# Proposed Biomass Plant

# Wood Lane, Ellesmere

## Air Quality Assessment

Tudor Griffiths Ltd

SLR Ref: 403.03441.00006
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## 1.0 INTRODUCTION

SLR Consulting Ltd (SLR) has been instructed by Tudor Griffiths Ltd to undertake an Air Quality Assessment to support the planning application for a proposed biomass boiler plant at their Wood Lane, Ellesmere facility.

### 1.1 Description of Proposals

Tudor Griffiths Ltd are seeking to install a biomass boiler plant in order to generate heat for use in drying products to enhance their saleability. The proposed plant would include 7 995kW boilers, with a total capacity of 6,965kW.

The proposed boiler will be fuelled on A grade wood chip (BSI PAS 111:2012) and, as such, will have an associated emission of combustion products to atmosphere.

### *1.2 Scope and Objective*

*The scope of the assessment* is to assess the impact on local air quality of combustion emissions from the proposed biomass boiler plant.

The principal objective of the study is to assess the impact of combustion emissions in relation to the relevant Air Quality Objectives (AQO) and Environment Assessment Levels (EALs) for the protection of human health and vegetation and ecosystems

A Dispersion Modelling Assessment is therefore required to support the planning application to assess potential impacts on air quality.

Pre-application discussion was undertaken with the Environmental Resilience department within Shropshire Council (SC) in order to agree upon the scope and methodology of the Air Quality Assessment[1].

### 1.3 Structure of the Report

The remainder of this report is structured as follows:

- Section 2 provides a summary of the legislation and guidelines relevant to the proposed activities at the site;
- Section 3 details the methodology applied;
- Section 4 provides a description of the surrounding environment, including the identification of potentially sensitive receptors and a description of local meteorology and air quality conditions;
- Section 5 provides details of the modelling inputs and quantification of emissions to atmosphere;
- Section 6 provides the results of the dispersion modelling assessment; and
- Section 7 summarises and concludes the assessment.

[1] Email correspondence between Matthew Clarke, Public Protection Officer within the Environmental Resilience department at Shropshire Council and SLR Consulting, dated 3rd June 2016.

## 2.0 RELEVANT AIR QUALITY LEGISLATION AND GUIDANCE

### 2.1 Air Quality Strategy

The United Kingdom Air Quality Strategy (UK AQS) 2007 for England, Scotland, Wales and Northern Ireland[2] sets out the Government's policies aimed at delivering cleaner air in the United Kingdom (UK). It sets out a comprehensive strategic framework within which air quality policy will be taken forward in the short to medium term, and the roles that Government, industry, the Environment Agency (EA), local government, business, individuals and transport have in protecting and improving air quality.

### 2.2 Air Quality Strategy

The Air Quality Standards Regulations 2010 seek to simplify air quality regulation and provide a new transposition of the Air Quality Framework Directive, and also transpose the Fourth Daughter Directive within the UK. The Air Quality Limit Values are transposed into the updated Regulations as Air Quality Standards, with attainment dates in line with the European Directives. SI 2010 No. 1001 Regulation 14 extends powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to Local Authorities (LAs) for the implementation of these Directives.

The UK AQS is the method for implementation of the air quality limit values in England, Scotland, Wales and Northern Ireland and provides a framework for improving air quality and protecting human health from the effects of pollution. For each nominated pollutant, the UK AQS sets clear, measurable, outdoor air quality standards and target dates by which these must be achieved: the combined standard and target date is referred to as the Air Quality Objective (AQO) for that pollutant. The UK AQS includes more exacting Objectives for some pollutants than those required by EU legislation. This Air Quality Assessment refers to UK Air Quality Standards, as compliance with these standards will also ensure that the less demanding EU Air Quality limit values would also be met.

The Air Quality Strategy defines 'standards' and 'objectives' in paragraph 17:

> *'For the purposes of the strategy:*
>
> *standards are the concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups or on ecosystems;*
>
> *objectives are policy targets often expressed as a maximum ambient concentration not to be exceeded, either without exception or with a permitted number of exceedences, within a specified timescale.'*

The air quality Standards and Objectives considered within this Air Quality Assessment are presented within Table 2-1.

[2] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA. July 2007.

**Table 2-1**
**Relevant Air Quality Strategy Standards and Objectives**

| Pollutant | Standard (µg/m$^3$) | Measured as | Equivalent percentile |
|---|---|---|---|
| Nitrogen dioxide ($NO_2$) | 40 | Annual mean | - |
| | 200 | 1 hour mean | 99.79$^{th}$ percentile of 1-hour-means (equivalent to 18 1-hour exceedences) |
| Particulate matter with an aerodynamic diameter of less than 10µm ($PM_{10}$) (gravimetric) | 40 | Annual mean | - |
| | 50 | 24 hour mean | 90.41$^{th}$ percentile of 24-hour-means (equivalent to 35 24-hour exceedences) |

*Applicable Public Exposure*

In accordance with the Department for Environment, Food and Rural Affairs (DEFRA) technical guidance on Local Air Quality Management (LAQM.TG(16)), the AQOs should be assessed at locations where members of the public are likely to be regularly exposed for a period of time appropriate to the averaging period of the objective. A summary of relevant exposure for the objectives presented in Table 2-1 are shown below in Table 2-2.

**Table 2-2**
**Relevant Public Exposure**

| Objective Averaging Period | Relevant Locations | Objectives should apply at: | Objectives should not apply at: |
|---|---|---|---|
| Annual mean | Where individuals are exposed for a cumulative period of 6 months in a year | Building facades of residential properties, schools, hospitals etc. | Facades of offices<br>Hotels<br>Gardens of residences<br>Kerbside sites |
| 24-hour mean | Where individuals may be exposed for eight hours or more in a day | As above together with hotels and gardens of residential properties | Kerbside sites where public exposure if expected to be short term |
| 1-hour mean | Where individuals might reasonably expected to spend one hour or longer | As above together with kerbside sites of regular access, car parks, bus stations etc. | Kerbside sites where public would not be expected to have regular access |

## 2.3 Local Authority Air Quality Review and Assessment

Local Authorities (LAs), including SC, have formal powers to control air quality through a combination of LAQM and by use of their wider planning policies.

Section 82 of the Environment Act 1995 (Part IV) requires local authorities to periodically review and assess the quality of air within their administrative area. The reviews have to consider the present and future air quality and whether any AQOs prescribed in regulations are being achieved or are likely to be achieved in the future.

Where any of the prescribed air quality Objectives are not likely to be achieved the authority concerned must designate an AQMA. For each AQMA the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the AQOs.

DEFRA has published technical guidance for use by local authorities in their review and assessment work[3]. The results of SC's Review and Assessment of air quality are summarised in Section 4.3.1.

## 2.4 Legislation for Protection of Nature Conservation Sites

Sites of nature conservation importance at a European, national and local level, are provided environmental protection, including from atmospheric emissions by the legislation as indicated in Table 2-3.

**Table 2-3**
**Legislation for Protection of Nature Conservation Sites**

| Nature Conservation Site | Legislation |
|---|---|
| **European sites:**<br>Special Areas of Conservation (SAC)<br>candidate Special Areas of Conservation (cSAC)<br>Special Protection Areas (SPA)<br>potential Special Protection Areas (pSPA)<br>Ramsar sites<br>Marine Protection Areas. | The Conservation of Habitats and Species Regulations (2010); known as the 'Habitats Regulations' |
| Sites of Special Scientific Interest (SSSI) | The Countryside and Rights of Way (CRoW) Act 2000 |
| National Nature Reserves (NNR)<br>Local Nature Reserves (LNR)<br>local wildlife sites (LWS)<br>ancient woodland (AW) | the Environment Act 1995; and<br>the Natural Environment and Rural Communities Act (NERC) 2006. |

## 2.5 Applicable Environmental Assessment Levels

### *2.5.1 EALs for Human Health*

For many substances which are released to air AQOs have not been defined. Where the necessary criteria are absent then the Regulators have adopted interim values known as EALs. An EAL is defined by the EA as:

> '*the concentration of a substance which in a particular environmental medium the Regulators regard as a comparator value to enable a comparison to be made between the environmental effects of different substances in that medium and between environmental effects in different media and to enable the summation of those effects*'.

EALs used in this assessment are as prescribed in *Air emissions risk assessment for your environmental permit*[4] as published by the EA, which superseded H1 Guidance Note: Annex (f) on 1st February 2016. A summary of the appropriate EALs for pollutants emitted by the proposed facility are included in Table 2-4. EALs have been applied in this assessment where no air quality standard exists, or where the EAL is lower than the corresponding air quality standard. However, it is noted that the relevant EALs are identical to the AQOs.

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[3] DEFRA: Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(16), 2016.

[4] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit - accessed June 2016.

**Table 2-4**
**Relevant UK Air Quality Objectives / EALs**

| Pollutant | Averaging Period | EAL | Source |
|---|---|---|---|
| $NO_2$ | 1-hour mean not to be exceeded more than 18 times per year (99.79%ile) | 200µg/m$^3$ | AQS / EPR H1 |
| | Annual mean | 40µg/m$^3$ | AQS / EPR H1 |
| $PM_{10}$ | 24-hour mean not to be exceeded more than 35 times per year (90.41%ile) | 50µg/m$^3$ | AQS / EPR H1 |
| | Annual Mean | 40µg/m$^3$ | AQS / EPR H1 |

### *2.5.2 EALs for the protection of Ecosystems and Vegetation*

EALs exist for nature conservation sites known as Critical Levels (for airborne concentrations) and Critical Loads (for deposition of nitrogen or acid forming compounds).

<u>Critical Levels</u>

Critical levels 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 not occur, according to present knowledge. In addition to the Critical Levels defined in the AQS for NOx the following EALs for the protection of ecosystems and vegetation, also defined in *Air emissions risk assessment for your environmental permit* as critical levels.

**Table 2-5**
**Critical Levels for the Protection of Vegetation and Ecosystems**

| Pollutant | Concentration (µg/m$^3$) | Measured as |
|---|---|---|
| NOx | 30 | Annual mean |
| | 75 | Daily mean |

<u>Critical Loads</u>

Critical loads 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. Critical Loads are set for the deposition of various substances to sensitive ecosystems. In relation to combustion emissions critical loads for eutrophication and acidification are relevant which can occur via both wet and dry deposition, however on a local scale only dry (direct deposition) is considered significant.

Empirical critical loads for eutrophication (derived from a range of experimental studies) are assigned for different habitats, including grassland ecosystems, mire, bog and fen habitats, freshwaters, heathland ecosystems, coastal and marine habitats, and forest habitats and can be obtained from the UK Air Pollution Information System (APIS) website[5]. The critical loads relevant to this assessment are presented in Section 4.3.6.

[5] http://www.apis.ac.uk/ - accessed June 2016.

## 2.6 Regulation of Emissions from Industrial Activities

European Union Directive 2015/2193/EU (the Medium Combustion Plant Directive or MCPD) regulates pollutant emissions from the combustion of fuels in plants with a rated thermal input equal to or greater than $1MW_{th}$ and less than $50MW_{th}$ and is currently being transposed into UK law (by December 2017).

## 2.7 Planning Policy

### *2.7.1 National Policy*

The National Planning Policy Framework (NPPF) describes the policy context in relation to pollutants including air pollutants:

> *'The Government's objective is that planning should help to deliver a healthy natural environment for the benefit of everyone and safe places which promote wellbeing.*
>
> *To achieve this objective, the planning system should contribute and enhance the natural and local environment by:*
>
> *[...] preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of land, air, water or noise pollution or land instability.'*

Where pollution is defined as:

> *'Any consideration of the quality of land, air, water, soils, which might lead to an adverse impact on human health, the natural environment or general amenity. Pollution can arise from a range of emissions, including smoke, fumes, gases, dust, steam and odour.'*

Specifically in terms of development with regard to air quality:

> *'Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan.'*

The policies within the NPPF in relation to air pollution are considered within this Air Quality Assessment.

### *2.7.2 Local Policy*

SC formally adopted the Core Strategy Development Plan Document (DPD) on 24th February 2011.

The Core Strategy sets out the strategic planning policy for Shropshire, including a 'spatial' vision and objectives. It also sets out a development strategy identifying the level of development expected to take place in Shropshire (excluding the Borough of Telford and Wrekin) up until 2026.

The following policy relating to air quality is contained within the Shropshire DPD:

> *'CS6: Sustainable Design and Development Principles*

*To create sustainable places, development will be designed to a high quality using sustainable design principles, to achieve an inclusive and accessible environment which respects and enhances local distinctiveness and which mitigates and adapts to climate change. […] And ensuring that all development:*

*Contributes to the health and wellbeing of communities, including safeguarding residential and local amenity and the achievement of local standards for the provision and quality of open space, sport and recreational facilities.*

*Makes the most effective use of land and safeguards natural resources including high quality agricultural land, geology, minerals, air, soil and water;'*

The policy contained within the Shropshire Core Strategy DPD relating to air quality are addressed within this assessment.

## 3.0 ASSESSMENT METHODOLOGY

In accordance with the EA's *Air emissions risk assessment for your environmental permit* guidance (*air emissions risk assessment)*, and the additional guidance provided by the Air Quality Modelling and Assessment Unit (AQMAU) of the EA, a detailed dispersion modelling assessment has been undertaken to assess the impact of combustion emissions from the biomass boiler plant. An atmospheric dispersion model has been used to model ground level concentrations for comparison against relevant EALs and to calculate atmospheric deposition for comparison with Critical Loads ($C_{Lo}$) for ecological receptors.

### 3.1 Assessment of Impacts on Air Quality

The significance of impacts from industrial sources on air quality is determined using the EA's *Air emissions risk assessment*. The *air emissions risk assessment* states that 'process contribution' (PC) can be considered insignificant if:

- the long term process contribution is <1% of the long term environmental standard; and/or
- the short term process contribution is <10% of the short term environmental standard.

On this basis the PC is described as either 'insignificant' or 'not insignificant'. Where impacts are not classified as 'not insignificant', consideration of the resultant Predicted Environmental Concentration (PEC) as a percentage of the applied limit value is required. The PEC is then used to identify whether the emission is 'potentially significant' as follows:

- [Maximum Process Contribution (long term) + background concentration] ≥ 70% of the Environmental Assessment Level; or

- Maximum Process Contribution (short term) is less than 20% of the short-term environmental standards minus twice the long-term background concentration.

The *air emissions risk assessment* guidance indicates that impacts are likely to be considered to be unacceptable where significant breaches (or significant addition to an existing breach) of the EALs occur as a result of the impact from the facility. In such a situation consideration of the application of abatement techniques beyond the requirements of indicative best available techniques (BAT).

### 3.2 Assessment of Impacts on Habitats

The EA's Operational Instruction 66_12 '*Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation*' 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 a likely significant effect on a European site;
- be an operation likely to damage (OLD) a SSSI; or
- result in significant pollution of an NNR, LNR, LWS or ancient woodland.

The screening criteria for significance of impact are as follows:

- PC <1% long-term critical level and/or load <u>or</u> that the PEC <70% long-term critical level and/or load for European sites and SSSIs;
- PC <10% short-term critical level for NOx for European sites and SSSIs;
- PC <100% long-term critical level and/or load other conservation sites;
- PC <100% short-term critical level for NOx for other conservation sites.

Where the screening criteria identifies 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 *'Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation'*. 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).

### *3.2.1 Calculation of Contribution to Critical Loads*

Deposition rates were calculated using empirical methods recommended by the Environment Agency (AQTAG06)[6]. Dry deposition flux was calculated using the following equation:

> Dry deposition flux (µg/m²/s) = ground level concentration (µg/m³) x deposition velocity (m/s)

The applied deposition velocities for the relevant chemical species are as shown in Table 3-1.

**Table 3-1**
**Applied Deposition Velocities**

| **Chemical Species** | **Recommended deposition velocity (m/s)** | |
|---|---|---|
| $NO_2$ | Grassland | 0.0015 |
| | Woodland | 0.003 |

As a worst-case scenario, the deposition velocity for 'woodland' has been applied to the calculations, regardless of whether the location is relevant to woodland habitat.

The units are then converted from µg/m²/s to units of kg/ha/year by multiplying the dry deposition flux by standard conversion factors as summarised in Table 3-2.

**Table 3-2**
**Applied Deposition Conversion Factors**

| **Chemical Species** | **Conversion factor [µg/m²/s to kg/ha/year]** | |
|---|---|---|
| $NO_2$ | of N: | 95.9 |

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.

<u>Critical Loads – Eutrophication</u>

The contribution to critical loads for nitrogen (N) deposition are recorded as KgN/ha/yr.

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

Critical Loads – Acidification

The predicted deposition rates are converted to units of equivalents ($k_{eq}$/ha/year), which is a measure of how acidifying the chemical species can be, by dividing the dry deposition flux (kg/ha/year) by standard conversion factors as presented in Table 3-3.

**Table 3-3**
**Applied Acidification Conversion Factors**

| Chemical Species | Conversion factor [µg/m$^2$/s to keq/ha/year] |
|---|---|
| of N: | multiply by 6.84 |

### *3.2.2 Calculation of PC as a percentage of Acid Critical Load Function*

The calculation of the process contribution of N to the critical load function has been carried out according to the guidance on 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'*

However, it is noted that in the instance of the proposed Wood Lane biomass boiler plant there is no corresponding sulphur (S) emission. Therefore, potential impacts on $C_{Lo}$ are solely calculated from the corresponding N emission.

# 4.0 BASELINE ENVIRONMENT

Existing air quality conditions and sensitive receptors in the vicinity of the Site were identified in order to provide a baseline for assessment. These are detailed in the following Sections.

## 4.1 Site Setting

The proposed Site is situated to the south of the existing Tudor Griffiths Ltd quarry at Wood Lane, Ellesmere. The locale surrounding the site is predominantly rural in setting, with open rural pasture and agricultural arable land bounding the site to all sides.

The town of Ellesmere is located approximately 3.25km to the north-west of the Site. The nearest residential receptors are located approximately to the west of the site off A528, and to the north-west of the Site in in the urban area of Whitemere. The Site (proposed biomass boiler building) is centred on approximate National Grid Reference (NGR) x342285, y332520.

## 4.2 Potentially Sensitive Receptors

The receptor locations considered for human exposure are those where the public may be exposed for relevant exposure periods (*e.g.* 1-hour, 24-hours or 12-months), in accordance with DEFRA LAQM.TG(16) Box 1.1 as presented within Table 2-2. Properties (for human impact) have been selected on the basis that they are the closest, in all directions, around the biomass boiler plant.

The identified receptors are presented in Table 4-1 and Drawing AQ1 based upon receptor locations within the vicinity of the development (up to 1.5km).

**Table 4-1**
**Potentially Sensitive Receptors**

| ID | Receptor | Receptor Type | NGR (m) | | Distance from site (m) (A) | Direction from Site (A) |
|---|---|---|---|---|---|---|
| | | | X | Y | | |
| R1 | Wood Lane Farm - residential | Residential | 341860.4 | 332680.2 | 450 | WNW |
| R2 | Residential property on A528 | Residential | 341874.4 | 332794.5 | 500 | NW |
| R3 | Alford Cottage - residential | Residential | 341853.1 | 332912.1 | 590 | NW |
| R4 | Whitemere Lodge - residential | Residential | 341596.0 | 333264.9 | 1021 | NNW |
| R5 | Spunhill Farm - residential | Residential | 341658.4 | 333260.9 | 980 | NNW |
| R6 | Residential property in Spunhill 1 | Residential | 341419.1 | 333282.6 | 1160 | NW |
| R7 | Residential property in Spunhill 2 | Residential | 341379.3 | 333289.3 | 1200 | NW |
| R8 | Residential property in Spunhill 3 | Residential | 341319.8 | 333265.2 | 1225 | NW |
| R9 | Residential property in Spunhill 4 | Residential | 341272.0 | 333227.7 | 1240 | NW |
| R10 | Whitemere Cottages | Residential | 341246.4 | 333170.5 | 1230 | NW |
| R11 | Colemere Farm | Residential | 343040.6 | 332714.3 | 800 | ENE |

| ID | Receptor | Receptor Type | NGR (m) | | Distance from site (m) (A) | Direction from Site (A) |
|---|---|---|---|---|---|---|
| | | | X | Y | | |
| R12 | Residential property in Colemere 1 | Residential | 343156.4 | 332871.2 | 940 | ENE |
| R13 | Residential property in Colemere 2 | Residential | 343157.4 | 332812.8 | 960 | ENE |
| R14 | Residential property in Colemere 3 | Residential | 343240.8 | 332811.7 | 1020 | ENE |
| R15 | Crab Mill - residential | Residential | 343264.6 | 332908.0 | 1075 | ENE |
| R16 | Belgrave Cottages - residential | Residential | 343253.7 | 332547.7 | 985 | E |
| R17 | Colemere House - residential | Residential | 343186.7 | 332404.9 | 920 | E |
| R18 | Colemere Roads - residential | Residential | 342241.0 | 331739.4 | 760 | S |
| R19 | New Lea Farm | Residential | 341140.3 | 331922.4 | 1275 | SW |

Notes:
(A) Distance and direction from site calculated from the location of the stacks serving the proposed boiler plant.

The discrete receptors presented within Table 4-1 are not an exhaustive list and there may be other locations within the vicinity of the Site that may experience impacts associated with process emissions that have not been individually identified. In addition the surrounding industrial area and access routes are relevant short-term receptors, and therefore this assessment has used a receptor grid across an Ordnance Survey map of the study area.

Pollutant exposure isopleths are generated by interpolation between receptor points and superimposed onto the map. This method allows the exposure at any receptor (long term or short term) in the study area to be determined and presented graphically, above those presented within Table 4-1.

### *4.2.1 Ecological Receptors*

Pre-application discussion with the Shropshire Wildlife Trust has been used to determine the relevant receptor locations for consideration within the assessment. Relevant designated sites to this assessment are presented in Table 4-2. Ecological habitats surrounding the Site have been digitised into the dispersion modelling assessment as a series of array receptor polygon grids, with the resolution defined in accordance with AQTAG06[7].

**Table 4-2**
**Potentially Sensitive Ecological Receptors**

| ID | Site | Designation | APIS Main Habitat Types (A) |
|---|---|---|---|
| ER1 | Newton Mere (B) | LWS | Fen, Marsh and Swamp |
| ER2 | Blakemere, Kettlemere & SU Canal (B) | LWS | Fen, Marsh and Swamp / Woodland |
| ER3 | Near Shropshire Union Canal, Colemere (B) | LWS | Grassland |

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

| ID | Site | Designation | APIS Main Habitat Types (A) |
|---|---|---|---|
| ER4 | SW Clarepool Moss (non SSSI) (B) | LWS | Fen, Marsh and Swamp / Grassland |
| ER5 | SW Corner of White Mere (non SSSI) (B) | LWS | Woodland |
| ER6 | Woodland Near Colemere (B) | LWS | Woodland |
| ER7 | Crose-Mere Non SSSI (B) | LWS | Grassland |
| ER8 | Baysil Wood Fen (B) | LWS | Fen, Marsh and Swamp |
| ER9 | Wood Lane Reserve (B) | LWS | Fen, Marsh and Swamp |
| ER10 | Black Coppice Mire (B) | LWS | Fen, Marsh and Swamp / Woodland |
| ER11 | Lee / Yarnest Woods | AW | Woodland |
| ER12 | White Mere | SSSI | Fen, Marsh and Swamp (C) |
| ER13 | Clarepool Moss | SSSI | Fen, Marsh and Swamp (C) |
| ER14 | Cole Mere | SSSI | Fen, Marsh and Swamp (C) |
| ER15 | Sweat Mere and Crose Mere | SSSI | Fen, Marsh and Swamp (C) |
| ER16 | Midland Meres & Mosses - Phase 1 | Ramsar | Fen, Marsh and Swamp (C) |
| ER17 | Midland Meres & Mosses - Phase 2 | Ramsar | Fen, Marsh and Swamp (C) |
| ER18 | West Midlands Mosses | SAC | Fen, Marsh and Swamp (C) |
| ER19 | Colemere | LNR | Woodland (C) |

Notes:
(A) Comparable habitat type, as presented on APIS.
(B) Habitat details for the LWS were as provided through consultation with the Shropshire Wildlife Trust.
(C) Fringe habitats, as the main habitat declared is an open body of water.

The grid references for the identified receptors are presented in Table 4-3.

**Table 4-3**
**Potentially Sensitive Ecological Receptors – Grid References**

| ID | Receptor | Designation | NGR (m) | |
|---|---|---|---|---|
| | | | X | Y |
| R1 | Newton Mere (A) | LWS | 342511 | 334242 |
| R2 | Blakemere, Kettlemere & SU Canal (A) | LWS | 341748 | 333922 |
| R3 | Near Shropshire Union Canal, Colemere (A) | LWS | 342443 | 333470 |
| R4 | SW Clarepool Moss (non SSSI) (A) | LWS | 343227 | 334165 |
| R5 | SW Corner of White Mere (non SSSI) (A) | LWS | 341510 | 332555 |
| R6 | Woodland Near Colemere (A) | LWS | 342978 | 332839 |
| R7 | Crose-Mere Non SSSI (A) | LWS | 343131 | 330703 |
| R8 | Baysil Wood Fen (A) | LWS | 342833 | 333106 |
| R9 | Wood Lane Reserve (A) | LWS | 342402 | 332846 |
| R10 | Black Coppice Mire (A) | LWS | 343126 | 333708 |
| R11 | Lee / Yarnest Woods (A) | AW | 341200 | 332430 |
| R12 | White Mere (B) | SSSI | 341450 | 333050 |
| R13 | Clarepool Moss (B) | SSSI | 343350 | 334250 |
| R14 | Cole Mere (B) | SSSI | 343350 | 333250 |
| R15 | Sweat Mere and Crose Mere (B) | SSSI | 343450 | 330450 |

| ID | Receptor | Designation | NGR (m) | |
|---|---|---|---|---|
| | | | X | Y |
| R16 | Midland Meres & Mosses - Phase 1 (B) | Ramsar | 341450 | 333050 |
| R17 | Midland Meres & Mosses - Phase 2 (B) | Ramsar | 343350 | 333250 |
| R18 | West Midlands Mosses (B) | SAC | 343350 | 334250 |
| R19 | Colemere (A) | LNR | 343400 | 331200 |

Notes:
(A) Grid reference based upon information provided by the Shropshire Wildlife Trust.
(B) Grid reference based upon the NGR presented on the citation.

### *4.2.2 Local Wind Speed and Direction Data*

For meteorological data to be suitable for dispersion modelling purposes a number of meteorological parameters need to be measured on a continuous basis. There are only a limited number of sites where the required meteorological measurements are made. In the whole of the UK, all of these sites are quality controlled by the Met Office.

The most important meteorological parameters governing the atmospheric dispersion of pollutants are as follows:

- Wind direction: determines the broad transport of the emission and the sector of the compass into which the emission is released;
- Wind speed: will affect ground level emissions by determining the initial dilution of pollutants emitted; and
- Atmospheric stability: is a measure of the turbulence, particularly of the vertical motions present. Advanced dispersion models use Monin-Obukhov lengths - a more advanced method of determining stability[8].

Sequential 1-hour meteorological data used in this assessment were taken from Shawbury meteorological station (NGR: 355126, 322702) located approximately 16km south-east of the Site over the period 1st January 2009 to 31st December 2013 (inclusive), as recommended to SLR by the data provider ADM Ltd.

A wind rose of the 2009 – 2013 Shawbury meteorological dataset utilised within this assessment is presented within Figure 4-1. The wind rose indicates that the prevailing wind direction from the Shawbury observation station was from west, south-western sectors, with frequency north-western and southern components. Winds from northern through to north-eastern sectors occur relatively infrequently. Reference should be made to Appendix AQ1 for the wind roses for each individual assessment year.

[8] Defined as: '*the height over the ground, where mechanically produced (by vertical shear) turbulence is in balance with the dissipative effect of negative buoyancy, thus where Richardson number equals to 1.*' Essentially it is a more quantitative method of estimating stability than the previously used Pasquill Stability Classes. It requires two quantities not routinely measured by national meteorological networks: the friction velocity $u$ and flux of sensible heat $H$.

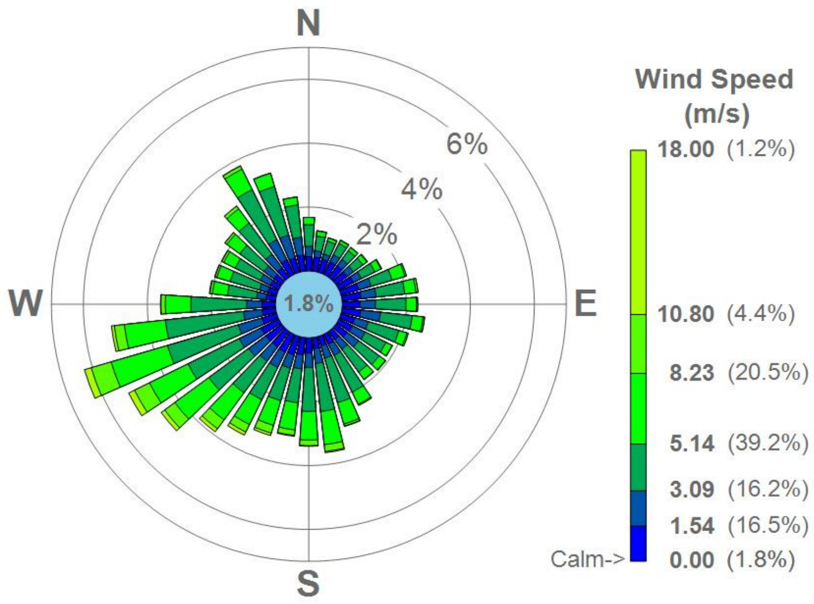


**Figure 4-1**
**Wind-rose for Shawbury Meteorological Station (2009 – 2013)**

## 4.3 Ambient Air Quality

### *4.3.1 Local Air Quality Management*

The Application Site lies within the administrative area of SC. As required under Section 82 of the Environment Act (1995) (Part IV), SC has conducted an ongoing exercise to review and assess air quality within their area of jurisdiction. This process has indicated that annual mean $NO_2$ concentrations are above, and likely to remain above the AQO at locations of relevant exposure within SC's administrative area.

As such, SC has declared the following five AQMAs within their administrative area for annual mean $NO_2$:

- AQMA No. 1 – The area comprising part of Hereford Road A49 between Sharpstones Lane and Burgs Lane, and adjacent land;
- AQMA No. 2 – The area comprising parts of Ditherington Road A5191, Whitchurch Road A5112, Sundorne Road B5062 and Telford Way A5112 and adjacent land;
- AQMA No. 3 – The area comprising Frankwell, part of Bridge Street and Smithfield Road Castle Gates and adjacent land, extending to encompass most of the Town Centre including High Street, Wyle Cop, English Bridge and Coleham Head gyratory;
- Bridgnorth AQMA – An area encompassing Pound Street and the junction of Whitburn Street and Salop Street; and
- Oswestry AQMA – The property known as Gate House situated on the junction of the A483 (between Sweeny Hall and Llynclys Crossroads) and Albridge Lane.

The closest of the declared AQMAs is the Oswestry AQMA, located approximately 13.5km to the west of the Application Site. At this stand-off distance, $NO_2$ emissions from the proposed biomass boiler combustion process will not have a significant impact. Therefore, the declared Oswestry AQMA has not been considered as part of this assessment.

All other Air Quality Strategy pollutants were below the relevant AQOs at locations of relevant public exposure, as such no further AQMAs have been declared within the Council's administrative area.

#### *4.3.2 AURN Monitoring*

The UK Automatic Urban and Rural Network (AURN) is a country-wide network of air quality monitoring stations operated on behalf of the DEFRA. Monitoring data for AURN sites is available from the UK Air Information Resource (UK-AIR).

The closest AURN monitor to the Application Site is the Wrexham AURN (NGR: 332865, 349909) located approximately 19.6km north north-west of the Site. Given the distance between the Wrexham AURN and the Site, representative pollutant concentrations to that of the locale surrounding the Site would not be anticipated. Therefore, this source of data has not been considered as part of the assessment.

SC does not undertake any automatic monitoring in proximity to the Site.

#### *4.3.3 Shropshire Council Passive Monitoring*

SC does no operate any passive diffusion tubes as part of their commitment to LAQM, in close proximity to the Site.

#### *4.3.4 DEFRA Background Maps*

Background pollutant concentration data on a 1km x 1km spatial resolution is provided by the UK National Air Quality Archive[9] and is routinely used in assessing background pollutant concentrations where monitoring has not taken place.

Mapped background concentrations were downloaded for the 9No. grid squares surrounding the development (centred upon grid square 342500, 332500 which contains the Site). To present a worst-case scenario, the maximum mapped background concentrations from selected grid squares surrounding the Site have been selected for further consideration within the context of this assessment.

Background pollutant concentrations of NOx, $NO_2$ and $PM_{10}$ are based upon 2011 base year[10].

The maximum mapped background concentration of each considered pollutant is presented within Table 4-4.

**Table 4-4**
**DEFRA Predicted Annual Mean Background Concentrations (2011)**

| Pollutant | Concentration (µg/m$^3$) |
|---|---|
| $NO_2$ | 10.5 |
| $NO_x$ | 13.7 |
| $PM_{10}$ | 14.8 |

[9] www.airquality.co.uk.

[10] Background mapping data for local authorities – http://uk-air.defra.gov.uk/data/laqm-background-home.

#### *4.3.5 Applied Background Levels*

The background concentrations in Table 4-6 have been applied in this air quality assessment.

Concentrations for different averaging periods have been calculated in accordance with EA guidance *Air emissions risk assessment for your environmental permit*[11], which indicates that annual background concentrations should be multiplied by a factor of 2 to derive 1-hour backgrounds, and adjusted to other averaging periods as recommended. The conversion factors applied are illustrated in Table 4-5.

**Table 4-5**
**H1 Conversion Factors for Environmental Standards**

| From ↓ To→ | 1-hour | 24-hours |
|---|---|---|
| 1-hour | 1.00 | 0.59 |

Note:
For example to convert hourly data to 24-hour data, multiply the 1-hour value by 0.59.

The background concentrations in Table 4-6 have been applied in this Atmospheric Dispersion Modelling; these values are based on the predicted background concentrations detailed in the previous section.

**Table 4-6**
**Calculated Background Concentrations for other Averaging Periods**

| Pollutant | Averaging Period | Concentration ($\mu g/m^3$) | Source |
|---|---|---|---|
| $NO_2$ | Annual Mean | 10.5 | Maximum DEFRA Background Mapping in study area, 2011 |
| | 1-hour Mean | 21.0 | |
| $PM_{10}$ | Annual Mean | 14.8 | Maximum DEFRA Background Mapping in study area, 2011 |
| | 24-hour Mean | 17.5 | |

#### *4.3.6 Critical Levels and Critical Loads*

The Air Pollution Information System (APIS[12]) is 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. APIS has been used to provide information on:

- identification of whether the habitats present are sensitive;
- Critical Levels and current baseline concentrations (Table 4-7); and
- Critical Loads and current deposition rates (Table 4-8).

As there is no emission of sulphur from the site, the presented CLo for each habitat relate solely to nitrogen.

It is noted that the current load for nutrient nitrogen deposition exceeds the upper critical load threshold at several sites within each ecological designation.

[11] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit - accessed June 2016.
[12] www.apis.ac.uk.

**Table 4-7**
**Background $NO_x$ Concentrations**

| ID | Site | $NO_x$ (µg/m$^3$) | |
|---|---|---|---|
| | | Annual Mean | 24-hour Mean |
| ER1 | Newton Mere | 11.2 | 13.2 |
| ER2 | Blakemere, Kettlemere & SU Canal | 11.2 | 13.2 |
| ER3 | Near Shropshire Union Canal, Colemere | 11.2 | 13.2 |
| ER4 | SW Clarepool Moss (non SSSI) | 11.2 | 13.2 |
| ER5 | SW Corner of White Mere (non SSSI) | 11.2 | 13.2 |
| ER6 | Woodland Near Colemere | 11.2 | 13.2 |
| ER7 | Crose-Mere Non SSSI | 11.2 | 13.2 |
| ER8 | Baysil Wood Fen | 11.2 | 13.2 |
| ER9 | Wood Lane Reserve | 11.2 | 13.2 |
| ER10 | Black Coppice Mire | 11.2 | 13.2 |
| ER11 | Lee / Yarnest Woods | 11.2 | 13.2 |
| ER12 | White Mere | 11.2 | 13.2 |
| ER13 | Clarepool Moss | 11.2 | 13.2 |
| ER14 | Cole Mere | 11.2 | 13.2 |
| ER15 | Sweat Mere and Crose Mere | 11.2 | 13.2 |
| ER16 | Midland Meres & Mosses - Phase 1 | 11.2 | 13.2 |
| ER17 | Midland Meres & Mosses - Phase 2 | 11.2 | 13.2 |
| ER18 | West Midlands Mosses | 11.2 | 13.2 |
| ER19 | Colemere | 11.2 | 13.2 |

Note:
(A) Background NOx concentration based upon NGR grid square containing designation.

**Table 4-8**
**N Critical Loads and Current Loads**

| ID | Site | Terrestrial Habitat Information [A] | Critical Load Range (kg N/ha/yr)) | Current Load (kg N/ha/yr)) |
|---|---|---|---|---|
| ER1 | Newton Mere | Valley mires, poor fens and transition mires | 10 – 15 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |
| ER2 | Blakemere, Kettlemere & SU Canal | Valley mires, poor fens and transition mires | 10 – 15 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |
| | | Broadleaved deciduous woodland | 10 – 20 | 37.4 |
| | | Fagus woodland | 10 – 20 | 37.4 |
| | | Acidophilous Quercus-dominated woodland | 10 – 15 | 37.4 |
| | | Meso- and eutrophic Quercus woodland | 15 – 20 | 37.4 |
| ER3 | Near Shropshire Union Canal, Colemere | Low and medium altitude hay meadows | 20 – 30 | 22.4 |
| | | Mountain hay meadows | 10 – 20 | 22.4 |
| ER4 | SW Clarepool Moss (non SSSI) | Valley mires, poor fens and transition mires | 10 – 15 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |
| | | Broadleaved deciduous woodland | 10 – 20 | 37.4 |
| | | Fagus woodland | 10 – 20 | 37.4 |
| | | Acidophilous Quercus-dominated woodland | 10 – 15 | 37.4 |
| | | Meso- and eutrophic Quercus woodland | 15 – 20 | 37.4 |
| ER5 | SW Corner of White Mere (non SSSI) | Broadleaved deciduous woodland | 10 – 20 | 37.4 |
| | | Fagus woodland | 10 – 20 | 37.4 |
| | | Acidophilous Quercus-dominated woodland | 10 – 15 | 37.4 |
| | | Meso- and eutrophic Quercus woodland | 15 – 20 | 37.4 |
| ER6 | Woodland Near Colemere | Broadleaved deciduous woodland | 10 – 20 | 37.4 |
| | | Fagus woodland | 10 – 20 | 37.4 |
| | | Acidophilous Quercus-dominated woodland | 10 – 15 | 37.4 |
| | | Meso- and eutrophic Quercus woodland | 15 – 20 | 37.4 |
| ER7 | Crose-Mere Non SSSI | Low and medium altitude hay meadows | 20 – 30 | 22.4 |
| | | Mountain hay meadows | 10 – 20 | 22.4 |
| ER8 | Baysil Wood Fen | Valley mires, poor fens and transition mires | 10 – 15 | 22.4 |

| ID | Site | Terrestrial Habitat Information [(A)] | Critical Load Range (kg N/ha/yr)) | Current Load (kg N/ha/yr)) |
|---|---|---|---|---|
| | | Rich fens | 15 – 30 | 22.4 |
| ER9 | Wood Lane Reserve | Valley mires, poor fens and transition mires | 10 – 15 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |
| ER10 | Black Coppice Mire | Valley mires, poor fens and transition mires | 10 – 15 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |
| | | Broadleaved deciduous woodland | 10 – 20 | 37.4 |
| | | Fagus woodland | 10 – 20 | 37.4 |
| | | Acidophilous Quercus-dominated woodland | 10 – 15 | 37.4 |
| | | Meso- and eutrophic Quercus woodland | 15 – 20 | 37.4 |
| ER11 | Lee / Yarnest Woods | Broadleaved deciduous woodland | 10 – 20 | 37.4 |
| | | Fagus woodland | 10 – 20 | 37.4 |
| | | Acidophilous Quercus-dominated woodland | 10 – 15 | 37.4 |
| | | Meso- and eutrophic Quercus woodland | 15 – 20 | 37.4 |
| ER12 | White Mere | Broad-leaved, mixed and yew woodland (Alnus glutinosa | 10 – 20 | 37.4 |
| ER13 | Clarepool Moss | Raised and blanket bogs | 5 – 10 | 22.4 |
| | | Raised and blanket bogs | 5 – 10 | 22.4 |
| | | Valley mires, poor fens and transition mires | 10 – 15 | 37.4 |
| | | Acidophilous Quercus-dominated woodland | 10 – 15 | 22.4 |
| ER14 | Cole Mere | Broadleaved deciduous woodland | 10 – 20 | 37.4 |
| | | Moist and wet oligotrophic grasslands: Molinia caerulea | 15 – 25 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |
| | | Low and medium altitude hay meadows | 20 – 30 | 22.4 |
| ER15 | Sweat Mere and Crose Mere | Broadleaved deciduous woodland | 10 – 20 | 37.4 |
| | | Broadleaved deciduous woodland | 10 – 20 | 37.4 |
| | | Meso- and eutrophic Quercus woodland | 15 – 20 | 37.4 |
| | | Moist and wet oligotrophic grasslands: Molinia caerulea | 15 – 25 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |

| ID | Site | Terrestrial Habitat Information (A) | Critical Load Range (kg N/ha/yr)) | Current Load (kg N/ha/yr)) |
|---|---|---|---|---|
| | | Rich fens | 15 – 30 | 22.4 |
| | | Low and medium altitude hay meadows | 20 – 30 | 22.4 |
| ER16 | Midland Meres & Mosses - Phase 1 | Valley mires, poor fens and transition mires | 10 – 15 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |
| ER17 | Midland Meres & Mosses - Phase 2 | Valley mires, poor fens and transition mires | 10 – 15 | 22.4 |
| | | Rich fens | 15 – 30 | 22.4 |
| ER18 | West Midlands Mosses (UK0013595) | Permanent dystrophic lakes, ponds and pools | 3 – 10 | 13.4 |
| | | Valley mires, poor fens and transition mires | 10 – 15 | 24.3 |
| ER19 | Colemere | Broadleaved deciduous woodland | 10 – 20 | 37.4 |
| | | Fagus woodland | 10 – 20 | 37.4 |
| | | Acidophilous Quercus-dominated woodland | 10 – 15 | 37.4 |
| | | Meso- and eutrophic Quercus woodland | 15 – 20 | 37.4 |

Notes:
(A) Critical Load class from APIS.

**Table 4-9**
**Acid Critical Load Functions and Current Loads**

| ID | Habitat | Critical Load Acidity Class (A) | Critical Load Function (keq/ha/yr) | Current Acid Load (keq/ha/yr) |
|---|---|---|---|---|
| ER1 | Fen, Marsh and Swamp | This habitat is not sensitive to acidity | - (B) | - (B) |
| ER2 | Fen, Marsh and Swamp | This habitat is not sensitive to acidity | - (B) | - (B) |
| | Broadleaved, Mixed and Yew Woodland | Broadleafed/Coniferous unmanaged woodland | CLminN: 0.14 CLmaxN: 1.62 | 2.67 |
| ER3 | Neutral Grassland | Calcareous grassland (using base cation) | CLminN: 0.85 CLmaxN: 4.72 | 1.6 |
| ER4 | Fen, Marsh and Swamp | This habitat is not sensitive to acidity | - (B) | - (B) |
| | Broadleaved, Mixed and Yew Woodland | Broadleafed/Coniferous unmanaged woodland | CLminN: 0.14 CLmaxN: 1.62 | 2.67 |
| ER5 | Broadleaved, Mixed and Yew Woodland | Broadleafed/Coniferous unmanaged woodland | CLminN: 0.14 CLmaxN: 1.62 | 2.67 |
| ER6 | Broadleaved, Mixed and Yew Woodland | Broadleafed/Coniferous unmanaged woodland | CLminN: 0.14 CLmaxN: 1.62 | 2.67 |
| ER7 | Neutral Grassland | Calcareous grassland (using base cation) | CLminN: 0.85 CLmaxN: 4.72 | 1.6 |
| ER8 | Fen, Marsh and Swamp | This habitat is not sensitive to acidity | - (B) | - (B) |

| ID | Habitat | Critical Load Acidity Class (A) | Critical Load Function (keq/ha/yr) | Current Acid Load (keq/ha/yr) |
|---|---|---|---|---|
| ER9 | Fen, Marsh and Swamp | This habitat is not sensitive to acidity | - (B) | - (B) |
| ER10 | Fen, Marsh and Swamp | This habitat is not sensitive to acidity | - (B) | - (B) |
| | Broadleaved, Mixed and Yew Woodland | Broadleafed/Coniferous unmanaged woodland | CLminN: 0.14 CLmaxN: 1.62 | 2.67 |
| ER11 | Broadleaved, Mixed and Yew Woodland | Broadleafed/Coniferous unmanaged woodland | CLminN: 0.14 CLmaxN: 1.62 | 2.67 |
| ER12 | Broad-leaved, mixed and yew woodland (Alnus glutinosa - Urtica dioica woodland) | Unmanaged Broadleafed/Coniferous Woodland | MinCLMaxN: 1.674 MaxCLMaxN: 1.677 | 2.67 |
| ER13 | Fen, marsh and swamp (Carex rostrata - Sphagnum recurvum (fallax) mire) | Bogs | MinCLMaxN: 0.518 MaxCLMaxN: 0.519 | 1.6 |
| | Bogs (Sphagnum cuspidatum/recurvum (fallax) bog pool community) | Bogs | MinCLMaxN: 0.518 MaxCLMaxN: 0.519 | 1.6 |
| | Bogs (Sphagnum cuspidatum/recurvum (fallax) bog pool community) | Bogs | MinCLMaxN: 0.518 MaxCLMaxN: 0.519 | 1.6 |
| | Broad-leaved, mixed and yew woodland (Quercus spp.-Betula spp.-Deschampsia flexuosa woodland) | Unmanaged Broadleafed/Coniferous Woodland | MinCLMaxN: 1.675 MaxCLMaxN: 1.676 | 2.67 |
| ER14 | Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland) | Acid grassland | MinCLMaxN: 1.630 MaxCLMaxN: 1.630 | 1.6 |
| | Neutral grassland (Cynosurus cristatus - Centaurea nigra grassland) | Calcareous grassland (using base cation) | MinCLMaxN: 4.856 MaxCLMaxN: 4.856 | 1.6 |
| | Fen, marsh and swamp (Juncus effusus / acutiflorus - Galium palustre rush pasture) | Acid grassland | MinCLMaxN: 1.630 MaxCLMaxN: 1.630 | 1.6 |
| | Fen, marsh and swamp (Molinia caerula - Cirsium dissectum fen-meadow) | Acid grassland | MinCLMaxN: 1.630 MaxCLMaxN: 1.630 | 1.6 |
| | Broad-leaved, mixed and yew woodland (Alnus glutinosa - Carex paniculata woodland) | Unmanaged Broadleafed/Coniferous Woodland | MinCLMaxN: 1.673 MaxCLMaxN: 1.685 | 2.67 |
| | Fen, marsh and swamp (Phragmites australis swamp and reed-beds) | This habitat is not sensitive to acidity | - (B) | - (B) |
| | Nuphar pumila - Least Water-Lily | No broad habitat assigned | - (B) | - (B) |
| ER15 | Broad-leaved, mixed and yew woodland (Alnus glutinosa - Carex paniculata woodland) | Unmanaged Broadleafed/Coniferous Woodland | MinCLMaxN: 0.519 MaxCLMaxN: 1.648 | 2.67 |
| | Broad-leaved, mixed and yew woodland (Alnus | Unmanaged Broadleafed/Coniferous Woodland | MinCLMaxN: 0.519 MaxCLMaxN: 1.648 | 2.67 |

| ID | Habitat | Critical Load Acidity Class (A) | Critical Load Function (keq/ha/yr) | Current Acid Load (keq/ha/yr) |
|---|---|---|---|---|
| | Broad-leaved, mixed and yew woodland (Quercus robur - Pteridium aquilinum - Rubus fruticosus | Unmanaged Broadleafed/Coniferous Woodland | MinCLMaxN: 0.519 MaxCLMaxN: 1.648 | 2.67 |
| | Neutral grassland (Cynosurus cristatus - Caltha palustris grassland) | Acid grassland | MinCLMaxN: 0.552 MaxCLMaxN: 1.630 | 1.6 |
| | Neutral grassland (Cynosurus cristatus - Caltha palustris grassland) | Calcareous grassland (using base cation) | MinCLMaxN: 4.856 MaxCLMaxN: 4.999 | 1.6 |
| | Fen, marsh and swamp (Juncus effusus / acutiflorus - Galium palustre rush pasture) | Acid grassland | MinCLMaxN: 0.552 MaxCLMaxN: 1.630 | 1.6 |
| | Fen, marsh and swamp (Juncus subnodulosus - Cirsium palustre fen meadow) | Acid grassland | MinCLMaxN: 0.552 MaxCLMaxN: 1.630 | 1.6 |
| | Fen, marsh and swamp (Cladium mariscus swamp and sedge-beds) | This habitat is not sensitive to acidity | - (B) | - (B) |
| | Fen, marsh and swamp (Phragmites australis swamp and reed-beds) | This habitat is not sensitive to acidity | - (B) | - (B) |
| | Fen, marsh and swamp (Scirpus lacustris ssp. tabernaemontani swamp) | This habitat is not sensitive to acidity | - (B) | - (B) |
| | Fen, marsh and swamp (Scirpus lacustris ssp. tabernaemontani swamp) | This habitat is not sensitive to acidity | - (B) | - (B) |
| | Fen, marsh and swamp (Scirpus lacustris ssp. tabernaemontani swamp) | This habitat is not sensitive to acidity | - (B) | - (B) |
| | Fen, marsh and swamp (Typha angustifolia swamp) | This habitat is not sensitive to acidity | - (B) | - (B) |
| ER16 | Fen, Marsh and Swamp | This habitat is not sensitive to acidity | - (B) | - (B) |
| ER17 | Fen, Marsh and Swamp | This habitat is not sensitive to acidity | - (B) | - (B) |
| ER18 | Transition mires and quaking bogs (H7140) | Bogs | MinCLMaxN: 0.518 MaxCLMaxN: 0.621 | 1.74 |
| ER19 | Broadleaved, Mixed and Yew Woodland | Broadleafed/Coniferous unmanaged woodland | CLminN: 0.14 CLmaxN: 1.62 | 2.67 |

Notes:

(A) Critical Load class from APIS.
(B) Habitat not sensitive to acidification, so there is no relevant Critical Load function / Current Load.

The existing acid deposition is greater than the CLminN CLo for each considered ecological designations and relevant habitat. Therefore, in accordance with APIS guidance[13], the inputs of N (as total acidity) have been considered to calculate the proportion of the CLmaxN.

[13] http://www.apis.ac.uk/clf-guidance.

# 5.0 QUANTIFICATION OF EMISSIONS TO ATMOSPHERE

The operation of the Site has the potential to release emissions to atmosphere. These are to be emitted from 7 distinct stacks, discharging process emissions from the proposed boiler plant.

## 5.1 Modelling Scenarios

The scenarios considered within the dispersion modelling assessment are detailed in Table 5-1.

**Table 5-1**
**Dispersion Modelling Scenarios**

| Pollutant | Modelled As | |
|---|---|---|
| | Short-term | Long term |
| $NO_2$ | 99.79 Percentile of 1-hour means | Annual Mean |
| NOx | 24-hour mean | Annual Mean |
| $PM_{10}$ | 90.41 Percentile of 24-hour means | Annual Mean |

## 5.2 Process Conditions

The physical parameters applied to the emission sources, as provide by Tudor Griffiths Ltd are as shown in Table 5-1. There are 7 proposed Lin-ka 995 units to be installed, each of 995kW output, each discharging process emissions via separate stacks.

**Table 5-2**
**Physical Characteristics**

| Parameter | Stack Source | | | | | | |
|---|---|---|---|---|---|---|---|
| | Boiler 1 | Boiler 2 | Boiler 3 | Boiler 4 | Boiler 5 | Boiler 6 | Boiler 7 |
| Stack NGR (m) – X | 342249.53 | 342251.72 | 342254.39 | 342256.76 | 342259.31 | 342261.92 | 342264.35 |
| Stack NGR (m) – Y | 332513.47 | 332510.15 | 332506.29 | 332502.68 | 332499.00 | 332495.09 | 332491.53 |
| Stack Height above ground level (m) | 16.7 | 16.7 | 16.7 | 16.7 | 16.7 | 16.7 | 16.7 |
| Internal Stack Diameter (m) (A) | 0.348 | 0.348 | 0.348 | 0.348 | 0.348 | 0.348 | 0.348 |
| Exit Velocity (m/s) (A) | 8.82 | 8.82 | 8.82 | 8.82 | 8.82 | 8.82 | 8.82 |
| Temperature of Exit Gas (°C) (A) | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Actual Flow Rate ($Am^3/s$) (A) | 0.84 | 0.84 | 0.84 | 0.84 | 0.84 | 0.84 | 0.84 |
| Oxygen Content (%, wet) (A) | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| Moisture Content (%)(A) | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| Normalised Flow ($Nm^3/s$) (A) | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 |

### 5.2.1 Boiler Pollutant Emission Rates

Emissions have been calculated based upon those emission limit values (ELVs) stated by Lin-ka, the technology provider for the proposed boilers, based upon a biomass feedstock. Applied emission concentrations and associated emission rates are detailed in Table 5-3.

**Table 5-3**
**Biomass Boiler Plant – Pollutant Emission Rates (Per Boiler)**

| Pollutant | Emission Limit (mg/Nm$^3$) | Emission Rate (g/s) |
|---|---|---|
| $NO_x$ | 152 | 0.063 |
| PM | 34 | 0.014 |

## 5.3 Detailed Atmospheric Dispersion Modelling

For this assessment the AERMOD model[14] has been applied with due consideration to relevant guidance[15]. This model is widely used and accepted by the EA for undertaking such assessments and its predictions have been against real-time monitoring data by the United State (US) Environmental Protection validated Agency (EPA)[16]. It is therefore considered a suitable model for this assessment.

### 5.3.1 Met Data Preparation

Atmospheric Dispersion Modelling (ADM) Ltd was consulted in order to determine the most appropriate meteorological dataset to utilise within the Dispersion Modelling Assessment.

Meteorological data used in this assessment comprised a 5-year sequential hourly average dataset, covering the period 2009 – 2013 inclusive, to comply with current EA modelling guidance. Shawbury meteorological data was obtained in .met format from the data supplier and converted to the required surface and profile (.sfc and .pfl) formats for use in AERMOD using AERMET[17].

Details specific to the exact site location were used for the conversion, such as latitude, longitude and surface characteristics in accordance with US EPA methodology[18]. The surface characteristics were based upon land use characteristics 1km from the point source, as shown in Table 5-4.

**Table 5-4**
**Meteorological Data Preparation**

| Zone Start (deg) | Zone End (deg) | Landscape Character (A) | Albedo | Bowen | Roughness |
|---|---|---|---|---|---|
| 0 | 150 | Desert Shrubland | 0.3275 | 4.75 | 0.2625 |
| 150 | 290 | Grassland | 0.29 | 0.925 | 0.04025 |
| 290 | 315 | Water | 0.14 | 0.45 | 0.0001 |

14 Software used: Lakes AERMOD View, version 9.0.0.

15 USEPA, Aermod Implementation Workgroup, Aermod Implementation Guide, (Jan 9th, 2008).

16 AERMOD: Latest Features and Evaluation Results. USEPA Report: EPA-454/R-03-003 June 2003, (http://www.epa.gov/scram001/dispersion_prefrec.htm#aermod).

17 Software used: Lakes AERMET View, version 9.0.0.

18 AERMOD Implementation guide. AERMOD implementation workgroup, USEPA. Last revised January 8, 2008.

| | | | | | |
|---|---|---|---|---|---|
| 315 | 0 | Desert shrubland | 0.3275 | 4.75 | 0.2625 |

Note:
(A) Based upon AEMET descriptors for land use type. The 'desert shrubland' category has been chosen to select the character of the surrounding quarry working area.

Table 5-5 presents statistics on the meteorological dataset illustrating the number of calm hours and the number 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 in accordance with EA modelling guidance.

**Table 5-5**
**Shawbury Met Data Statistics**

| Year | Calm Hours (%) | Missing Hours (%) |
|---|---|---|
| 2009 | 1.95 | 0.54 |
| 2010 | 3.07 | 0.00 |
| 2011 | 1.29 | 0.00 |
| 2012 | 1.45 | 0.15 |
| 2013 | 1.06 | 0.26 |

### *5.3.2 Model Domain*

The potential air quality impact of Site was assessed over an area of 1.5km radius from the Site, centred on NGR: 342273.28, 332494.93.

In addition, the identified potentially sensitive locations, detailed in Table 4-1 and Table 4-2, were modelled as discrete receptors (see Drawing AQ1).

### *5.3.3 Terrain*

Digital height contour data has been processed by the AERMAP function within AERMOD to calculate terrain heights, and interpolate data to calculate terrain heights for sources and buildings.

### *5.3.4 Building Downwash / Entrainment*

The movement of air over and around buildings and other structures generates areas of flow re-circulation that can lead to increased ground level concentrations of pollutants close to the source. Where the stack height is less than 2.5 times the height of any nearby building (within 5 stack heights), downwash effects and entrainment can be significant. 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.

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. The dimensions of building and significant structures of the proposed Wood Lane biomass boiler stack were input to the BPIP Building Downwash pre-processor, as presented within Table 5-6. The coordinates presented are for the south-western corner of the building.

A visualisation of buildings and structures incorporated into the dispersion model is presented in Figure 5-1.

**Table 5-6**
**Buildings and Structures Modelled – Wood Lane Biomass Boiler Plant**

| Structure | NGR (m) | | Height (m) | X Width (m) | Y Length (m) |
|---|---|---|---|---|---|
| | X | Y | | | |
| Main biomass building | 342247.83 | 332515.94 | 14.7 | 32.9 | 67.3 |
| Stack lean-to | 342237.9 | 332509.32 | 10.2 | 32.9 | 12.0 |
| Fan lean-to | 342304.05 | 332553.45 | 5.50 | 32.9 | 7.50 |

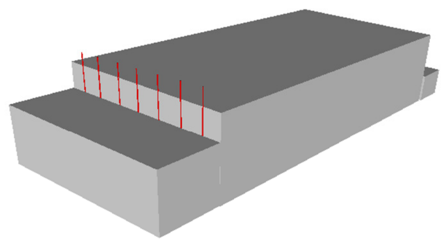

**Figure 5-1**
**Wood Lane Biomass Boiler Plant Site Layout Applied in Model**

### *5.3.5 Special Treatment of Model Results*

Oxides of nitrogen ($NO_x$) emitted to atmosphere as a result of combustion will consist largely of nitric oxide (NO), a relatively innocuous substance. Once released into the atmosphere, NO is oxidised to $NO_2$. The proportion of NO converted to $NO_2$ depends on a number of factors including wind speed, distance from the source, solar radiation and the availability of oxidants, such as ozone ($O_3$).

Following the EA AQMAU guidance[19] on conversion ratio for NOx and $NO_2$ a worst case scenario has been applied in that 35% of NOx is presented as $NO_2$ in relation to short term impacts and 70% of NOx is present as $NO_2$ in relation to long term impacts.

### *5.3.6 Presentation of Results*

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
- where impacts are potentially significant, illustrations of the impact as isopleths (contours of concentration) for the criteria selected enabling determination of impact at any locations within the study area.

[19] http://www.environment-agency.gov.uk/business/regulation/38791.aspx.

# 6.0 PREDICTION OF IMPACTS

This section provides a presentation of the predicted air quality impact of the Site, as determined through the detailed dispersion modelling study.

## 6.1 Discrete Receptor Long-term Impacts

### *6.1.1 Annual Mean $NO_2$*

Predicted annual mean $NO_2$ process contribution (PC) and predicted environmental concentration (PEC) at discrete receptors identified within Table 4-1 are presented within Table 6-1. Modelled PCs and/or PECs which cannot be considered insignificant in terms of the applied '*risk assessment for permits*' methodology are displayed in bold text.

**Table 6-1**
**Predicted Annual Mean $NO_2$ Concentrations at Discrete Receptors**

| Receptor | PC (µg/m³) | PC as Percentage of EAL (%) | PEC (µg/m³) (A) | PEC as Percentage of EAL (%) |
|---|---|---|---|---|
| R1 | **0.69** | **1.73** | 11.2 | 28.0 |
| R2 | **0.62** | **1.56** | 11.1 | 27.8 |
| R3 | **0.50** | **1.24** | 11.0 | 27.5 |
| R4 | 0.22 | 0.56 | 10.7 | 26.8 |
| R5 | 0.24 | 0.60 | 10.7 | 26.8 |
| R6 | 0.18 | 0.45 | 10.7 | 26.7 |
| R7 | 0.18 | 0.44 | 10.7 | 26.7 |
| R8 | 0.17 | 0.43 | 10.7 | 26.7 |
| R9 | 0.17 | 0.42 | 10.7 | 26.7 |
| R10 | 0.17 | 0.42 | 10.7 | 26.7 |
| R11 | **0.72** | **1.80** | 11.2 | 28.0 |
| R12 | **0.53** | **1.33** | 11.0 | 27.6 |
| R13 | **0.56** | **1.39** | 11.1 | 27.6 |
| R14 | **0.49** | **1.23** | 11.0 | 27.5 |
| R15 | **0.45** | **1.14** | 11.0 | 27.4 |
| R16 | **0.42** | **1.06** | 10.9 | 27.3 |
| R17 | 0.32 | 0.80 | 10.8 | 27.1 |
| R18 | 0.25 | 0.62 | 10.7 | 26.9 |
| R19 | 0.09 | 0.22 | 10.6 | 26.5 |

Notes:
PC = Process contribution.
PEC = Predicted environmental concentration.
(A) Inclusive of background concentration of 10.5µg/m³.

Table 6-1 illustrates that the annual mean $NO_2$ PC is greater than 1% of the relevant EAL, and therefore cannot be considered 'insignificant' against the *risk assessment for permits* methodology, at a number of considered discrete receptors (R1, R2, R3, R11, R12, R13, R14, R15 and R16). However, it should be noted that the modelling scenario assumes that the boiler will be operating at the emission limit, and operating at full load 365-days per year, as a worst-case scenario. As actual operations are likely to be lower (due to periods of down-time associated with maintenance, for example) actual impacts are likely to be correspondingly lower.

PECs presented are less than the relevant EAL, therefore no exceedence of the long-term (annual mean) $NO_2$ EAL / AQO is predicted as a result of the emissions from the Site.

Further, PECs are less than 70% of the EAL / AQO and, therefore, are considered 'not significant' against the *risk assessment for permits* methodology.

#### *6.1.2 Annual Mean $PM_{10}$*

Predicted annual mean $PM_{10}$ PCs and PECs at discrete receptors identified within Table 4-1 are presented within Table 6-2. Modelled PCs and/or PECs which cannot be considered insignificant in terms of the applied '*risk assessment for permits*' methodology are displayed in bold text.

**Table 6-2**
**Predicted Annual Mean $PM_{10}$ Concentrations at Discrete Receptors**

| Receptor | PC (µg/m³) | PC as Percentage of EAL (%) | PEC (µg/m³) (A) | PEC as Percentage of EAL (%) |
|---|---|---|---|---|
| R1 | 0.22 | 0.55 | 15.0 | 37.5 |
| R2 | 0.20 | 0.49 | 15.0 | 37.5 |
| R3 | 0.16 | 0.39 | 15.0 | 37.4 |
| R4 | 0.07 | 0.18 | 14.9 | 37.2 |
| R5 | 0.08 | 0.19 | 14.9 | 37.2 |
| R6 | 0.06 | 0.14 | 14.9 | 37.1 |
| R7 | 0.06 | 0.14 | 14.9 | 37.1 |
| R8 | 0.05 | 0.14 | 14.9 | 37.1 |
| R9 | 0.05 | 0.13 | 14.9 | 37.1 |
| R10 | 0.05 | 0.13 | 14.9 | 37.1 |
| R11 | 0.23 | 0.57 | 15.0 | 37.6 |
| R12 | 0.17 | 0.42 | 15.0 | 37.4 |
| R13 | 0.18 | 0.44 | 15.0 | 37.4 |
| R14 | 0.16 | 0.39 | 15.0 | 37.4 |
| R15 | 0.14 | 0.36 | 14.9 | 37.4 |
| R16 | 0.13 | 0.34 | 14.9 | 37.3 |
| R17 | 0.10 | 0.26 | 14.9 | 37.3 |
| R18 | 0.08 | 0.20 | 14.9 | 37.2 |
| R19 | 0.03 | 0.07 | 14.8 | 37.1 |

Notes:
PC = Process contribution.
PEC = Predicted environmental concentration.
(A) Inclusive of background concentration of 14.8µg/m³.

Table 6-2 illustrates that the annual mean $PM_{10}$ PC is less than 1% of the relevant EA / AQO at all discrete receptors, and therefore can be considered 'insignificant' against the *risk assessment for permits* methodology.

PECs presented are less than the relevant EAL / AQO, therefore no exceedence of the short-term (24-hour mean 90.41 percentile concentration) $PM_{10}$ EAL / AQO is predicted as a result of the emissions from the Site.

### 6.2 Discrete Receptor Short-term Impacts

#### *6.2.1 1-hour Mean $NO_2$*

Predicted 99.79 percentile 1-hour mean $NO_2$ PCs and PECs at discrete receptors identified within Table 4-1 are presented within Table 6-3. Modelled PCs and/or PECs which cannot be considered insignificant in terms of the applied '*risk assessment for permits*' methodology are displayed in bold text.

**Table 6-3**
**Predicted 99.79 Percentile 1-hour Mean $NO_2$ Concentrations at Discrete Receptors**

| Receptor | PC (µg/m$^3$) | PC as Percentage of EAL (%) | PEC (µg/m$^3$) (A) | PEC as Percentage of EAL (%) |
|---|---|---|---|---|
| R1 | 15.7 | 7.84 | 36.7 | 18.3 |
| R2 | 16.0 | 8.01 | 37.0 | 18.5 |
| R3 | 14.2 | 7.09 | 35.2 | 17.6 |
| R4 | 7.68 | 3.84 | 28.7 | 14.3 |
| R5 | 7.98 | 3.99 | 29.0 | 14.5 |
| R6 | 6.20 | 3.10 | 27.2 | 13.6 |
| R7 | 5.98 | 2.99 | 27.0 | 13.5 |
| R8 | 5.47 | 2.74 | 26.5 | 13.2 |
| R9 | 5.54 | 2.77 | 26.5 | 13.3 |
| R10 | 5.56 | 2.78 | 26.6 | 13.3 |
| R11 | 13.1 | 6.57 | 34.1 | 17.1 |
| R12 | 11.2 | 5.62 | 32.2 | 16.1 |
| R13 | 11.4 | 5.69 | 32.4 | 16.2 |
| R14 | 10.5 | 5.23 | 31.5 | 15.7 |
| R15 | 10.1 | 5.07 | 31.1 | 15.6 |
| R16 | 10.8 | 5.38 | 31.8 | 15.9 |
| R17 | 10.6 | 5.28 | 31.6 | 15.8 |
| R18 | 8.56 | 4.28 | 29.6 | 14.8 |
| R19 | 3.07 | 1.54 | 24.1 | 12.0 |

Notes:
PC = Process contribution.
PEC = Predicted environmental concentration.
(A) Inclusive of background concentration of 21.0µg/m$^3$.

Table 6-3 illustrates that 99.79 percentile 1-hour mean $NO_2$ PC is less than 10% of the relevant EAL, and therefore can be considered 'insignificant' against the *risk assessment for permits* methodology.

PECs presented are less than the relevant EAL / AQO, therefore no exceedence of the $NO_2$ short-term (1-hour 99.79 percentile) EAL / AQO is predicted as a result of the emissions from the Site. Further, it is noted that the PC is less than 20% of the headroom between the EAL / AQO and twice the background concentration at all considered receptors (where the PC would need to be ≥19.0µg/m$^3$ in order to be equal to or greater than the stated threshold). Therefore, in accordance with the *risk assessment for permits* methodology, PECs are considered to be 'insignificant'.

### *6.2.2 24-hour Mean $PM_{10}$*

Predicted 90.41 percentile 24-hour mean $PM_{10}$ PCs and PECs at discrete receptors identified within Table 4-1 are presented within Table 6-4.

**Table 6-4**
**Predicted 90.41 Percentile 24-hour Mean $PM_{10}$ Concentrations at Discrete Receptors**

| Receptor | PC (µg/m$^3$) | PC as Percentage of EAL (%) | PEC (µg/m$^3$) (A) | PEC as Percentage of EAL (%) |
|---|---|---|---|---|
| R1 | 0.72 | 1.43 | 18.2 | 36.4 |
| R2 | 0.63 | 1.26 | 18.1 | 36.2 |
| R3 | 0.53 | 1.07 | 18.0 | 36.0 |

| Receptor | PC (µg/m³) | PC as Percentage of EAL (%) | PEC (µg/m³) (A) | PEC as Percentage of EAL (%) |
|---|---|---|---|---|
| R4 | 0.26 | 0.52 | 17.7 | 35.4 |
| R5 | 0.28 | 0.56 | 17.7 | 35.5 |
| R6 | 0.21 | 0.41 | 17.7 | 35.3 |
| R7 | 0.20 | 0.39 | 17.7 | 35.3 |
| R8 | 0.18 | 0.37 | 17.6 | 35.3 |
| R9 | 0.18 | 0.37 | 17.6 | 35.3 |
| R10 | 0.18 | 0.36 | 17.6 | 35.3 |
| R11 | 0.71 | 1.41 | 18.2 | 36.3 |
| R12 | 0.49 | 0.99 | 18.0 | 35.9 |
| R13 | 0.54 | 1.07 | 18.0 | 36.0 |
| R14 | 0.48 | 0.96 | 17.9 | 35.9 |
| R15 | 0.42 | 0.84 | 17.9 | 35.8 |
| R16 | 0.45 | 0.89 | 17.9 | 35.8 |
| R17 | 0.35 | 0.70 | 17.8 | 35.6 |
| R18 | 0.26 | 0.51 | 17.7 | 35.4 |
| R19 | 0.08 | 0.16 | 17.5 | 35.1 |

Notes:
PC = Process contribution.
PEC = Predicted environmental concentration.
(A) Inclusive of background concentration of 17.5µg/m³.

Table 6-4 illustrates that the 90.41 percentile 24-hour mean $PM_{10}$ PC is less than 10% of the relevant EAL / AQO at all discrete receptors, and therefore can be considered 'insignificant' against the *risk assessment for permits* methodology.

PECs presented are less than the relevant EAL, therefore no exceedence of the $PM_{10}$ short-term (24-hour mean 90.41 percentile concentration) EAL / AQO is predicted as a result of the emissions from the Site.

## 6.3 Detailed Modelling – Impacts at Ecological Receptors

Modelling of impacts at ecological receptors has been undertaken for the proposed Site, to determine impacts on $C_{Lo}$ and $C_{Le}$, as presented within the following subsections.

### *6.3.1 Critical Levels*

The maximum predicted ground level PC of annual mean and 24-hour maximum NOx from the Site at each nature conservation site is presented in the following tables, for consideration against the NOx $C_{Le}$.

**Table 6-5**
**Predicted Nitrogen Oxide Critical Level Impacts on Sensitive Ecosystems (Annual Mean)**

| Ecological Receptor | Background (µg/m³) | Process Contribution (PC) | PC as % of CLe | Predicted Environmental Concentration (PEC) | PEC as Percentage of CLe (%) |
|---|---|---|---|---|---|
| ER1 | 11.2 | 0.28 | 0.94 | 11.5 | 15.3 |
| ER2 | 11.2 | 0.47 | 1.56 | 11.7 | 15.6 |
| ER3 | 11.2 | 0.54 | 1.78 | 11.7 | 15.6 |
| ER4 | 11.2 | 0.24 | 0.80 | 11.4 | 15.3 |
| ER5 | 11.2 | 0.54 | 1.80 | 11.7 | 15.7 |

| Ecological Receptor | Background (µg/m³) | Process Contribution (PC) | PC as % of CLe | Predicted Environmental Concentration (PEC) | PEC as Percentage of CLe (%) |
|---|---|---|---|---|---|
| ER6 | 11.2 | 1.27 | 4.24 | 12.5 | 16.6 |
| ER7 | 11.2 | 0.25 | 0.84 | 11.5 | 15.3 |
| ER8 | 11.2 | 1.05 | 3.49 | 12.2 | 16.3 |
| ER9 | 11.2 | 7.86 | 26.2 | 19.1 | 25.4 |
| ER10 | 11.2 | 0.36 | 1.19 | 11.6 | 15.4 |
| ER11 | 11.2 | 0.53 | 1.77 | 11.7 | 15.6 |
| ER12 | 11.2 | 0.64 | 2.13 | 11.8 | 15.8 |
| ER13 | 11.2 | 0.25 | 0.83 | 11.4 | 15.3 |
| ER14 | 11.2 | 0.60 | 1.99 | 11.8 | 15.7 |
| ER15 | 11.2 | 0.21 | 0.70 | 11.4 | 15.2 |
| ER16 | 11.2 | 0.64 | 2.13 | 11.8 | 15.8 |
| ER17 | 11.2 | 0.60 | 1.99 | 11.8 | 15.7 |
| ER18 | 11.2 | 0.25 | 0.83 | 11.4 | 15.3 |
| ER19 | 11.2 | 0.69 | 2.28 | 11.9 | 15.8 |

The PC from the Site is less than 100% of the applied CLe for annual mean $NO_X$ at ecological receptors ER1 – ER11 and ER19 (i.e. the LWS, LNR and AW designations), therefore emissions cause *'no significant pollution'* in accordance with EA Operational Instruction 66_12[20]. Furthermore, the PC from the Site is less than 1% of the applied CLe for annual mean $NO_X$ at ecological receptors ER13, ER15 and ER18 (i.e. the SSSI and SAC designations) therefore emissions do not have a '*likely significant effect*' on the SAC, or will '*be an operation likely to damage*' the SSSI.

The PC from the Site is greater than 1% of the applied CLe for annual mean $NO_X$ at receptors ER12, ER14, ER16 and ER17 (i.e. the SSSI and Ramsar designations). However, the PEC is less than 70% of the CLe at receptors ER12, ER14, ER16 and ER17 and therefore emissions do not have a '*likely significant effect*' on the SAC, or will '*be an operation likely to damage*' the SSSI.

**Table 6-6**
**Predicted Nitrogen Oxide Critical Level Impacts on Sensitive Ecosystems (Daily Mean)**

| Ecological Receptor | Background (µg/m³) | Process Contribution (PC) | PC as % of CL | Predicted Environmental Concentration (PEC) | PEC as Percentage of CL (%) |
|---|---|---|---|---|---|
| ER1 | 13.2 | 2.90 | 3.86 | 16.1 | 21.5 |
| ER2 | 13.2 | 4.58 | 6.10 | 17.8 | 23.7 |
| ER3 | 13.2 | 6.39 | 8.52 | 19.6 | 26.1 |
| ER4 | 13.2 | 2.54 | 3.39 | 15.8 | 21.0 |
| ER5 | 13.2 | **7.91** | **10.5** | 21.1 | 28.2 |
| ER6 | 13.2 | **8.71** | **11.6** | 21.9 | 29.2 |
| ER7 | 13.2 | 4.24 | 5.65 | 17.5 | 23.3 |
| ER8 | 13.2 | 9.36 | 12.5 | 22.6 | 30.1 |
| ER9 | 13.2 | **41.5** | **55.4** | 54.7 | 73.0 |

[20] http://infrastructure.planningportal.gov.uk/wp-content/ipc/uploads/projects/EN010039/2.%20Post-Submission/Hearings/Issue%20Specific%20Hearing%20-%2030-04-2015%20-%201000%20-%20Dukes%20Head%20Hotel/Environment%20Agency%20-%20Document%201.pdf – Accessed June 2016.

| Ecological Receptor | Background (µg/m$^3$) | Process Contribution (PC) | PC as % of CL | Predicted Environmental Concentration (PEC) | PEC as Percentage of CL (%) |
|---|---|---|---|---|---|
| ER10 | 13.2 | 3.45 | 4.59 | 16.7 | 22.2 |
| ER11 | 13.2 | **10.7** | **14.2** | 23.9 | 31.9 |
| ER12 | 13.2 | **10.8** | **14.4** | 24.0 | 32.1 |
| ER13 | 13.2 | 2.49 | 3.32 | 15.7 | 20.9 |
| ER14 | 13.2 | 5.33 | 7.10 | 18.5 | 24.7 |
| ER15 | 13.2 | 3.58 | 4.78 | 16.8 | 22.4 |
| ER16 | 13.2 | **10.8** | **14.4** | 24.0 | 32.1 |
| ER17 | 13.2 | 5.33 | 7.10 | 18.5 | 24.7 |
| ER18 | 13.2 | 2.49 | 3.32 | 15.7 | 20.9 |
| ER19 | 13.2 | 6.04 | 8.05 | 19.3 | 25.7 |

The PC from the Site is less than 100% of the applied CLe for 24-hour mean $NO_X$ (based upon the 1$^{st}$ highest modelled NOx PC) at ecological receptors ER1 – ER11 and ER19 (i.e. the LWS, LNR and AW designations), therefore PCs can be concluded to cause '*no significant pollution'* in accordance with EA Operational Instruction 66_12.

Furthermore, the PC from the Site is less than 10% of the applied CLe for 24-hour mean $NO_X$ (based upon the 1$^{st}$ highest modelled NOx PC) at ecological receptors ER13, ER14, ER15, ER17 and ER18 (i.e. the SSSI, Ramsar and SAC designations) therefore PCs do not have a '*likely significant effect*' on the SAC, or will '*be an operation likely to damage*' the SSSI.

The PC is greater than 10% of the applied CLe for 24-hour mean $NO_X$ (based upon the 1$^{st}$ highest modelled NOx PC) at ecological receptors ER12 and ER16 (i.e. the SSSI and Ramsar designations). At this location, the maximum PEC is 32.1% of the CLe.

The PC is greater than 10% of the CLe for 24-hour mean NOx over an area of 32,943m$^2$ compared to the total area of the designation of 320,603m$^2$, representing 10.3% of the entire SSSI (ER12) / Ramsar (ER16) designation. However, it should be noted that the modelling scenario assumes that all 7 biomass boilers will be operating at the emission limit, and operating at full load, as a worst-case scenario. As actual operations are likely to be lower (due to periods of down-time associated with maintenance, for example) actual impacts are likely to be correspondingly lower.

There are three units which comprise the White Mere SSSI designation. The condition of these units are described as being 'unfavourable – recovering' (unit 001 and 003) and 'favourable' (unit 002)[21]. Analysis of the dispersion modelling outputs illustrates that this maximum concentration occurs at NGR: 341770.5, 332773.5 – this maximum predicted 24-hour mean NOx PC occurs within the extent of unit 001.

Therefore, in accordance with EA Operational Instruction 67_12, '*if the PC plus background (i.e. PEC) is less than 100% of the appropriate environmental criteria, it can be assumed there will be **no adverse effect***'. Furthermore, PC impacts can be concluded to cause '*no damage*' at ER12 (White Mere SSSI) and '*no adverse effect on site integrity*' at ER16 (Midland Meres & Mosses - Phase 1 Ramsar).

21 https://designatedsites.naturalengland.org.uk/ReportUnitCondition.aspx?SiteCode=S1001139&ReportTitle=White Mere SSSI – accessed June 2016.

### *6.3.2 Critical Loads*

The process contribution to Critical Load (CLo) for nitrogen deposition is presented in Table 6-7 below.

The process contribution to critical loads for nitrogen contribution to acid deposition is presented in Table 6-8 below.

**Table 6-7**
**Predicted N Deposition and Contribution to N Critical Loads (kg N/ha/yr)**

| Ecological Receptor | Habitat Information | Critical Load (CL) Range (kg N/ha/yr) | PC (kg N/ha/yr) | PC as a % of Lower CL | PC as a % of Upper CL |
|---|---|---|---|---|---|
| ER1 | Valley mires, poor fens and transition mires | 10 – 15 | 0.08 | 0.81 | 0.54 |
| | Rich fens | 15 – 30 | 0.08 | 0.54 | 0.27 |
| ER2 | Valley mires, poor fens and transition mires | 10 – 15 | 0.13 | 1.34 | 0.90 |
| | Rich fens | 15 – 30 | 0.13 | 0.90 | 0.45 |
| | Broadleaved deciduous woodland | 10 – 20 | 0.13 | 1.34 | 0.67 |
| | Fagus woodland | 10 – 20 | 0.13 | 1.34 | 0.67 |
| | Acidophilous Quercus-dominated woodland | 10 – 15 | 0.13 | 1.34 | 0.90 |
| | Meso- and eutrophic Quercus woodland | 15 – 20 | 0.13 | 0.90 | 0.67 |
| ER3 | Low and medium altitude hay meadows | 20 – 30 | 0.15 | 0.77 | 0.51 |
| | Mountain hay meadows | 10 – 20 | 0.15 | 1.54 | 0.77 |
| ER4 | Valley mires, poor fens and transition mires | 10 – 15 | 0.07 | 0.69 | 0.46 |
| | Rich fens | 15 – 30 | 0.07 | 0.46 | 0.23 |
| | Broadleaved deciduous woodland | 10 – 20 | 0.07 | 0.69 | 0.34 |
| | Fagus woodland | 10 – 20 | 0.07 | 0.69 | 0.34 |
| | Acidophilous Quercus-dominated woodland | 10 – 15 | 0.07 | 0.69 | 0.46 |
| | Meso- and eutrophic Quercus woodland | 15 – 20 | 0.07 | 0.46 | 0.34 |
| ER5 | Broadleaved deciduous woodland | 10 – 20 | 0.16 | 1.55 | 0.78 |
| | Fagus woodland | 10 – 20 | 0.16 | 1.55 | 0.78 |
| | Acidophilous Quercus-dominated woodland | 10 – 15 | 0.16 | 1.55 | 1.03 |
| | Meso- and eutrophic Quercus woodland | 15 – 20 | 0.16 | 1.03 | 0.78 |
| ER6 | Broadleaved deciduous woodland | 10 – 20 | 0.37 | 3.66 | 1.83 |
| | Fagus woodland | 10 – 20 | 0.37 | 3.66 | 1.83 |
| | Acidophilous Quercus-dominated woodland | 10 – 15 | 0.37 | 3.66 | 2.44 |
| | Meso- and eutrophic Quercus woodland | 15 – 20 | 0.37 | 2.44 | 1.83 |
| ER7 | Low and medium altitude hay meadows | 20 – 30 | 0.07 | 0.36 | 0.24 |
| | Mountain hay meadows | 10 – 20 | 0.07 | 0.72 | 0.36 |
| ER8 | Valley mires, poor fens and transition mires | 10 – 15 | 0.30 | 3.01 | 2.01 |

| Ecological Receptor | Habitat Information | Critical Load (CL) Range (kg N/ha/yr) | PC (kg N/ha/yr) | PC as a % of Lower CL | PC as a % of Upper CL |
|---|---|---|---|---|---|
| | Rich fens | 15 – 30 | 0.30 | 2.01 | 1.00 |
| ER9 | Valley mires, poor fens and transition mires | 10 – 15 | 2.26 | 22.6 | 15.08 |
| | Rich fens | 15 – 30 | 2.26 | 15.1 | 7.54 |
| ER10 | Valley mires, poor fens and transition mires | 10 – 15 | 0.10 | 1.03 | 0.68 |
| | Rich fens | 15 – 30 | 0.10 | 0.68 | 0.34 |
| | Broadleaved deciduous woodland | 10 – 20 | 0.10 | 1.03 | 0.51 |
| | Fagus woodland | 10 – 20 | 0.10 | 1.03 | 0.51 |
| | Acidophilous Quercus-dominated woodland | 10 – 15 | 0.10 | 1.03 | 0.68 |
| | Meso- and eutrophic Quercus woodland | 15 – 20 | 0.10 | 0.68 | 0.51 |
| ER11 | Broadleaved deciduous woodland | 10 – 20 | 0.15 | 1.53 | 0.77 |
| | Fagus woodland | 10 – 20 | 0.15 | 1.53 | 0.77 |
| | Acidophilous Quercus-dominated woodland | 10 – 15 | 0.15 | 1.53 | 1.02 |
| | Meso- and eutrophic Quercus woodland | 15 – 20 | 0.15 | 1.02 | 0.77 |
| ER12 | Broad-leaved, mixed and yew woodland (Alnus glutinosa - Urtica dioica woodland) | 10 – 20 | 0.18 | **1.84** | 0.92 |
| ER13 | Raised and blanket bogs | 5 – 10 | 0.07 | **1.43** | 0.71 |
| | Raised and blanket bogs | 5 – 10 | 0.07 | **1.43** | 0.71 |
| | Valley mires, poor fens and transition mires | 10 – 15 | 0.07 | 0.71 | 0.48 |
| | Acidophilous Quercus-dominated woodland | 10 – 15 | 0.07 | 0.71 | 0.48 |
| ER14 | Broadleaved deciduous woodland | 10 – 20 | 0.17 | **1.72** | 0.86 |
| | Moist and wet oligotrophic grasslands: Molinia caerulea meadows | 15 – 25 | 0.17 | **1.14** | 0.69 |
| | Rich fens | 15 – 30 | 0.17 | **1.14** | 0.57 |
| | Rich fens | 15 – 30 | 0.17 | **1.14** | 0.57 |
| | Low and medium altitude hay meadows | 20 – 30 | 0.17 | 0.86 | 0.57 |
| ER15 | Broadleaved deciduous woodland | 10 – 20 | 0.06 | 0.61 | 0.30 |
| | Broadleaved deciduous woodland | 10 – 20 | 0.06 | 0.61 | 0.30 |
| | Meso- and eutrophic Quercus woodland | 15 – 20 | 0.06 | 0.40 | 0.30 |
| | Moist and wet oligotrophic grasslands: Molinia caerulea meadows | 15 – 25 | 0.06 | 0.40 | 0.24 |
| | Rich fens | 15 – 30 | 0.06 | 0.40 | 0.20 |
| | Rich fens | 15 – 30 | 0.06 | 0.40 | 0.20 |

| Ecological Receptor | Habitat Information | Critical Load (CL) Range (kg N/ha/yr) | PC (kg N/ha/yr) | PC as a % of Lower CL | PC as a % of Upper CL |
|---|---|---|---|---|---|
| | Rich fens | 15 – 30 | 0.06 | 0.40 | 0.20 |
| | Low and medium altitude hay meadows | 20 – 30 | 0.06 | 0.30 | 0.20 |
| ER16 | Valley mires, poor fens and transition mires | 10 – 15 | 0.18 | **1.84** | **1.22** |
| | Rich fens | 15 – 30 | 0.18 | **1.22** | 0.61 |
| ER17 | Valley mires, poor fens and transition mires | 10 – 15 | 0.17 | **1.72** | **1.14** |
| | Rich fens | 15 – 30 | 0.17 | **1.14** | 0.57 |
| ER18 | Permanent dystrophic lakes, ponds and pools | 3 – 10 | 0.07 | **2.38** | 0.71 |
| | Valley mires, poor fens and transition mires | 10 – 15 | 0.07 | 0.71 | 0.48 |
| ER19 | Broadleaved deciduous woodland | 10 – 20 | 0.20 | 1.97 | 0.99 |
| | Fagus woodland | 10 – 20 | 0.20 | 1.97 | 0.99 |
| | Acidophilous Quercus-dominated woodland | 10 – 15 | 0.20 | 1.97 | 1.31 |
| | Meso- and eutrophic Quercus woodland | 15 – 20 | 0.20 | 1.31 | 0.99 |

Notes:
PC = Process contribution.

**Table 6-8**
**Predicted Acid Deposition and Contribution to Acid Critical Loads (kg N/ha/yr)**

| Ecological Receptor | Habitat Information – Critical Load Class | CLmaxN (keq/ha/yr) | PC N (keq/ha/yr) | PC N as a % of CLmaxN (%) |
|---|---|---|---|---|
| ER1 | This habitat is not sensitive to acidity | - (A) | 0.006 | - (A) |
| ER2 | This habitat is not sensitive to acidity | - (A) | 0.010 | - (A) |
| | Broadleafed/Coniferous unmanaged woodland | 1.62 | 0.010 | 0.59 |
| ER3 | Calcareous grassland (using base cation) | 4.72 | 0.011 | 0.23 |
| ER4 | This habitat is not sensitive to acidity | - (A) | 0.005 | - (A) |
| | Broadleafed/Coniferous unmanaged woodland | 1.62 | 0.005 | 0.30 |
| ER5 | Broadleafed/Coniferous unmanaged woodland | 1.62 | 0.011 | 0.68 |
| ER6 | Broadleafed/Coniferous unmanaged woodland | 1.62 | 0.026 | 1.61 |
| ER7 | Calcareous grassland (using base cation) | 4.72 | 0.005 | 0.11 |
| ER8 | This habitat is not sensitive to acidity | - (A) | 0.021 | - (A)- |
| ER9 | This habitat is not sensitive to acidity | - (A) | 0.161 | - (A) |
| ER10 | This habitat is not sensitive to acidity | - (A) | 0.007 | - (A) |
| | Broadleafed/Coniferous unmanaged woodland | 1.62 | 0.007 | 0.45 |
| ER11 | Broadleafed/Coniferous unmanaged woodland | 1.62 | 0.011 | 0.67 |
| ER12 | Unmanaged Broadleafed/Coniferous Woodland | 1.677 | 0.013 | 0.78 |
| ER13 | Bogs | 0.519 | 0.005 | 0.98 |
| | Bogs | 0.519 | 0.005 | 0.98 |
| | Bogs | 0.519 | 0.005 | 0.98 |
| | Unmanaged Broadleafed/Coniferous Woodland | 1.676 | 0.005 | 0.30 |
| ER14 | Acid grassland | 1.63 | 0.012 | 0.75 |
| | Calcareous grassland (using base cation) | 4.856 | 0.012 | 0.25 |
| | Acid grassland | 1.63 | 0.012 | 0.75 |
| | Acid grassland | 1.63 | 0.012 | 0.75 |
| | Unmanaged Broadleafed/Coniferous Woodland | 1.685 | 0.012 | 0.73 |
| | This habitat is not sensitive to acidity | - (A) | 0.012 | - (A) |
| | No broad habitat assigned | - (A) | 0.012 | - (A) |
| ER15 | Unmanaged Broadleafed/Coniferous Woodland | 1.648 | 0.004 | 0.26 |

| Ecological Receptor | Habitat Information – Critical Load Class | CLmaxN (keq/ha/yr) | PC N (keq/ha/yr) | PC N as a % of CLmaxN (%) |
|---|---|---|---|---|
| | Unmanaged Broadleafed/Coniferous Woodland | 1.648 | 0.004 | 0.26 |
| | Unmanaged Broadleafed/Coniferous Woodland | 1.648 | 0.004 | 0.26 |
| | Acid grassland | 1.63 | 0.004 | 0.27 |
| | Calcareous grassland (using base cation) | 4.999 | 0.004 | 0.09 |
| | Acid grassland | 1.63 | 0.004 | 0.27 |
| | Acid grassland | 1.63 | 0.004 | 0.27 |
| | This habitat is not sensitive to acidity | - (A) | 0.004 | - (A) |
| | This habitat is not sensitive to acidity | - (A) | 0.004 | - (A) |
| | This habitat is not sensitive to acidity | - (A) | 0.004 | - (A) |
| | This habitat is not sensitive to acidity | - (A) | 0.004 | - (A) |
| | This habitat is not sensitive to acidity | - (A) | 0.004 | - (A) |
| | This habitat is not sensitive to acidity | - (A) | 0.004 | - (A) |
| ER16 | This habitat is not sensitive to acidity | - (A) | 0.013 | - (A) |
| ER17 | This habitat is not sensitive to acidity | - (A) | 0.012 | - (A) |
| ER18 | Bogs | 0.621 | 0.005 | 0.82 |
| ER19 | Broadleafed/Coniferous unmanaged woodland | 1.62 | 0.014 | 0.87 |

Notes:
PC = Process contribution.
(A) Habitat not sensitive to acidification.

Critical Loads (Nutrient Nitrogen) – Analysis

The predicted PC to nutrient nitrogen deposition (Table 6-7) from the Site is greater than 1% of the lower CLo at the following receptor locations based upon the stated habitat features and CLo classes:

- ER12 (White Mere SSSI):
    - Habitat feature: Broad-leaved, mixed and yew woodland (*Alnus glutinosa - Urtica dioic*a woodland); and
    - CLo class: Broadleaved deciduous woodland.
- ER13 (Clarepool Moss SSSI):
    - Habitat features: Bogs (*Erica Tetralix - Sphagnum Papillosum* Raised And Blanket Mire); and Bogs (*Sphagnum cuspidatum/recurvum* (fallax) bog pool community); and
    - CLo class: Raised and blanket bogs.
- ER14 (Cole Mere SSSI):
    - Habitat feature: Broad-leaved, mixed and yew woodland (*Alnus glutinosa - Carex paniculata* woodland); Fen, marsh and swamp (*Juncus effusus / acutiflorus - Galium palustre* rush pasture); Fen, marsh and swamp (*Molinia caerula - Cirsium dissectum* fen-meadow); and Fen, marsh and swamp (*Phragmites australis* swamp and reed-beds); and
    - CLo class: Broadleaved deciduous woodland; Moist and wet oligotrophic grasslands: *Molinia caerulea* meadows; and Rich fens.
- ER16 (Midland Meres & Mosses - Phase 1 Ramsar):
    - Habitat feature: Fen, Marsh and Swamp; and
    - CLo class: Valley mires, poor fens and transition mires; and Rich fens.
- ER17 (Midland Meres & Mosses - Phase 2 Ramsar):
    - Habitat feature: Fen, Marsh and Swamp; and
    - CLo class: Valley mires, poor fens and transition mires; and Rich fens.
- ER18 (West Midlands Mosses (UK0013595) SAC):
    - Habitat feature: Natural dystrophic lakes and ponds (H3160); and
    - CLo class: Permanent dystrophic lakes, ponds and pools.

However, it is noted that at ecological receptors ER12, ER13, ER14 and ER18 the PC to nutrient nitrogen deposition from the Site is less than 1% of the upper CLo at all habitat features and CLo classes.

The location of the maximum annual mean NOx PC is predicted to occur at the following locations within each considered ecological designation:

- ER12 (White Mere SSSI) NGR: 341770.5, 332773.5;
- ER13 (Clarepool Moss SSSI) NGR: 343122.7, 334222.7;
- ER14 (Cole Mere SSSI) NGR: 342908.9, 333306.4;
- ER16 (Midland Meres & Mosses - Phase 1 Ramsar) NGR: 341770.5, 332773.5
- ER17 (Midland Meres & Mosses - Phase 2 Ramsar) NGR: 342908.9, 333306.4; and
- ER18 (West Midlands Mosses (UK0013595) SAC) NGR: 343122.7, 334222.7.

Analysis of Google Earth aerial photography for the site illustrates that each location of maximum PC from the Site occurs on the periphery of each designation within an area characterised by tree planting / woodland.

As the considered habitat feature / CLo class in the location of the predicted exceedence relates to 'Bogs (*Erica Tetralix - Sphagnum Papillosum* Raised And Blanket Mire)'; and

'Bogs (*Sphagnum cuspidatum/recurvum* (fallax) bog pool community)'for receptor location ER13, 'Fen, marsh and swamp (*Juncus effusus / acutiflorus - Galium palustre* rush pasture)'; 'Fen, marsh and swamp (*Molinia caerula - Cirsium dissectum* fen-meadow)'; and 'Fen, marsh and swamp (*Phragmites australis* swamp and reed-beds)' for receptor location ER14, 'fen, marsh and swamp' for receptor locations ER16 and ER17, and 'natural dystrophic lakes and ponds (H3160)' for receptor location ER18; the stated habitat class CLo class does not apply at the location of maximum predicted PC.

At the location of receptors ER12 and ER14, the applied CLo class relates to 'Broadleaved deciduous woodland, specifically Broad-leaved, mixed and yew woodland of *Alnus glutinosa - Urtica dioica* woodland' (ER12), '*Alnus glutinosa - Carex paniculata* woodland (ER14). Analysis of the citation for White Mere SSSI (ER12)[22] states that:

> *"On the western side is an area of alder carr in which elongated sedge Carex elongata and bay willow Salix pentandra occur."*

Analysis of the citation for the Cole Mere SSSI (ER14)[23] states that

> *"Most of the surrounding woodland is of artificial origin but is included in the site since it is of value as a habitat for birds and adds to the diversity of the site. However, near the eastern end there is an area of semi-natural alder carr in which greater spearwort Ranunculus lingua and the rare elongated sedge Carex elongata occur."*

Analysis of the modelling outputs illustrates that a N Deposition of 0.1kg/ha/yr i.e. 1% of the lower CLo of the 'Broadleaved deciduous woodland' CLo class, relevant to the 'Broad-leaved, mixed and yew woodland (*Alnus glutinosa - Urtica dioica* woodland)' feature present in ER12, does <u>not</u> occur on the western portion of ER12 (White Mere SSSI).

Analysis of the modelling outputs illustrates that a N Deposition of 0.1kg/ha/yr i.e. 1% of the lower CLo of the 'Broad-leaved, mixed and yew woodland (*Alnus glutinosa - Carex paniculata* woodland)' feature present in ER14 occurs over only a small portion of the eastern end of ER14 (Cole Mere SSSI).

However, there are <u>no</u> exceedences of the upper CLo at any location on ER12 and ER14.

Furthermore, it is noted that the predicted N Deposition impacts against the relevant CLo class are based upon an assumption that all proposed biomass boilers will operate at full load, 24-hours per days, 365-days per year. In reality, it is understood that the biomass boilers for the site would each be operational for a <u>maximum</u> of 5,000 hours per year in order to provide the heat / power demand for the site. This 5,000 hours per year operation equates to an approximate 57.1% annual utilisation (i.e. 5,000 / 8760 * 100 = 57.1%). The EA *air emissions risk assessments* guidance states the following with regards to adjusting modelled results:

> *'Adjust your figures down, based on the percentage of the year that your site isn't operating. For example, a site that only operates January to June should reduce its PC figures by 50%. This only applies at annual average calculations and not short term assessments.'*

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[22] http://www.sssi.naturalengland.org.uk/citation/citation_photo/1001139.pdf - accessed June 2016.

[23] http://www.sssi.naturalengland.org.uk/citation/citation_photo/1003090.pdf- accessed June 2016

On this basis, should annual mean N deposition impacts be reduced by 42.9% to reflect the reduced heat / power demand for the site, analysis of the modelling outputs illustrates that a N Deposition of 0.1kg/ha/yr i.e. 1% of the lower CLo for the 'Broadleaved deciduous woodland' CLo class, does <u>not</u> occur at any location across the ER12 White Mere SSSI or ER14 Cole Mere SSSI designations. Therefore, it can be concluded that the emission will cause '*no damage*' to the SSSI designations in accordance with EA Operational Instruction 66_12.

At all other locations, the predicted PC to nutrient nitrogen deposition (Table 6-7) from the Site is less than 1% of both the lower and upper CLo at all European and SSSI ecological receptors, and less than 100% of both the lower and upper critical load at all LWS, LNR and AW ecological receptors. On the basis that the PC to N deposition is less than the 1% / 100% of the CLo threshold, it can be concluded that the emission will cause '*no significant pollution*' in accordance with EA Operational Instruction 66_12.

Furthermore, it is noted that the calculations presented within this assessment are based upon the application of a deposition velocity for 'woodland' (factor of 0.003), regardless of whether the location is relevant to woodland habitat. Should a 'grassland' deposition velocity be applied to the assessment (factor of 0.0015) PC to nutrient nitrogen deposition would <u>not be in excess</u> of 1% of any relevant habitat feature CLo class at any considered ecological designation.

<u>Critical Loads (Acidification) – Analysis</u>

The predicted PC to acid deposition (Table 6-8) from the Site is less than 1% of the CLo at all European and SSSI ecological receptors, and less than 100% of the CLo at all LWS, LNR and AW ecological receptors. On the basis that the PC to acidification is less than the 1% / 100% of the CLo threshold, it can be concluded that the emission will cause '*no significant pollution*' in accordance with EA Operational Instruction 66_12.

## 7.0 CONCLUSIONS

An air quality assessment has been undertaken relating to the proposed Wood Lane biomass boiler plant. The assessment involves quantification of the potential impact on air quality of the emissions from the proposed installation of 7 biomass boiler plant, through detailed atmospheric dispersion modelling.

Background air quality data obtained from the DEFRA mapping studies indicates that the annual average background concentrations of all modelled pollutants are well below AQOs / EALs in the vicinity of the site.

The impact at receptor locations resulting from the combustion emissions from the proposed boiler plant indicates that Process Contributions of annual mean $NO_2$ and $PM_{10}$ are greater than 1% of the AQO / EAL at a number of locations of relevant exposure, and therefore are not 'insignificant' in accordance with the stated *air emissions risk assessment* methodology. However, the Predicted Environmental Concentrations locations are below AQS objectives for all pollutants considered at all locations of relevant exposure. There are no predicted exceedences of any relevant EAL / AQO within the study area. Therefore, Predicted Environmental Concentrations are considered 'insignificant' against the *risk assessment for permits* methodology.

The results of the deposition assessment based upon the application of a worst-case 'woodland' deposition velocity, indicates that PCs are not in excess of 1% of the long-term / 10% of the short-term CLo for any relevant habitat class in any of the considered ecological receptors. Analysis of the predicted Critical Load (of nutrient nitrogen and acidification) and Critical Level impacts (of annual and 24-hour mean NOx) illustrates that emissions will cause '*no significant pollution*', do not have a '*likely significant effect*', or will '*be an operation likely to damage*' and, therefore, no further assessment is required.

It is understood that the biomass boilers for the site would each be operational for a maximum of 5,000 hours per year in order to provide the heat / power demand for the site. This 5,000 hours per year operation equates to an approximate 57.1% annual utilisation (i.e. 5,000 / 8760 * 100 = 57.1%). This modelling assessment has assumed a 24/7 365-day per year option, which would ultimately over-predict potential annual mean concentrations and impacts on air quality resulting from process emissions from the site. The EA *air emissions risk assessments* guidance states the following with regards to adjusting modelled results:

> *'Adjust your figures down, based on the percentage of the year that your site isn't operating. For example, a site that only operates January to June should reduce its PC figures by 50%. This only applies at annual average calculations and not short term assessments.'*

Therefore, the annual mean impacts on air quality associated with the operation of the site can be considered to be approximately 43% lower than those predicted and presented as part of this assessment. However, short-term (1-hour mean 99.79 percentile $NO_2$, maximum 24-hour mean NOx and 24-hour mean 90.41 percentile $PM_{10}$) modelled impacts remain relevant as these outputs could occur within the projected 5,000 hours typical operation.

As such, it is not considered that air quality a material constraint to the development proposals, which conform to the principles of National Planning Policy Framework and National Planning Practice Guidance, or the Shropshire Core Strategy.

## 8.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

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# Appendix AQ1 – Shawbury Meteorological Station 2009 – 2013 Individual Wind Roses

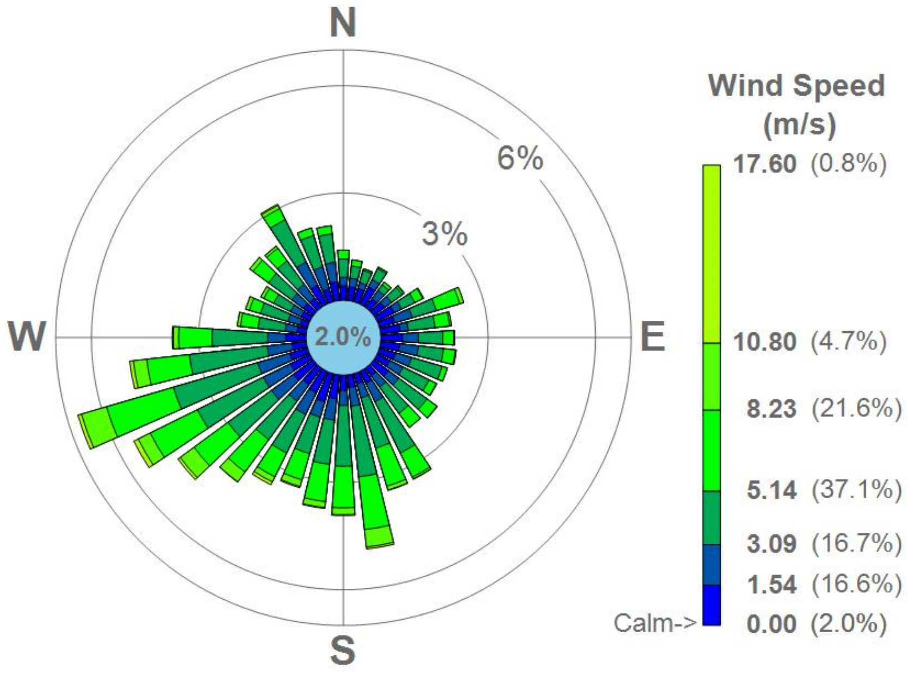


**Figure AQ1-1**
**Wind-rose for Shawbury Meteorological Station (2009)**

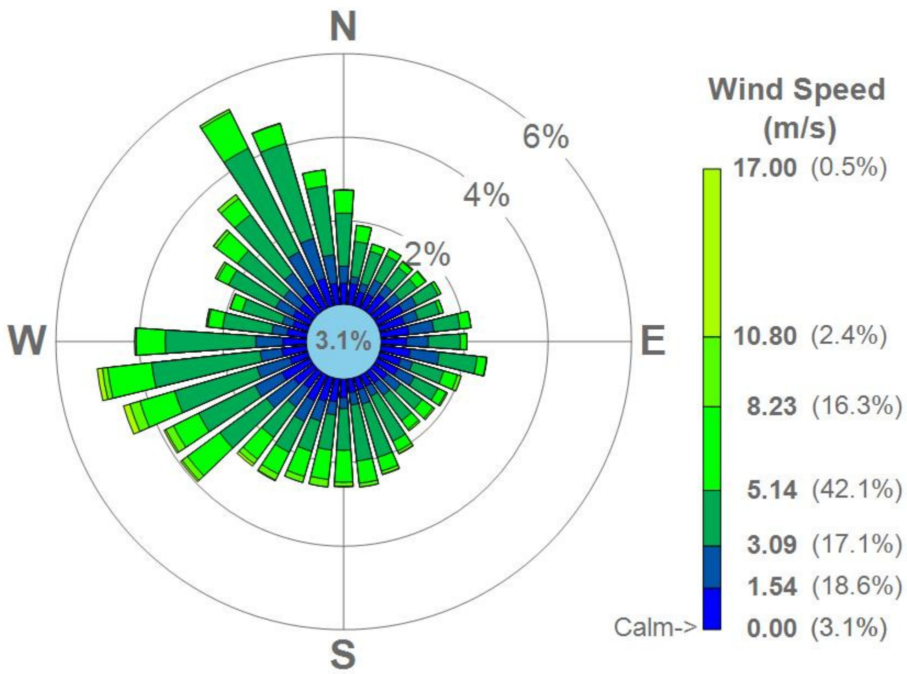


**Figure AQ1-2**
**Wind-rose for Shawbury Meteorological Station (2010)**

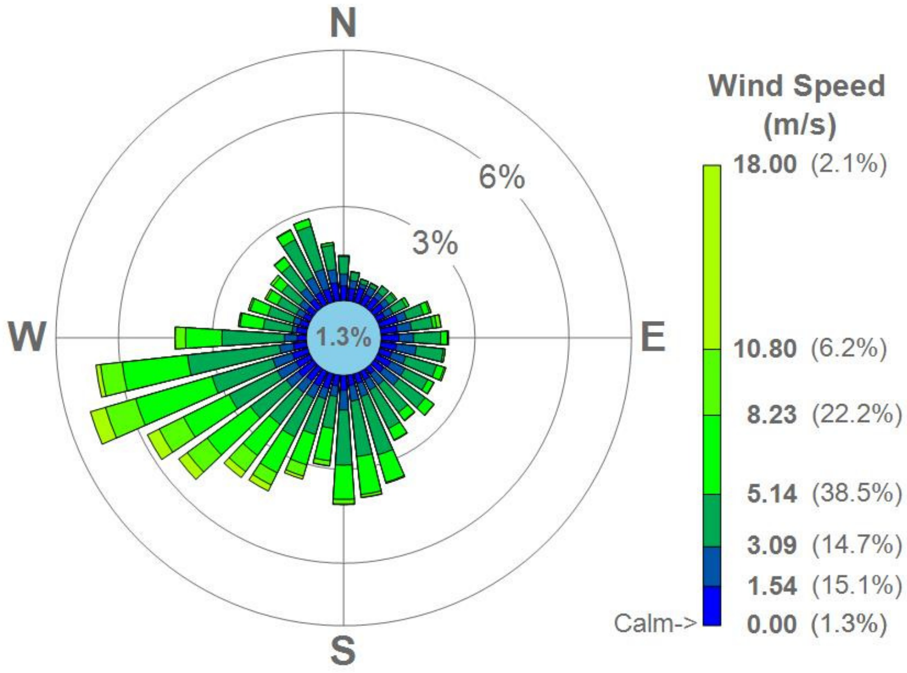


**Figure AQ1-3**
**Wind-rose for Shawbury Meteorological Station (2011)**

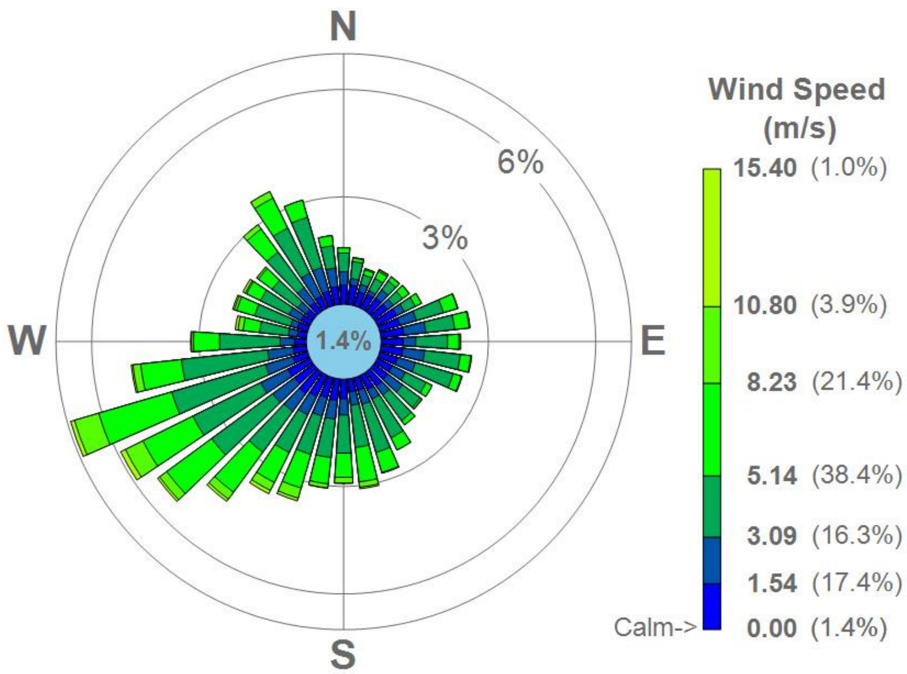


**Figure AQ1-4**
**Wind-rose for Shawbury Meteorological Station (2012)**

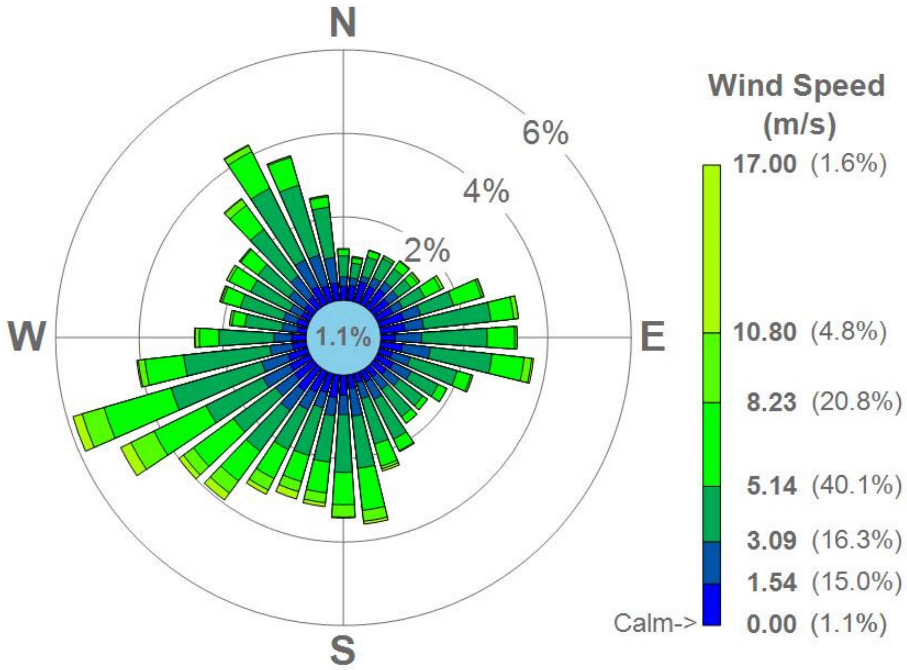


**Figure AQ1-5**
**Wind-rose for Shawbury Meteorological Station (2013)**

**Drawings**

**ABERDEEN**
214 Union Street,
Aberdeen AB10 1TL, UK
T: +44 (0)1224 517405

**AYLESBURY**
7 Wornal Park, Menmarsh Road,
Worminghall, Aylesbury,
Buckinghamshire HP18 9PH, UK
T: +44 (0)1844 337380

**BELFAST**
Suite 1 Potters Quay, 5 Ravenhill Road,
Belfast BT6 8DN, Northern Ireland
T: +44 (0)28 9073 2493

**BRADFORD ON AVON**
Treenwood House, Rowden Lane,
Bradford on Avon, Wiltshire BA15 2AU,
UK
T: +44 (0)1225 309400

**BRISTOL**
Langford Lodge, 109 Pembroke Road,
Clifton, Bristol BS8 3EU, UK
T: +44 (0)117 9064280

**CAMBRIDGE**
8 Stow Court, Stow-cum-Quy,
Cambridge CB25 9AS, UK
T: + 44 (0)1223 813805

**CARDIFF**
Fulmar House, Beignon Close,
Ocean Way, Cardiff CF24 5PB, UK
T: +44 (0)29 20491010

**CHELMSFORD**
Unit 77, Waterhouse Business Centre,
2 Cromar Way, Chelmsford, Essex
CM1 2QE, UK
T: +44 (0)1245 392170

**DUBLIN**
7 Dundrum Business Park,
Windy Arbour, Dublin 14 Ireland
T: + 353 (0)1 2964667

**EDINBURGH**
4/5 Lochside View, Edinburgh Park,
Edinburgh EH12 9DH, UK
T: +44 (0)131 3356830

**EXETER**
69 Polsloe Road, Exeter EX1 2NF, UK
T: + 44 (0)1392 490152

**GLASGOW**
4 Woodside Place, Charing Cross,
Glasgow G3 7QF, UK
T: +44 (0)141 3535037

**GRENOBLE**
BuroClub, 157/155 Cours Berriat,
38028 Grenoble Cedex 1, France
T: +33 (0)4 76 70 93 41

**GUILDFORD**
65 Woodbridge Road, Guildford
Surrey GU1 4RD, UK
T: +44 (0)1483 889 800

**LEEDS**
Suite 1, Jason House, Kerry Hill,
Horsforth, Leeds LS18 4JR, UK
T: +44 (0)113 2580650

**LONDON**
83 Victoria Street,
London, SW1H 0HW, UK
T: +44 (0)203 691 5810

**MAIDSTONE**
19 Hollingworth Court, Turkey Mill,
Maidstone, Kent ME14 5PP, UK
T: +44 (0)1622 609242

**MANCHESTER**
8th Floor, Quay West, MediaCityUK,
Trafford Wharf Road,
Manchester M17 1HH, UK
T: +44 (0)161 872 7564

**NEWCASTLE UPON TYNE**
Sailors Bethel, Horatio Street,
Newcastle upon Tyne NE1 2PE, UK
T: +44 (0)191 2611966

**NOTTINGHAM**
Aspect House, Aspect Business Park,
Bennerley Road, Nottingham NG6 8WR,
UK
T: +44 (0)115 9647280

**SHEFFIELD**
Unit 2 Newton Business Centre,
Thorncliffe Park Estate, Newton
Chambers Road, Chapeltown,
Sheffield S35 2PW, UK
T: +44 (0)114 2455153

**SHREWSBURY**
2nd Floor, Hermes House,
Oxon Business Park,
Shrewsbury, SY3 5HJ, UK
T: +44 (0)1743 239250

**STAFFORD**
8 Parker Court, Staffordshire Technology
Park, Beaconside, Stafford ST18 0WP,
UK
T: +44 (0)1785 241755

**STIRLING**
No. 68 Stirling Business Centre,
Wellgreen, Stirling FK8 2DZ, UK
T: +44 (0)1786 239900

**WORCESTER**
Suite 5, Brindley Court, Gresley Road,
Shire Business Park, Worcester
WR4 9FD, UKT: +44 (0)1905 751310

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