.

Where impacts cannot be classified as resulting in 'no likely significant effect', more detailed assessment may be required depending on the sensitivity of the feature in accordance with the EA's Operational Instruction 67_12[21] and as applied by NRW. This can require the consideration of the potential for in-combination effects, the actual distribution of sensitive features within the site, and local factors (such as the water table).

The guidance provides the following further criteria:

- If the PEC does not exceed 100% of the appropriate limit it can be assumed there will be no adverse effect;
- If the background is below the limit, but a small PC leads to an exceedance – decision based on local considerations;
- If the background is currently above the limit and the additional PC will cause a small increase – decision based on local considerations;
- If the background is below the limit, but a significant PC leads to an exceedance – cannot conclude no adverse effect; and
- If the background is currently above the limit and the additional PC is large – cannot conclude no adverse effect.

3.9 In-combination Assessment

NRW's response to the Scoping Opinion Request[24], included reference for the requirement to consider the potential for in-combination effects even where Process Contributions are less than 1% of the applied environmental standard at the considered ecological receptors.

The Site is in close proximity to a number of existing operational point sources, including the Parc Adfer Energy Recovery Facility (ERF)[22], and the existing biogas boiler (boiler 7 / emission point reference A20[23]) which will be retained as part of the Site. To consider and present a cumulative assessment of potential impacts on air quality, relevant emissions from the Parc Adfer ERF and the biogas boiler have been included within the dispersion modelling assessment where there is crossover with those emissions associated with the new sources at the Site as identified in Section 3.1 (i.e. the suite of pollutants with associated impacts on Critical Levels, identified as NOx and SO_2, and the suite of pollutants with associated impacts on Critical Loads with a nitrifying and acidifying potential, identified as NOx, sulphur dioxide (SO_2) and hydrogen chloride (HCl)).

In addition, a further review of FCC's planning portal determined two planning applications for committed development (but as yet to be built / fully operational following commissioning) which warranted inclusion and consideration as part of an in-combination assessment of potential impacts arising from emissions to air, as follows:

- FCC Application reference: 063104:
    - Location : Weighbridge Road, Deeside Industrial Estate, Deeside, CH5 2LL;

[21] EA Working Instruction 67_12 – Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation.

[22] Permit reference number: EPR/AB3092CV

[23] Permit reference number: EPR/BT4885IT.

  - Description of proposal: Erection of an advanced gasification plant and associated development; and
  - Applicant: Logik WTE Ltd.
  - Pollutant suite considered: NOx, SO_2 and HCl.
- FCC Application reference: 063721:
  - Location : The Airfields (Airfields Delta) Welsh Road;
  - Description of proposal: Erection of a Paper Processing Mill to produce and manufacture tissue paper (B2, B8 use class) with ancillary B1a office space; associated servicing and infrastructure including car parking, HGV parking and vehicle and pedestrian circulation; noise mitigation features; earthworks to create development platforms; creation of drainage features including a new outfall to the River Dee; water treatment plant; and landscaping; and
  - Applicant: ICT UK Ltd & Craig Hill Estates.
  - Pollutant suite considered: NOx.

The planning applications for the above Logik WTE Ltd site and the ICT UK Ltd & Craig Hill Estates site were each accompanied by an Air Quality Assessment. Those Air Quality Assessments were reviewed in order to source corresponding Process Contributions / impacts at the considered ecological receptors in order to provide an in-combination assessment.

Reference should be made to Table 3-13 (Logik WTE Ltd) and Table 3-14 (ICT UK Ltd) for details of the modelled parameters.

The emission parameters applied in the modelling for the existing biogas boiler as part of the cumulative assessment are provided in Table 3-11below. It is noted that the cumulative assessment of emissions from the existing biogas boiler is limited to that pollutant suite with a potential cumulative impact with the Site (i.e. NOx, SO_2 and HCl, as the same pollutant suite emitted from the Site or those pollutants with a potential contribution to nutrient nitrogen or acidification).

Table 3-11: Biogas Boiler Emission Parameters

Parameter	A20 Biogas Boiler
NGR (x,y)	x:330652 y:371480
Stack Height (m)	69
Stack Internal Diameter (m)	3.20
Volume Flow (Nm^3/s) (A)	51.9
Emission Temperature (^oC)	70
Oxygen Content (% O_2 dry gas)	7.7
Moisture content (% H_2O)	22.0
Actual Flow Rate (Am^3/s)	62.8
Emission velocity (m/s) per stack	7.8
NOx Concentration (mg/Nm^3)	200
NOx Emission (g/s)	10.38
SO_2 Concentration (mg/Nm^3)	50

Parameter	A20 Biogas Boiler
SO_2 Emission (g/s)	2.60
HCl Concentration (mg/Nm^3)	10
HCl Emission (g/s)	0.52
Note: (A) Normalised to 273K, dry, 101.3kPa, 11% O_2.	

The emission parameters applied in the modelling for Parc Adfer are provided in Table 3-12 below. It is noted that the cumulative assessment of emissions from Parc Adfer is limited to that pollutant suite with a potential cumulative impact with the Site (i.e. NOx, SO_2 and HCl, as the same pollutant suite emitted from the Site or those pollutants with a potential contribution to nutrient nitrogen or acidification).

Table 3-12: Parc Adfer Emission Parameters

Parameter	Parc Adfer
NGR (x,y)	x:331093, y:371418
Stack Height (m)	85
Stack Internal Diameter (m)	2.30
Volume Flow (Nm^3/s) (A)	37.6
Emission Temperature (^{o}C)	140
Oxygen Content (% O_2 dry gas)	10.1
Moisture content (% H_2O)	18.1
Actual Flow Rate (Am^3/s)	63.8
Emission velocity (m/s) per stack	15.4
NOx Concentration (mg/Nm^3)	200
NOx Emission (g/s)	7.53
SO_2 Concentration (mg/Nm^3)	50
SO_2 Emission (g/s)	1.88
HCl Concentration (mg/Nm^3)	10
HCl Emission (g/s)	0.38
Note: (A) Normalised to 273K, dry, 101.3kPa, 11% O_2.	

Table 3-13: Logik WTE Ltd Emission Parameters

Parameter	Logik WTE Ltd
NGR (x,y)	x:331088.99, y:371227.98
Stack Height (m)	65
Stack Internal Diameter (m)	1.13
Volume Flow (Nm^3/s) (A)	22.3
Emission Temperature (^{o}C)	127
Oxygen Content (% O_2 dry gas)	6.0

Parameter	Logik WTE Ltd
Moisture content (% H_2O)	10.3
Actual Flow Rate (Am^3/s)	24.9
Emission velocity (m/s) per stack	21.9
NOx Concentration (mg/Nm^3)	200
NOx Emission (g/s)	3.345
SO_2 Concentration (mg/Nm^3)	50
SO_2 Emission (g/s)	0.5575
HCl Concentration (mg/Nm^3)	10
HCl Emission (g/s)	0.1115
Note: (A) Normalised to 273K, dry, 101.3kPa, 11% O_2.	

Table 3-14: ICT UK Ltd Emission Parameters

Parameter	ICT UK Ltd						
Source	PM1/E10	PM2/E10	PM3/E10	CV1/E1	CV1/E2	CV3/E1	CV3/E2
NGR (x,y)	332020, 369755	332090, 369653	332108, 369628	332377, 369851	332375, 369855	332425, 369778	332423, 36978
Stack Height (m)	30	30	30	12.5	12.5	12.5	12.5
Stack Internal Diameter (m)	1.8	1.8	1.8	0.45	0.45	0.45	0.45
Emission Temperature (°C)	220	220	220	120	120	120	120
Actual Flow Rate (Am^3/s)	50.1304	50.1304	50.1304	0.9196	0.9196	0.9196	0.9196
Emission velocity (m/s) per stack	19.7	19.7	19.7	5.782	5.782	5.782	5.782
NOx Concentration (mg/Nm^3)	50	50	50	100	100	100	100
NOx Emission (g/s)	2.5	2.5	2.5	0.09	0.09	0.09	

Furthermore, it is noted the Air Quality Chapter and Technical Appendix within the Environmental Statement (ES) for the planning applications for the Site originally considered air quality impacts associated with both point source and road traffic emission contributions. The scope of this AERA and assessment of PCs is limited to point source emission contributions. However, for completeness, where PECs are considered, this includes the relevant by-receptor road traffic emission contributions in order to provide a comprehensive cumulative assessment.

4.0 Baseline Environment

4.1 Site Setting and Sensitive Receptors

The Site is located within the setting of the Shotton Mill complex, and the Deeside Industrial Park at the approximate National Grid Reference (NGR) x330500, y371600. The Site setting and assessed receptor locations are described in the following sections.

4.1.1 Human Receptors

Consistent with the approach taken within the Air Quality Chapter and Technical Appendix within the Environmental Statement (ES) for the planning applications for the Site, human receptors have been identified in reference to LAQM.TG(22).

According to LAQM.TG(22), AQALs should only apply to locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant AQAL. The dispersion modelling has been completed using a receptor grid to allow potential short-term exposure to be assessed at all locations surrounding the Site. The assessed human receptors remain consistent with those considered within the Air Quality Chapter and Technical Appendix within the ES for planning applications.

Specific locations surrounding the Site have been selected to inform the risk assessment that are broadly representative of either worst-case relevant exposure locations or population centres. As such, 19 locations surrounding the Site have been selected to inform the risk assessment in terms of relevant annual mean exposure referred to as HR1 – HR19, and as presented in Table 4-1 and Figure 4-1.

It is noted that the considered receptors are consistent with those presented and assessed within the original planning application and ES was submitted and granted consent.

Further, the dispersion modelling has been completed using a receptor grid to allow potential short-term exposure to be assessed at all locations surrounding the Site, as discussed in Section 3.6.2.

Table 4-1: Modelled Discrete Human Receptor Locations

Reference	NGR-x (m)	NGR-y (m)	Description
HR1	329983	375917	Residential
HR2	330134	374813	Residential
HR3	331350	374134	Residential
HR4	331412	373423	Leisure (Birdwatching Area)
HR5	332445	373388	Residential
HR6	333654	371858	Residential
HR7	332510	369352	Residential
HR8	330501	369144	Residential
HR9	329734	369569	Residential
HR10	328944	370085	Residential
HR11	327979	370707	Residential
HR12	327881	370739	Residential
HR13	328010	370672	Residential
HR14	328042	370651	Residential

Reference	NGR-x (m)	NGR-y (m)	Description
HR15	333627	370879	Residential
HR16	327421	371095	Residential
HR17	327262	371142	Residential
HR18	327155	371215	Residential
HR19	327118	371125	Residential

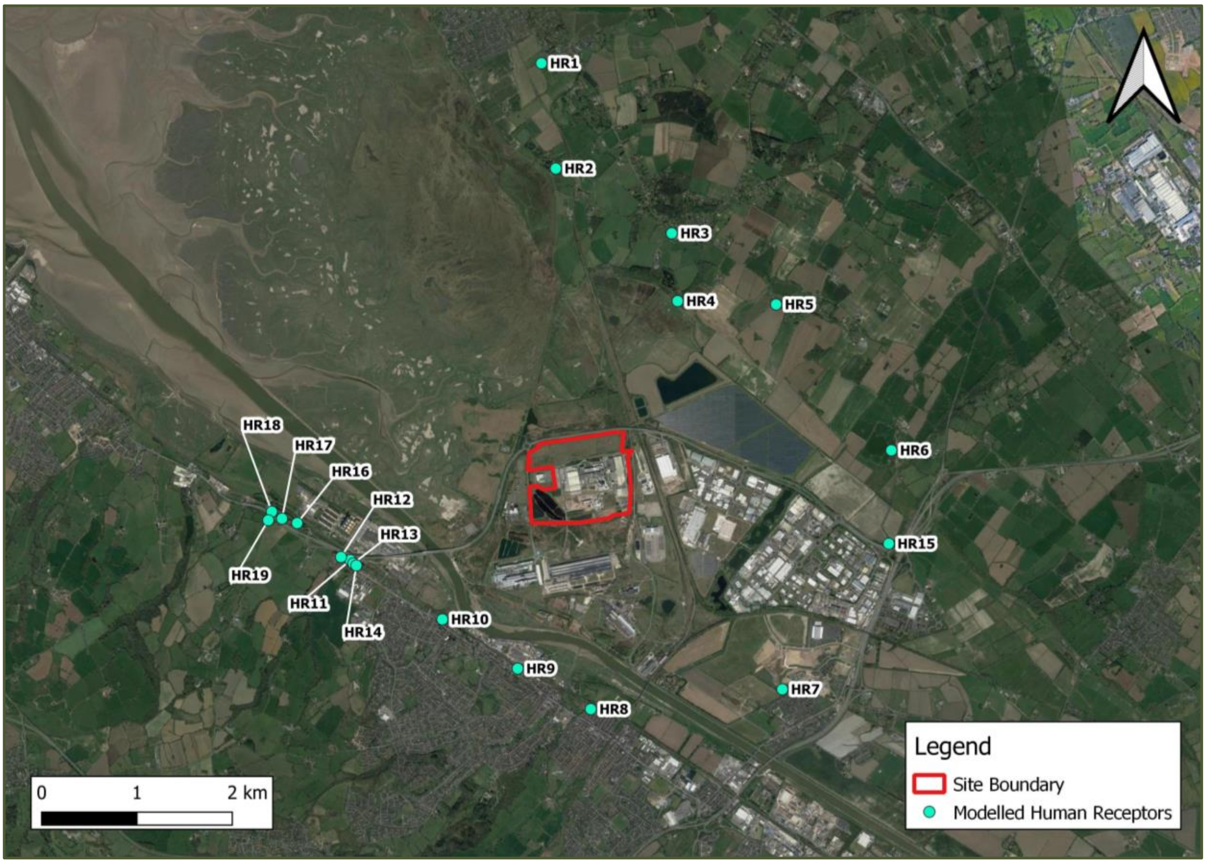

Figure 4-1: Modelled Human Receptor Locations

4.1.2 Ecological Receptors

Consistent with the approach taken within the Air Quality Chapter and Technical Appendix within the Environmental Statement (ES) for the planning applications for the Site, ecological receptors have been identified in reference to NRW guidance and the content of the Scoping Opinion[24] as part of the ES for the original planning application. It is noted that the assessed ecological receptors remain consistent with those considered within the Air Quality Chapter and Technical Appendix within the ES for the planning applications for the Site.

NRW guidance requires that designated ecological sites should be screened against relevant AQALs if they are located within the following set distances. It is noted that as the Site includes the provision of a Combined Heat and Power (CHP) plant with an output greater than 50MW, a 15km screening distance has been applied for European sites as required by the stated NRW guidance:

- SPA, SAC or Ramsar sites within 15km of the installation; and

[24] NRW response to the Scoping Opinion Request, NRW reference: CAS-166697-C7F9, dated 27/10/2021.

- SSSI, NNR, LNR, Local Wildlife Sites (LWS or Sites of Biological Importance (SBI)) and AW within 2km of the location of the installation.

There are several designated sites within the relevant screening distances from the Site; details of which are presented in Table 4-2 and Figure 4-2. The ecological receptors considered are as confirmed within NRW's response to the Scoping Opinion Request.

Table 4-2: Designated Ecological Sites

Reference	Interest Status	Site and Designation
ER1 (SAC)	European	Dee Estuary / Aber Dyfrdwy SAC
ER1 (SPA)	European	The Dee Estuary SPA
ER2 (SAC)	European	River Dee and Bala Lake SAC
ER3 (SAC)	European	Dees and Buckley Newts SAC
ER4 (SAC)	European	Halkyn Mountain SAC
ER5 (SSSI)	National	Inner Marsh Farm SSSI
ER6 (SSSI)	National	Shotton Lagoons and Reedbeds SSSI
ER7 (SAC)	European	Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC
ER8 (SPA)	European	Mersey Estuary SPA

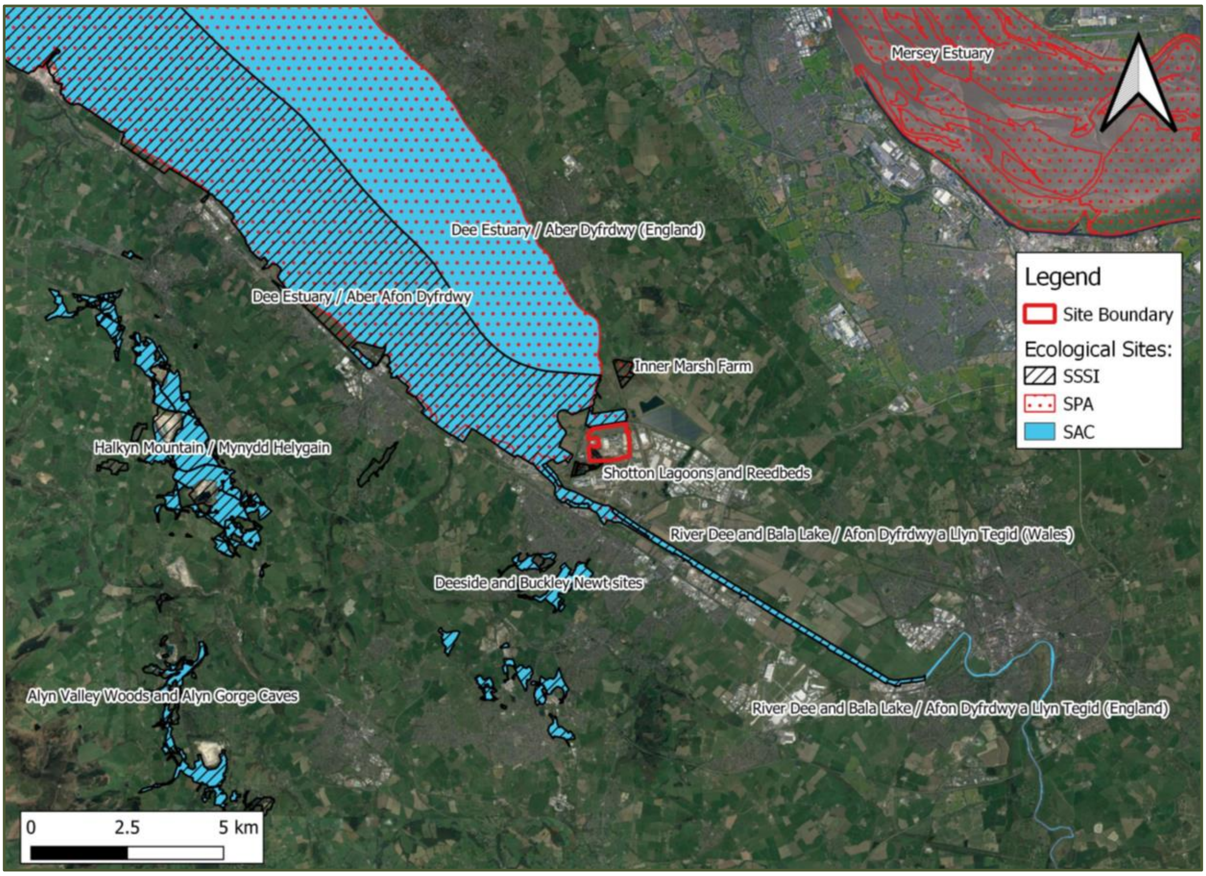

Figure 4-2: Modelled Designated Ecological Site Locations

4.2 Baseline Air Quality

Pollutant concentrations monitored during 2020 and 2021 (i.e. affected by the COVID-19 pandemic) are expected to be atypical as indicated by Defra[11] and the Institute of Air Quality Management (IAQM)[12]. Whilst still presented, these have not been used for the determination of baseline conditions.

4.2.1 Local Air Quality Management

FCC as part of the North Wales Authorities Collaborative (NWAC) and in fulfilment of statutory requirements, has conducted an on-going exercise to review and assess air quality within their administrative area. The latest publicly available LAQM report for NWAC (not impacted by the COVID-19 pandemic) at the time of writing is the 2023 Air Quality Progress Report [25].

FCC do not presently have any declared AQMAs within their administrative area.

4.2.1.1 Automatic Air Quality Monitoring

From review of both local and national automatic monitoring networks, the nearest continuous monitor is located >15km from the Site. No automatic monitoring is completed by FCC. Given the separation distance, and anticipated differences in local environments, no automatic monitoring locations have been considered.

[25] North Wales Authorities Collaborative Project, 2023 Air Quality Progress Report (2020), September 2023.

4.2.1.2 Passive Diffusion Tube Monitoring – FCC

Passive NO_2 diffusion tube monitoring is currently undertaken by FCC within the Site locale, at numerous locations, in fulfilment of their statutory LAQM obligations.

The details and results of the monitoring locations of relevance to the Site (i.e. within 2.5km of the Site) are presented in Table 4-3 and Table 4-4 respectively, whilst their locations are illustrated in Figure 4-3. All monitoring data presented has been ratified by FCC.

Table 4-3: Local LAQM NO_2 Passive Diffusion Tube Monitoring Sites: Details

Site ID	Site Type	NGR (m)		Height (m)	Within AQMA	Distance to Site (km)
		X	Y			
ADDC-015 (Site 8)	Urban Background	328032	370647	1.8	No	1.9
ADDC-024 (Site 17)	Kerbside	330599	368922	2.3	No	2.2
ADDC-030 (Site 23)	Industrial	332764	370981	2.0	No	1.9
ADDC-032 (Site 25)	Industrial	332031	371562	1.8	No	1.1
ADDC-033 (Site 26)	Industrial	329906	370882	1.8	No	0.2
ADDC-036 (Site 29)	Industrial	330575	371802	2.2	No	0.0 (on site)

Table 4-4: Local LAQM NO_2 Passive Diffusion Tube Monitoring Sites: Results

Site ID	2022 Data Capture %	Annual Mean NO_2 Concentration ($\mu g/m^3$)				
		2018	2019	2020	2021	2022
ADDC-015 (Site 8)	100	12.6	12.3	9.7	10.1	10.0
ADDC-024 (Site 17)	100	24.7	24.3	17.6	20.5	20.1
ADDC-030 (Site 23)	100	17.6	17.2	17.7	18.5	17.2
ADDC-032 (Site 25)	100	32.0	31.8	11.0	11.1	19.2
ADDC-033 (Site 26)	100	17.2	16.6	12.9	14.0	10.6
ADDC-036 (Site 29)	100	17.9	18.3	20.1	15.5	11.6

As shown in Table 4-4, there has been no exceedances of the annual mean NO_2 AQAL ($40\mu g/m^3$) at all considered passive diffusion tubes locations across the period presented (2015-2019). Furthermore, annual mean concentrations are considered to be 'well below' the AQAL in all 2022.

ADDC-036 (Site 29) is an industrial site located adjacent to the Site along Weighbridge Road and as such the most representative locations of conditions experienced at the Site. The NO_2 concentration in 2022 was $11.6\mu g/m^3$.

Annual mean NO_2 concentrations at all considered sites demonstrate a downward trend over the considered period, with some year-on-year fluctuations.

The empirical relationship given in LAQM.TG(22) states that exceedances of the 1-hour mean AQAL for NO_2 is unlikely to occur where annual mean concentrations are <60µg/m³. This indicates that an exceedance of the 1-hour mean AQAL was unlikely to have occurred at the above locations for the period assessed.

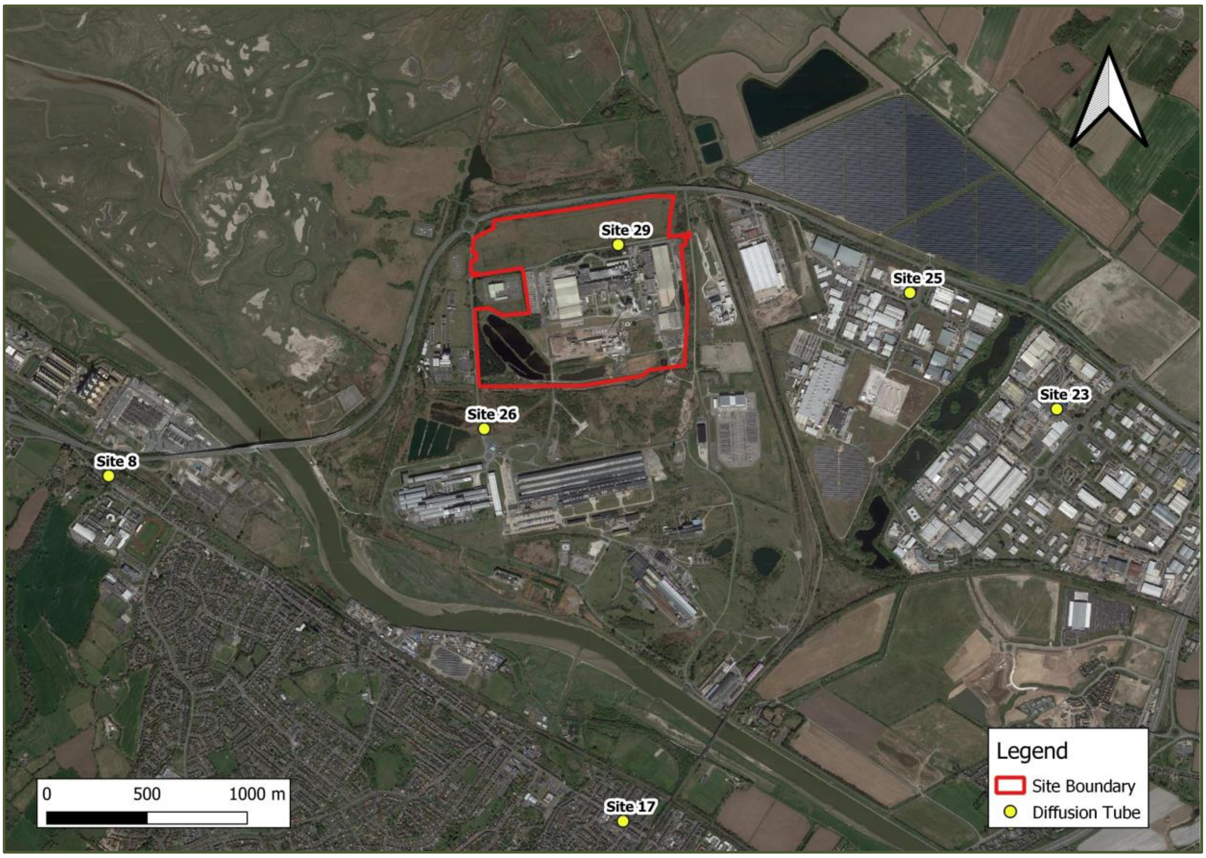

Figure 4-3: Monitoring Locations Relative to the Site

4.2.2 Defra Mapped Background Concentrations

Defra maintains a nationwide model of existing and future background air quality concentrations at a 1km grid square resolution which is routinely used to support LAQM requirements and air quality assessments. As a precautionary approach and for consistency with that assessment provided in support of the planning applications for the Site, mapped background concentrations equating to a 2018 base-year have been applied. It is noted that application of updated Defra mapped background 2021 base-year[26], a later future year forecast opening year beyond 2025 would be associated with lower mapped background NOx concentrations.

The Air Quality Assessment and Air Quality Chapter to the ES for the original planning applications corresponding 2025 mapped background concentrations as part of the predicted completed opening year of the Proposed Development. Mapped background concentrations of air pollutants including NOx and NO_2 are forecast to reduce year-on-year as there are improvements to the vehicle fleet-mix, for example, which is evident in the mapped background concentration datasets for FCC: earlier years (in comparison to later years) are associated with higher mapped background concentrations. Therefore, as a precautionary approach, 2025 has remained as the assumed predicted opening year of the Proposed Development with corresponding 2025 mapped background concentrations

[26] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2021.

applied across the modelled domain, as presented in Table 4-5. All of the mapped background concentrations presented are well below the respective annual mean AQALs.

It is noted that separate background concentrations have been considered at receptors based upon whether the given receptor was subject to road traffic emissions assessment as part of the Air Quality Assessment and Air Quality Chapter to the ES for the original planning applications. Reference should be made to Table 4-5 and Table 4-6 for the applied background concentrations.

Table 4-5: Defra Background Pollutant Concentrations – Human Receptors HR11 – HR19

Grid Square (m)	Year	Annual Mean Background Concentration (µg/m^3)	
		NOx	NO_2
x327500, 370500	2025	7.7	6.1
x328500, 370500	2025	9.9	7.7
x333500, 370500	2025	10.0	7.7
x327500, 371500	2025	7.8	6.2
AQAL		**-**	***40***

Table 4-6: Defra Background Pollutant Concentrations – Human Receptors HR1 – HR10

Grid Square (m)	Year	Annual Mean Background Concentration (µg/m^3)
		NO_2
x327500, y370500	2025	6.4
x328500, y370500	2025	8.0
x333500, y370500	2025	14.2
x327500, y371500	2025	6.4
AQAL		***40***

4.2.3 Application of Baseline Data in the Assessment

The annual mean background NO_2 concentrations applied at considered human receptor locations are as indicated in Table 4-5 and Table 4-6.

Where required, short-term background concentrations are determined in reference to the method outlined within the AERA guidance (short-term background concentration of a substance is twice its long-term concentration).

4.3 Baseline Conditions at Ecological Receptors

For consistency with the approach to the planning applications and ES for the Site, the stated NOx backgrounds have been sourced from 2018 base-year Defra projections for the anticipated opening year 2025 (Table 4-7) as a precautionary approach. Later base year mapped background projections (i.e. the 2021 base year[27] published in November 2024) and a later future year forecast opening year beyond 2025 would be associated with lower mapped background NOx concentrations.

The Air Pollution Information System (APIS) website[28], a support tool for assessment of potential effects of air pollutants on habitats and species developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology, has been used to provide information on deposition rates and CLo for nutrient nitrogen (Table 4-9) and CLo functions for acidity (Table 4-10) at the ecological receptors.

The applied CLo for nitrogen deposition has been informed by advice received from NRW in response[29] to a pre-application enquiry as part of the planning application – this advice provided guidance on the sensitivity features within each designation and the CLo to apply based upon those relevant features susceptible to air pollution. The advice received from NRW did not provide any guidance on the applicable CLo for acid deposition and therefore the applied CLo is based upon that from APIS for the corresponding habitat / feature as identified by NRW as part of the response to nitrogen deposition. It is noted that in the interim since the original planning application and ES was submitted and granted consent, APIS has been updated to provide existing background loads based a revised 2019 – 2021 base year.

Background SO_2 concentrations have been sourced from APIS, based upon the location of maximum predicted in-combination impact at each considered ecological designation, as presented in Table 4-8.

Table 4-7: Background NOx Concentrations at Considered Ecological Receptors

Site	Defra NOx Annual Mean (µg/m^3)	Calculated 24-hour Mean (µg/m^3) (A)
ER1 (SAC)	12.94	19.41
ER1 (SPA)	12.94	19.41
ER2 (SAC)	26.07	39.11
ER3 (SAC)	15.86	23.79
ER4 (SAC)	13.71	20.57
ER5 (SSSI)	12.94	19.41
ER6 (SSSI)	16.34	24.51
ER7 (SAC)	6.96	10.44
ER8 (SPA)	35.59	53.39
Note: (A) Calculated from 1.5x the annual mean concentration.		

Table 4-8: Background SO_2 Concentrations at Considered Ecological Receptors

Site	APIS SO_2 Annual Mean (µg/m^3)
ER1 (SAC)	2.4

[27] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2021.

[28] APIS, http://www.apis.ac.uk/.

[29] Response from North Planning of NRW to SLR Consulting Ltd, dated 15th December 2021.

Site	APIS SO_2 Annual Mean (µg/m^3)
ER1 (SPA)	2.4
ER2 (SAC)	2.6
ER3 (SAC)	2.1
ER4 (SAC)	1.3
ER5 (SSSI)	2.4
ER6 (SSSI)	2.8
ER7 (SAC)	0.9
ER8 (SPA)	3.3

Table 4-9: Nitrogen Critical Loads and Current Loads

Site	APIS C_{Lo} Class	CLo Applied in Assessment (kg N/ha/yr)	Current Load (kg N/ha/yr)
ER1 (SAC)	Atlantic salt meadows	20	18.350
ER1 (SPA)	Pioneer, low-mid, mid-upper saltmarshes	20	18.350
ER2 (SAC)	Riparian habitat as proxy	20	26.088
ER3 (SAC)	Acidophilous Quercus-dominated woodland	10	21.294
ER4 (SAC)	Calaminarian grassland – Non-mediterranean dry acid and neutral closed grassland	10	18.966
ER5 (SSSI)	Pioneer, low-mid, mid-upper saltmarshes	10	18.349
ER6 (SSSI)	Fen, Marsh or Swamp	10	19.201
ER7 (SAC)	Meso- and eutrophic Quercus woodland	15	32.255
ER8 (SPA)	Raised and blanket bogs	5	24.279
Note: The highest background has been applied with the exception of ER1 SAC/SPA Dee Estuary which covers a large area and the highest background occurring toward Chester. As such the background in the area of highest impact from Site emissions has been applied.			

Table 4-10: Acid Critical Load Functions and Current Loads

Site	APIS C_{Lo} Class	C_{Lo} Function (k_{eq}/ha/yr)			Current Load (k_{eq}/ha/yr)
		CLmaxS	CLminN	CLmaxN	
ER1 (SAC)	Atlantic salt meadows – habitat not acid sensitive	N/A	N/A	N/A	N/A
ER1 (SPA)	Acid grassland	4.1	0.4	4.5	1.51
ER2 (SAC)	No sensitive habitat with CL data	N/A	N/A	N/A	N/A

Site	APIS C_{Lo} Class	C_{Lo} Function (k_{eq}/ha/yr)			Current Load (k_{eq}/ha/yr)
		CLmaxS	CLminN	CLmaxN	
ER3 (SAC)	Broadleafed/Coniferous Woodland	0.142	1.448	1.72	1.62
ER4 (SAC)	Calaminarian grassland – Acid grassland	4.1	0.438	4.323	1.445
ER5 (SSSI)	No sensitive habitat with CL data	N/A	N/A	N/A	N/A
ER6 (SSSI)	Fen, Marsh or Swamp	4.11	0.438	4.548	1.552
ER7 (SAC)	Broadleafed/Coniferous Woodland	1.721	0.142	1.863	1.627
ER8 (SPA)	Bogs	0.177	0.321	0.498	1.931
Note: The highest background has been applied with the exception of ER1 SAC/SPA Dee Estuary which covers a large area and the highest background occurring toward Chester. As such the background in the area of highest impact from Site emissions has been applied.					

5.0 Assessment Results

The average predicted concentrations across the 5-years' meteorological data applied have been applied.

Potential impacts on air quality as PCs for this AERA have been assessed based upon the Scenarios described within Section 3.3. Where PECs are considered, in-combination assessment with those sources identified within Section 3.9 has been undertaken in conjunction with the stated background concentrations / loads as relevant.

5.1 Impacts on Human Receptors

5.1.1 Annual Mean NO_2 Impacts

5.1.1.1 'Boiler Project' Scenario

Predicted long-term (annual mean) NO_2 impacts at the modelled human receptor locations for the 'Boiler Project' scenario are summarised in Table 5-1.

The impacts of the predicted 'Boiler Project' scenario PC to the long-term (annual mean) NO_2 AQAL are described as 'insignificant' (i.e. <1% of the AQAL) at all considered receptors.

As the PCs are <1% of the AQAL at all considered human receptors, PECs are not considered.

Table 5-1: Predicted Annual Mean NO_2 Impacts: 'Boiler Project' Scenario

ID	PC (µg/m^3)	PC as % of AQAL
HR1	0.07	0.17
HR2	0.10	0.24
HR3	0.11	0.26
HR4	0.15	0.37
HR5	0.11	0.26
HR6	0.08	0.20
HR7	0.12	0.31
HR8	0.06	0.14
HR9	0.05	0.13
HR10	0.05	0.13
HR11	0.07	0.17
HR12	0.10	0.24
HR13	0.11	0.26
HR14	0.15	0.37
HR15	0.11	0.26
HR16	0.08	0.20
HR17	0.12	0.31
HR18	0.06	0.14
HR19	0.05	0.13

5.1.1.2 'CHP Project' Scenario

Predicted long-term (annual mean) NO_2 impacts at the modelled human receptor locations for the 'CHP Project' scenario are summarised in Table 5-2.

The impacts of the predicted 'CHP Project' scenario PC to the long-term (annual mean) NO_2 AQAL are described as 'insignificant' (i.e. <1% of the AQAL) at all considered receptors.

As the PCs are <1% of the AQAL at all considered human receptors, PECs are not considered.

Table 5-2: Predicted Annual Mean NO_2 Impacts: 'CHP Project' Scenario

ID	PC (µg/m^3)	PC as % of AQAL
HR1	0.12	0.29
HR2	0.17	0.42
HR3	0.17	0.41
HR4	0.23	0.57
HR5	0.17	0.43
HR6	0.14	0.34
HR7	0.17	0.43
HR8	0.08	0.19
HR9	0.07	0.18
HR10	0.08	0.19
HR11	0.12	0.29
HR12	0.17	0.42
HR13	0.17	0.41
HR14	0.23	0.57
HR15	0.17	0.43
HR16	0.14	0.34
HR17	0.17	0.43
HR18	0.08	0.19
HR19	0.07	0.18

5.1.2 1-hour Mean NO_2 Impacts

5.1.2.1 'Boiler Project' Scenario

Predicted short-term (1-hour mean 99.79 percentile) NO_2 impacts at the modelled human receptor locations for the 'Boiler Project' scenario are summarised in Table 5-3.

The impacts of the predicted 'Boiler Project' scenario PC to the 1-hour mean 99.79 percentile NO_2 AQAL are described as 'insignificant' (i.e. <10% of the AQAL) at all considered receptors.

As the PCs are <10% of the AQAL at all considered human receptors, PECs are not considered.

Table 5-3: Predicted 1-hour Mean (99.73 Percentile) NO_2 Impacts – 'Boiler Project' Scenario

ID	PC (µg/m^3)	PC as % of AQAL
HR1	2.28	1.14
HR2	3.34	1.67
HR3	4.76	2.38
HR4	5.49	2.74
HR5	4.52	2.26
HR6	2.34	1.17
HR7	4.79	2.40
HR8	2.92	1.46
HR9	2.24	1.12
HR10	2.39	1.20
HR11	1.78	0.89
HR12	1.51	0.75
HR13	1.85	0.93
HR14	1.93	0.96
HR15	4.29	2.15
HR16	1.14	0.57
HR17	1.11	0.56
HR18	1.06	0.53
HR19	1.07	0.54

5.1.2.2 'CHP Project' Scenario

Predicted short-term (1-hour mean 99.79 percentile) NO_2 impacts at the modelled human receptor locations for the 'CHP Project' scenario are summarised in Table 5-4.

The impacts of the predicted 'CHP Project' scenario PC to the 1-hour mean 99.79 percentile NO_2 AQAL are described as 'insignificant' (i.e. <10% of the AQAL) at all considered receptors.

As the PCs are <10% of the AQAL at all considered human receptors, PECs are not considered.

Table 5-4: Predicted 1-hour Mean (99.73 Percentile) NO_2 Impacts – 'CHP Project' Scenario

ID	PC (µg/m^3)	PC as % of AQAL
HR1	1.78	0.89
HR2	2.23	1.12
HR3	3.92	1.96
HR4	4.96	2.48
HR5	3.56	1.78

ID	PC (µg/m³)	PC as % of AQAL
HR6	2.13	1.06
HR7	6.13	3.07
HR8	2.68	1.34
HR9	2.42	1.21
HR10	2.45	1.22
HR11	2.11	1.05
HR12	2.03	1.01
HR13	2.09	1.04
HR14	2.15	1.08
HR15	5.92	2.96
HR16	1.83	0.92
HR17	1.64	0.82
HR18	1.53	0.77
HR19	1.56	0.78

5.1.3 15-minute Mean SO_2 Impacts

Predicted short-term (15-hour mean 99.9 percentile) SO_2 impacts at the modelled human receptor locations are summarised in Table 5-5.

The impacts of the predicted PC to the 15-minute mean 99.9 percentile SO_2 AQAL are described as ‘insignificant’ (i.e. <10% of the AQAL) at all considered receptors.

As the PCs are <10% of the AQAL at all considered human receptors, PECs are not considered.

Table 5-5: Predicted 15-minute Mean (99.9 Percentile) SO_2 Impacts

ID	PC (µg/m³)	PC as % of AQAL
HR1	0.52	0.19
HR2	0.57	0.22
HR3	0.68	0.25
HR4	0.83	0.31
HR5	0.62	0.23
HR6	0.57	0.21
HR7	0.88	0.33
HR8	0.74	0.28
HR9	0.65	0.25
HR10	0.62	0.23
HR11	0.41	0.16
HR12	0.42	0.16
HR13	0.43	0.16

ID	PC (µg/m^3)	PC as % of AQAL
HR14	0.45	0.17
HR15	0.70	0.26
HR16	0.37	0.14
HR17	0.35	0.13
HR18	0.34	0.13
HR19	0.34	0.13

5.1.4 1-hour Mean SO_2 Impacts

Predicted short-term (1-hour mean 99.73 percentile) SO_2 impacts at the modelled human receptor locations are summarised in Table 5-6.

The impacts of the predicted PC to the 1-hour mean 99.73 percentile SO_2 AQAL are described as 'insignificant' (i.e. <10% of the AQAL) at all considered receptors.

As the PCs are <10% of the AQAL at all considered human receptors, PECs are not considered.

Table 5-6: Predicted 1-hour Mean (99.73 Percentile) SO_2 Impacts

ID	PC (µg/m^3)	PC as % of AQAL
HR1	0.25	0.07
HR2	0.30	0.08
HR3	0.38	0.11
HR4	0.48	0.14
HR5	0.33	0.10
HR6	0.27	0.08
HR7	0.51	0.15
HR8	0.32	0.09
HR9	0.28	0.08
HR10	0.30	0.09
HR11	0.18	0.05
HR12	0.18	0.05
HR13	0.19	0.05
HR14	0.20	0.06
HR15	0.42	0.12
HR16	0.15	0.04
HR17	0.15	0.04
HR18	0.15	0.04
HR19	0.15	0.04

5.1.5 24-hour Mean SO_2 Impacts

Predicted short-term (24-hour mean 99.18 percentile) SO_2 impacts at the modelled human receptor locations are summarised in Table 5-7.

The impacts of the predicted PC to the 24-hour mean 99.18 percentile SO_2 AQAL are described as 'insignificant' (i.e. <10% of the AQAL) at all considered receptors.

As the PCs are <10% of the AQAL at all considered human receptors, PECs are not considered.

Table 5-7: Predicted 24-hour Mean (99.18 Percentile) SO_2 Impacts

ID	PC (µg/m^3)	PC as % of AQAL
HR1	0.05	0.04
HR2	0.07	0.06
HR3	0.08	0.06
HR4	0.12	0.10
HR5	0.07	0.06
HR6	0.06	0.05
HR7	0.10	0.08
HR8	0.09	0.07
HR9	0.08	0.07
HR10	0.09	0.07
HR11	0.06	0.05
HR12	0.06	0.05
HR13	0.06	0.05
HR14	0.06	0.05
HR15	0.09	0.07
HR16	0.05	0.04
HR17	0.05	0.04
HR18	0.04	0.04
HR19	0.04	0.04

5.2 Impacts on Ecological Receptors

5.2.1 Critical Levels – Annual Mean NOx

5.2.1.1 'Boiler Project' Scenario

The results of the assessment of impacts on the annual mean NOx CLe, as associated with the 'Boiler Project' scenario, are presented in Table 5-8.

Table 5-8 indicates the PC is greater than 1% of the annual mean NOx CLe at ER1 (SAC) and ER1 (SPA). However, at ER1 (SAC) and ER1 (SPA) the PEC is less than 100% of the annual mean NOx CLe and, therefore, following the stated EA Operational Instruction 67_12 it can be assumed there will be '*no adverse effect*'.

At the remaining considered receptors the PC is less than 1% of the annual mean NOx CLe and, therefore, following the stated EA Operational Instruction 66_12 the PC impacts can be concluded to:

- Result in '*no likely significant effect*' at ER2 (SAC), ER3 (SAC), ER4 (SAC), ER7 (SAC) and ER8 (SPA); and
- Cause '*No likely damage*' at ER5 (SSSI) and ER6 (SSSI).

Table 5-8: Impacts on Annual Mean NOx Critical Level: 'Boiler Project' Scenario

ID	Designation	Applied CLe (µg/m³)	PC (µg/m³)	PC as % of CLe	PEC (µg/m³)	PEC as % of CLe
ER1	Dee Estuary / Aber Dyfrdwy SAC	30	1.25	4.15	22.1	73.6
ER1	The Dee Estuary SPA	30	1.25	4.15	22.1	73.6
ER2	River Dee and Bala Lake SAC	30	0.16	0.53	27.1	90.3
ER3	Dees and Buckley Newts SAC	30	0.05	0.18	16.1	53.8
ER4	Halkyn Mountain SAC	30	0.01	0.02	13.8	46.0
ER5	Inner Marsh Farm SSSI	30	0.37	1.25	14.9	49.6
ER6	Shotton Lagoons and Reedbeds SSSI	30	0.57	1.91	18.5	61.7
ER7	Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC	30	0.01	0.03	7.10	23.7
ER8	Mersey Estuary SPA	30	0.03	0.10	35.8	119.3

5.2.1.2 'CHP Project' Scenario

The results of the assessment of impacts on the annual mean NOx CLe, as associated with the 'CHP Project' scenario, are presented in Table 5-9.

Table 5-9 indicates the PC is greater than 1% of the annual mean NOx CLe at ER1 (SAC) and ER1 (SPA). However, at ER1 (SAC) and ER1 (SPA) the PEC is less than 100% of the annual mean NOx CLe and, therefore, following the stated EA Operational Instruction 67_12 it can be assumed there will be '*no adverse effect*'.

At the remaining considered receptors, the PC is less than 1% of the annual mean NOx CLe and, therefore, following the stated EA Operational Instruction 66_12 the PC impacts can be concluded to:

- Result in '*no likely significant effect*' at ER2 (SAC), ER3 (SAC), ER4 (SAC), ER7 (SAC) and ER8 (SPA); and
- Cause '*No likely damage*' at ER5 (SSSI) and ER6 (SSSI).

Table 5-9: Impacts on Annual Mean NOx Critical Level: 'CHP Project' Scenario

ID	Designation	Applied CLe (µg/m³)	PC (µg/m³)	PC as % of CLe	PEC (µg/m³)	PEC as % of CLe
ER1	Dee Estuary / Aber Dyfrdwy SAC	30	1.54	5.12	22.0	73.5
ER1	The Dee Estuary SPA	30	1.54	5.12	22.0	73.5

ID	Designation	Applied CLe (µg/m³)	PC (µg/m³)	PC as % of CLe	PEC (µg/m³)	PEC as % of CLe
ER2	River Dee and Bala Lake SAC	30	0.24	0.79	27.1	90.5
ER3	Dees and Buckley Newts SAC	30	0.08	0.27	16.2	53.8
ER4	Halkyn Mountain SAC	30	0.02	0.07	13.8	46.0
ER5	Inner Marsh Farm SSSI	30	0.61	2.02	15.0	50.1
ER6	Shotton Lagoons and Reedbeds SSSI	30	0.66	2.21	18.5	61.8
ER7	Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC	30	0.04	0.12	7.11	23.7
ER8	Mersey Estuary SPA	30	0.06	0.20	35.8	119.4

5.2.2 Critical Levels – 24-hour Mean NOx

5.2.2.1 'Boiler Project' Scenario

The results of the assessment of impacts on the 24-hour mean NOx CLe, as associated with the 'Boiler Project' scenario, are presented in Table 5-10.

Table 5-10 indicates the PC is greater than 10% of the 24-hour mean NOx CLe at ER1 (SAC) and ER1 (SPA). However, at ER1 (SAC) and ER1 (SPA) the PEC is less than 100% of the 24-hour mean NOx CLe and, therefore, following the stated EA Operational Instruction 67_12 it can be assumed there will be '*no adverse effect*'.

At the remaining considered receptors, the PC is less than 10% of the 24-hour mean NOx CLe and, therefore, following the stated EA Operational Instruction 66_12 the PC impacts can be concluded to:

- Result in '*no likely significant effect*' at ER2 (SAC), ER3 (SAC), ER4 (SAC), ER7 (SAC) and ER8 (SPA); and
- Cause '*No likely damage*' at ER5 (SSSI) and ER6 (SSSI).

The PEC is less than the 24-hour mean NOx CLe at all considered receptors.

Table 5-10: Impacts on 24-hour Mean NOx Critical Level: 'Boiler Project' Scenario

ID	Designation	Applied CLe (µg/m³)	PC (µg/m³)	PC as % of CLe	PEC (µg/m³)	PEC as % of CLe
ER1	Dee Estuary / Aber Dyfrdwy SAC	75	18.1	24.1	37.5	49.9
ER1	The Dee Estuary SPA	75	18.1	24.1	37.5	49.9
ER2	River Dee and Bala Lake SAC	75	7.05	9.4	46.2	61.5
ER3	Dees and Buckley Newts SAC	75	3.07	4.09	26.9	35.8
ER4	Halkyn Mountain SAC	75	0.25	0.33	20.8	27.8
ER5	Inner Marsh Farm SSSI	75	6.10	8.13	25.5	34.0
ER6	Shotton Lagoons and Reedbeds SSSI	75	9.86	13.1	34.4	45.8

ID	Designation	Applied CLe (µg/m^3)	PC (µg/m^3)	PC as % of CLe	PEC (µg/m^3)	PEC as % of CLe
ER7	Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC	75	0.78	1.04	11.2	15.0
ER8	Mersey Estuary SPA	75	0.67	0.90	54.1	72.1

5.2.2.2 'CHP Project' Scenario

The results of the assessment of impacts on the 24-hour mean NOx CLe, as associated with the 'CHP Project' scenario, are presented in Table 5-11.

Table 5-11 indicates the PC is greater than 10% of the 24-hour mean NOx CLe at ER1 (SAC) and ER1 (SPA). However, at ER1 (SAC) and ER1 (SPA) the PEC is less than 100% of the 24-hour mean NOx CLe and, therefore, following the stated EA Operational Instruction 67_12 it can be assumed there will be '*no adverse effect*'.

At the remaining considered receptors, the PC is less than 10% of the 24-hour mean NOx CLe and, therefore, following the stated EA Operational Instruction 66_12 the PC impacts can be concluded to:

- Result in '*no likely significant effect*' at ER2 (SAC), ER3 (SAC), ER4 (SAC), ER7 (SAC) and ER8 (SPA); and
- Cause '*No likely damage*' at ER5 (SSSI) and ER6 (SSSI).

The PEC is less than the 24-hour mean NOx CLe at all considered receptors.

Table 5-11: Impacts on 24-hour Mean NOx Critical Level: 'CHP Project' Scenario

ID	Designation	Applied CLe (µg/m^3)	PC (µg/m^3)	PC as % of CLe	PEC (µg/m^3)	PEC as % of CLe
ER1	Dee Estuary / Aber Dyfrdwy SAC	75	19.0	25.4	48.7	65.0
ER1	The Dee Estuary SPA	75	19.0	25.4	48.7	65.0
ER2	River Dee and Bala Lake SAC	75	7.34	9.79	55.5	74.1
ER3	Dees and Buckley Newts SAC	75	2.97	3.96	31.5	42.0
ER4	Halkyn Mountain SAC	75	0.74	0.99	23.7	31.5
ER5	Inner Marsh Farm SSSI	75	5.67	7.56	33.6	44.8
ER6	Shotton Lagoons and Reedbeds SSSI	75	10.1	13.5	40.2	53.7
ER7	Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC	75	2.03	2.71	17.9	23.8
ER8	Mersey Estuary SPA	75	0.75	1.00	55.8	74.4

5.2.3 Critical Levels – Annual Mean SO_2

The results of the assessment of impacts on the annual mean SO_2 CLe are presented in Table 5-12. These apply to both 'Boiler Project' and 'CHP Project' Scenarios.

Table 5-12 indicates the PC is greater than 1% of the annual mean SO_2 CLe at ER1 (SAC), ER1 (SPA), ER2 (SAC), ER5 (SSSI) and ER6 (SSSI). However, at ER1 (SAC), ER1 (SPA), ER2 (SAC), ER5 (SSSI) and ER6 (SSSI) the PEC is less than 100% of the annual mean

SO_2 CLe and, therefore, following the stated EA Operational Instruction 67_12 it can be assumed there will be '*no adverse effect*'.

At the remaining considered receptors, the PC is less than 1% of the annual mean SO_2 CLe and, therefore, following the stated EA Operational Instruction 66_12 the PC impacts can be concluded to result in '*no likely significant effect*' at ER3 (SAC) and ER4 (SAC).

The PEC is less than the annual mean SO_2 CLe at all considered receptors.

Table 5-12: Impacts on Annual Mean SO_2 Critical Level

ID	Designation	Applied CLe (µg/m^3)	PC (µg/m^3)	PC as % of CLe	PEC (µg/m^3)	PEC as % of CLe
ER1	Dee Estuary / Aber Dyfrdwy SAC	20	0.63	3.13	6.39	31.9
ER1	The Dee Estuary SPA	20	0.70	3.49	6.39	31.9
ER2	River Dee and Bala Lake SAC	20	0.29	1.45	4.20	21.0
ER3	Dees and Buckley Newts SAC	20	0.17	0.87	3.34	16.7
ER4	Halkyn Mountain SAC	20	0.01	0.05	1.85	9.24
ER5	Inner Marsh Farm SSSI	20	0.22	1.11	4.75	23.8
ER6	Shotton Lagoons and Reedbeds SSSI	20	0.70	3.49	5.19	25.9
ER7	Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC	20	0.01	0.04	2.06	10.3
ER8	Mersey Estuary SPA	20	0.04	0.22	3.64	18.2

5.2.4 Critical Loads – Nutrient Nitrogen

5.2.4.1 'Boiler Project' Scenario

The results of the assessment of impacts on the nutrient nitrogen CLo, as associated with the 'Boiler Project' scenario, are presented in Table 5-13.

Table 5-13 indicates the PC is less than 1% of the applied nutrient nitrogen CLo at all considered ecological receptors. Therefore, following the stated EA Operational Instruction 66_12 the PC impacts on the nutrient nitrogen CLo can be concluded to:

- Result in '*No likely significant effect*' at ER1 (SAC), ER1 (SPA), ER2 (SAC), ER3 (SAC), ER4 (SAC), ER7 (SAC), and ER8 (SPA); and
- Cause '*No likely damage*' at ER5 (SSSI) and ER6 (SSSI).

Table 5-13: Impacts on Nutrient Nitrogen Critical Load: 'Boiler Project' Scenario

ID	Designation	Applied CLo (kg N/ha/yr)	PC (kg N/ha/yr)	PC as % of CLo	PEC (kg N/ha/yr)	PEC as % of CLo
ER1	Dee Estuary / Aber Dyfrdwy SAC	20	0.12	0.58	19.5	97.6
ER1	The Dee Estuary SPA	20	0.12	0.58	19.5	97.6
ER2	River Dee and Bala Lake SAC	20	0.02	0.08	26.2	131.1

ID	Designation	Applied CLo (kg N/ha/yr)	PC (kg N/ha/yr)	PC as % of CLo	PEC (kg N/ha/yr)	PEC as % of CLo
ER3	Dees and Buckley Newts SAC	10	0.01	0.10	21.3	213.4
ER4	Halkyn Mountain SAC	10	0.00	0.01	19.0	189.9
ER5	Inner Marsh Farm SSSI	10	0.04	0.36	18.8	187.8
ER6	Shotton Lagoons and Reedbeds SSSI	10	0.06	0.56	19.4	194.4
ER7	Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC	15	<0.01	0.01	32.3	215.1
ER8	Mersey Estuary SPA	5	<0.01	0.06	24.3	486.5

5.2.4.2 'CHP Project' Scenario

The results of the assessment of impacts on the nutrient nitrogen CLo, as associated with the 'CHP Project' scenario, are presented in Table 5-14.

Table 5-14 indicates the PC is less than 1% of the applied nutrient nitrogen CLo at all considered ecological receptors. Therefore, following the stated EA Operational Instruction 66_12 the PC impacts on the nutrient nitrogen CLo can be concluded to:

- Result in '*No likely significant effect*' at ER1 (SAC), ER1 (SPA), ER2 (SAC), ER3 (SAC), ER4 (SAC), ER7 (SAC), and ER8 (SPA); and
- Cause '*No likely damage*' at ER5 (SSSI) and ER6 (SSSI).

Table 5-14: Impacts on Nutrient Nitrogen Critical Load: 'CHP Project' Scenario

ID	Designation	Applied CLo (kg N/ha/yr)	PC (kg N/ha/yr)	PC as % of CLo	PEC (kg N/ha/yr)	PEC as % of CLo
ER1	Dee Estuary / Aber Dyfrdwy SAC	20	0.14	0.69	19.5	97.7
ER1	The Dee Estuary SPA	20	0.14	0.69	19.5	97.7
ER2	River Dee and Bala Lake SAC	20	0.02	0.10	26.2	131.2
ER3	Dees and Buckley Newts SAC	10	0.01	0.14	21.3	213.5
ER4	Halkyn Mountain SAC	10	0.00	0.02	19.0	189.9
ER5	Inner Marsh Farm SSSI	10	0.05	0.52	18.8	188.1
ER6	Shotton Lagoons and Reedbeds SSSI	10	0.07	0.73	19.5	194.7
ER7	Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC	15	0.01	0.04	32.3	215.2
ER8	Mersey Estuary SPA	5	<0.01	0.10	24.3	486.6

5.2.5 Critical Loads – Acidification

5.2.5.1 'Boiler Project' Scenario

The results of the assessment of impacts on the acid CLo, as associated with the 'Boiler Project' scenario, are presented in Table 5-15.

Table 5-15 indicates the PC is greater than 1% of the applied acid CLo at ER3 (SAC). However, at ER3 the PEC is less than 100% of the applied acid CLo and, therefore, following the stated EA Operational Instruction 67_12 it can be assumed there will be '*no adverse effect*'.

At the remaining considered receptors, the PC is less than 1% of the applied acid CLo and, therefore, following the stated EA Operational Instruction 66_12 the contributions to the acid CLo can be concluded to:

- Result in '*no likely significant effect*' at ER1 (SPA), ER4 (SAC), ER7 (SAC) and ER8 (SPA); and
- Cause '*No likely damage*' at ER6 (SSSI).

Table 5-15: Impacts on Acid Critical Load: 'Boiler Project' Scenario

ID	Applied CLo Function	Applied CLo (kg eq/ha/yr)	PC (kg eq/ha/yr)	PC as % of CLo	PEC (kg eq/ha/yr)	PEC as % of CLo
ER1 (SAC)	No sensitive habitat with Critical Load data					
ER1 (SPA)	CLmaxN	4.500	0.02	0.38	1.68	37.4
ER2 (SAC)	No sensitive habitat with Critical Load data					
ER3 (SAC)	CLmaxN	1.720	0.03	1.82	1.67	96.8
ER4 (SAC)	CLmaxN	4.323	<0.01	<0.01	1.45	33.5
ER5 (SSSI)	No sensitive habitat with Critical Load data					
ER6 (SSSI)	CLmaxN	4.548	<0.01	0.10	1.62	35.7
ER7 (SAC)	CLmaxN	1.863	<0.01	0.01	1.64	88.0
ER8 (SPA)	CLmaxN	0.498	<0.01	0.08	1.94	389.4

5.2.5.2 'CHP Project' Scenario

The results of the assessment of impacts on the acid CLo, as associated with the 'CHP Project' scenario, are presented in Table 5-16.

Table 5-16 indicates the PC is greater than 1% of the applied acid CLo at ER3 (SAC). However, at ER3 the PEC is less than 100% of the applied acid CLo and, therefore, following the stated EA Operational Instruction 67_12 it can be assumed there will be '*no adverse effect*'.

At the remaining considered receptors, the PC is less than 1% of the applied acid CLo and, therefore, following the stated EA Operational Instruction 66_12 the contributions to the acid CLo can be concluded to:

- Result in '*no likely significant effect*' at ER1 (SPA), ER4 (SAC), ER7 (SAC) and ER8 (SPA); and
- Cause '*No likely damage*' at ER6 (SSSI).

Table 5-16: Impacts on Acid Critical Load: 'CHP Project' Scenario

ID	Applied CLo Function	Applied CLo (kg eq/ha/yr)	PC (kg eq/ha/yr)	PC as % of CLo	PEC (kg eq/ha/yr)	PEC as % of CLo
ER1 (SAC)	No sensitive habitat with Critical Load data					
ER1 (SPA)	CLmaxN	4.500	0.02	0.41	1.68	37.4
ER2 (SAC)	No sensitive habitat with Critical Load data					
ER3 (SAC)	CLmaxN	1.720	0.03	1.83	1.67	96.8
ER4 (SAC)	CLmaxN	4.323	<0.01	<0.01	1.45	33.5
ER5 (SSSI)	No sensitive habitat with Critical Load data					
ER6 (SSSI)	CLmaxN	4.548	0.01	0.12	1.62	35.7
ER7 (SAC)	CLmaxN	1.863	<0.01	0.02	1.64	88.0
ER8 (SPA)	CLmaxN	0.498	<0.01	0.11	1.94	389.4

6.0 Summary and Conclusions

This AERA has quantified and assessed the potential air quality impacts associated with combustion emissions from the Site using EA approved techniques, as applied by NRW, against published standards for the protection of human health and designated ecological sites.

The conclusions of the AERA are as follows:

- The Process Contributions do not lead to any exceedances of the standards (long-term or short-term) for the protection of human health at any relevant location outside of the Site;
- The Process Contributions will result in '*no adverse effect*' on the annual mean and 24-hour mean NOx Critical Levels at the Dee Estuary / Aber Dyfrdwy SAC and the The Dee Estuary SPA;
- The Process Contributions will result in *no likely significant effect*' on the annual mean and 24-hour mean NOx Critical Levels at the River Dee and Bala Lake SAC, Dees and Buckley Newts SAC, Halkyn Mountain SAC, Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC, and the Mersey Estuary SPA;
- The Process Contributions will cause '*no likely damage*' on the annual mean and 24-hour mean NOx Critical Levels at Inner Marsh Farm SSSI, and Shotton Lagoons and Reedbeds SSSI;
- The Process Contributions will cause '*no adverse effect*' on the annual mean SO_2 Critical Level at the Dee Estuary / Aber Dyfrdwy SAC, The Dee Estuary SPA, River Dee and Bala Lake SAC, Inner Marsh Farm SSSI and the Shotton Lagoons and Reedbeds SSSI;
- The Process Contributions will cause '*no likely significant effect*' on the annual mean SO_2 Critical Level at the Dees and Buckley Newts SAC, and the Halkyn Mountain SAC;
- The Process Contributions will cause '*no likely significant effect*' on the nutrient nitrogen Critical Load at Dee Estuary / Aber Dyfrdwy SAC, The Dee Estuary SPA, River Dee and Bala Lake SAC, Dees and Buckley Newts SAC, Halkyn Mountain SAC, Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC, and Mersey Estuary SPA; and cause '*no likely damage*' at Inner Marsh Farm SSSI and Shotton Lagoons and Reedbeds SSSI; and
- The Process Contributions will cause '*no likely significant effect*' on the acid Critical Load at The Dee Estuary SPA, Dees and Buckley Newts SAC, Halkyn Mountain SAC, Alyn Valley Woods Coedwigoerr Dyffryn Alun SAC, and Mersey Estuary SPA; and cause '*no likely damage*' at Shotton Lagoons and Reedbeds SSSI.

Appendix A NRW Modelling Checklist

Shotton Paper Mill

Air Emissions Risk Assessment

Shotton Mill Ltd

SLR Project No.: 410.065169.00001

26 June 2025

Table A-1: Modelling Checklist

Item	Yes/No	Details / Reason for Omission
Location map	Yes	Figure 4-1 and Figure 4-2
Site plan	Yes	Figure 3-1
Pollutants modelled and relevant EALs	Yes	Table 3-1, Table 2-1, and Table 2-3
Details of modelled scenarios	Yes	Section 3.3
Details of relevant ambient concentrations	Yes	Section 4.2 and Section 4.3
Model description and justification	Yes	Section 3.6
Special model treatment used	Yes	Section 3.7.1
Table of emission parameters used	Yes	Table 3-2 to Table 3-5
Details of modelled domain and receptors	Yes	Sections 3.6.2 and 4.1
Details of meteorological data used	Yes	Section 3.6.5
Details of terrain treatment	Yes	Section 3.6.4
Details of building treatment	Yes	Section 3.6.3
Details of modelling deposition	Yes	Section 3.8
Model uncertainty and sensitivity	Yes	Section 3.6.6
Assessment of impacts	Yes	Section 5.0
Contour plots	Yes	No
Model input files	Yes	Appendix B

Appendix B Model Files (electronic only)

Shotton Paper Mill

Air Emissions Risk Assessment

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26 June 2025

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