# AIR EMISSIONS RISK ASSESSMENT (AERA)

**Environmental Permit Variation – Telford**

Prepared for: **Muller UK & Ireland Group LLP**

Client Ref: 410. V62639.00001

SLR Ref: 410.V62639.00001
Version No: V4.0
January 2023

SLR

# BASIS OF REPORT

This document has been prepared by SLR Consulting Limited with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with Muller UK & Ireland Group LLP (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid.

The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in SLR unless the terms of appointment state otherwise.

This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.

# CONTENTS

**1.0 INTRODUCTION......1**

1.1 Scope and Objective......1

**2.0 POLICY, LEGISLATION AND RELEVANT GUIDANCE......2**

2.1 Environmental Permitting Regulations......2

2.2 National Legislation and Guidance......2

2.3 Assessment Guidance Documents......4

**3.0 ASSESSMENT METHODOLOGY......5**

3.1 Modelled Scenarios......5

3.2 Quantification of Emissions......6

3.3 Model Setup......6

3.4 Assessment of Impacts on Air Quality......10

3.5 Assessment of Impacts on Vegetation and Ecosystems......10

**4.0 BASELINE ENVIRONMENT......13**

4.1 Site Setting and Sensitive Receptors......13

4.2 Ambient Air Quality......16

4.3 Baseline Conditions at Ecological Receptors......17

**5.0 ASSESSMENT RESULTS......19**

5.1 $NO_2$ Impacts – Human Receptors......19

5.2 Impacts on Ecological Receptors......21

**6.0 SUMMARY AND CONCLUSIONS......23**

## APPENDICIES

Appendix A: Model Checklist

Appendix B: Isopleth Plot Files

Appendix C: AERMOD Model Files (electronic)

# DOCUMENT REFERENCES

## TABLES

Table 2-1 Applied AQALs ..... 2
Table 2-2 Relevant Public Exposure ..... 3
Table 3-1 Modelled Pollutants ..... 5
Table 3-2 Emission Parameters ..... 6
Table 3-3 Applied Surface Characteristics ..... 8
Table 3-4 Model Outputs ..... 10
Table 3-5 Relevant Critical Levels for the Protection of Vegetation and Ecosystems ..... 10
Table 3-6 Applied Deposition Velocities ..... 11
Table 4-1 Modelled Discrete Human Receptor Locations ..... 13
Table 4-2 Designated Ecological Sites ..... 15
Table 4-3 Passive $NO_2$ Diffusion Tube Monitoring ..... 16
Table 4-4 Defra 2019 Annual Mean Background Concentrations $NO_2$ ($\mu g/m^3$) ..... 16
Table 4-5 Baseline Concentrations – Ecological Receptors ..... 17
Table 4-6 Nitrogen Critical Loads and Current Loads ..... 17
Table 4-7 Acid Critical Load Functions and Current Loads ..... 18
Table 5-1 Predicted $NO_2$ Annual Mean Impacts ..... 19
Table 5-2 Predicted $NO_2$ 1-hr Mean (99.79%ile) Impacts ..... 20
Table 5-3 Impact on Long Term Critical Levels ..... 21
Table 5-4 Impact on Short Term Critical Levels ..... 21
Table 5-5 Impact on Nitrogen Critical Load ..... 22
Table 5-6 Impact on Acid Critical Load ..... 22

## FIGURES

Figure 3-1 Modelled Buildings and Structures ..... 7
Figure 3-2 Surrounding Topography ..... 8
Figure 3-3 Shawbury Windrose (2016-2020) ..... 9
Figure 4-1 Modelled Human Receptor Locations and Diffusion Tube Monitoring (DTs) ..... 14
Figure 4-2 Ecological Sites ..... 15
Figure A-1 1-hour Mean (99.79%ile) Nitrogen Dioxide Process Contribution ..... 26
Figure A-2 Annual Mean Nitrogen Dioxide Process Contribution ..... 27

# 1.0 INTRODUCTION

SLR Consulting Ltd has been commissioned by Muller UK & Ireland Group LLP (Müller) to undertake an Air Emission Risk Assessment (AERA) as part of an Air Quality Assessment to support the permit variation for a Combined Heat and Power (CHP) Plant and Boiler on land at the existing Müller facility in Telford, Shropshire (the Site).

This report presents the AERA undertaken to support the EP variation.

## 1.1 Scope and Objective

The Site currently operates under an EP in accordance with the Environmental Permitting (England and Wales) Regulations (EPR) 2016 (as amended) permit reference EPR/SP3200SY. The proposed changes of direct relevance to this assessment concern the incorporation of the below sources into a single EP:

- Point A1 - 1.5MWe natural gas fired combined heat and power plant (CHP) will comprise of a generator with heat recovery; and
- Point A2 - 3.9MWth natural gas boiler.

The supporting statement to the EP variation should be referred to for a comprehensive background and description of the installation, this report is concerned with emissions to air only.

The objective of the study is to consider the impact of regulated pollutants from changes to emissions to air. Principally, these are limited to emission of Nitrogen Oxide ($NO_x$) emissions, relating to Point A1 and A2, assessed against the relevant Air Quality Standards for nitrogen dioxide ($NO_2$) for the protection of human health and the relevant Critical Levels ($C_{Le}$) (for $NO_x$) and Critical Loads ($C_{Lo}$) (for N and acid deposition) for the protection of designated ecological receptors.

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

# 2.0 POLICY, LEGISLATION AND RELEVANT GUIDANCE

## 2.1 Environmental Permitting Regulations

The CHP and Boiler will be regulated under the Environmental Permitting (England and Wales) Amendment Regulations 2018 (EPR 2018) which implements European Union Directive 2015/2193/EU (the Medium Combustion Plant Directive, MCPD) under Schedule 25A. The EP Regulations include requirements on operating conditions, monitoring and ELVs that would be incorporated into the site's Permit and would be enforceable by the Environment Agency (EA).

Various guidance documents are provided by the EA with respect the operation and assessment of impacts from facilities regulated under EP Regulation. Key to air quality assessments is the 'Air Emissions Risk Assessment for your Environmental Permit' (AERA) guidance.

## 2.2 National Legislation and Guidance

### 2.2.1 Air Quality Regulations

The Air Quality Standards Regulations 2010 (the Regulations) include Limit Values, Target Values, Objectives, Critical Levels and Exposure Reduction Targets for the protection of human health and the environment (collectively termed Air Quality Assessment Levels (AQALs) throughout this report). The standards applied in this assessment are provided in Table 2-1.

**Table 2-1**
**Applied AQALs**

| Pollutant | Standard (µg/m$^3$) | Measured as | |
|---|---|---|---|
| Nitrogen dioxide ($NO_2$) | 40 | Annual mean | - |
| | 200 | 1 hour mean | Not to be exceeded more than 18 times per year |
| Nitrogen oxides* ($NO_x$) | 30 | Annual mean | - |
| Table note:<br>*$C_{Le}$ for protection of vegetation. | | | |

Defra has published Technical Guidance (TG) for use in Local Air Quality Management (LAQM)[1]. According to LAQM.TG(22) air quality standards should only apply to locations where *'members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. Authorities should not consider exceedances of the objectives at any location where relevant public exposure would not be realistic'*.

This is emphasised in the EA modelling guidance which states that the 1-hour mean should apply (but may not be limited to) '*residential properties, schools, hospitals, care homes, hotels, gardens, busy shopping streets, bus stations and railway stations that are not fully enclosed, and car parks where the public are reasonably expected to spend an hour or more'*. Longer term standards such as annual means, should apply at houses or other locations where the public can be expected to occupy on a continuous basis. These standards do not apply to exposure at the workplace.

[1] Defra, Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(22), 2022.

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

| Averaging Period | Relevant Locations | AQAL's should apply at: | AQAL's don't 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 |
| 1-hour mean | Where individuals might reasonably be expected to spend one hour or longer | As above together with locations of regular access, car parks, bus stations etc. | Locations not publicly accessible or where occupation is not regular |

### 2.2.2 Air Quality Strategy

The United Kingdom Air Quality Strategy (AQS) 2007 for England, Scotland, Wales and Northern Ireland[2] 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 the Government, industry, the Environment Agency, local government, business, and individuals have in protecting and improving air quality. The AQS contains air quality objectives based on the protection of both human health and vegetation (ecosystems). Those relevant to this assessment are presented within Table 2-1.

### 2.2.3 Local Air Quality Management

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 AQALs prescribed in the Regulations are being achieved or are likely to be achieved in the future.

Where any of the prescribed AQALs are not likely to be achieved the authority concerned must designate an Air Quality Management Area (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 AQAL. As such, Local Authorities (LAs), have formal powers to control air quality through a combination of LAQM and by use of their wider planning policies.

Defra's technical guidance LAQM.TG(22), has been used where appropriate in the assessment presented here.

### 2.2.4 Protection of Nature Conservation Sites

Environmental Quality Standards exist for nature conservation sites known as 'Critical Levels' ($C_{Le}$'s) for airborne concentrations and 'Critical Loads' ($C_{Lo}$'s) for deposition of nitrogen or acid forming compounds.

$C_{Le}$'s values are not habitat specific, but have been set to cover broad vegetation types (e.g. forest arable, semi-natural), often with critical values set for sensitive lichens and bryophytes..

$C_{Lo}$'s 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. $C_{Lo}$'s are set for the deposition of various substances to sensitive ecosystems. $C_{Lo}$'s are site specific, being a function of soil chemistry. In relation to combustion emissions, $C_{Lo}$'s for eutrophication and acidification are relevant, which can occur via both wet and dry deposition. $C_{Le}$'s and $C_{Lo}$'s are further discussed in Section 3.4.

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

## 2.3 Assessment Guidance Documents

The key guidance documents consulted in undertaking this air quality assessment are described below.

### 2.3.1 Environment Agency AERA Guidance

The MCPD AERA guidance produced by the EA[3] is intended to assist operators in assessing risks to air when applying for a permit under the EP Regulations. This is part of the 'Risk assessments for specific activities: environmental permits' collection. The EA also provides specific guidance for assessing impacts on ecological sites known as AQTAG.06[4].

### 2.3.2 Defra Local Air Quality Management Technical Guidance

Defra LAQM.TG(22) was published for use by LAs in their LAQM review and assessment work. The document provides key guidance in aspects of air quality assessment, including screening, use of monitoring data, and use of background data that are applicable to all air quality assessments.

[3] https://www.gov.uk/guidance/medium-combustion-plant-apply-for-an-environmental-permit, accessed August 2022

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

# 3.0 ASSESSMENT METHODOLOGY

A detailed atmospheric dispersion modelling assessment has been undertaken to quantify process contribution (PC) from the CHP and Boiler and assess the impact of emissions in comparison against relevant AQALs, and Critical Levels and Critical Loads.

## 3.1 Modelled Scenarios

The AERA has considered a single modelling scenario considering the operation of the following sources operating at 100% load capacity, continuously for 8760 hours per year, fuelled by Natural Gas:

- A1 - CHP exhaust stack
- A2 – Boiler exhaust stack

Pollutants considered for the above modelled sources are detailed in Table 3-1.

**Table 3-1**
**Modelled Pollutants**

| Pollutant | Modelled As | |
|---|---|---|
| | Short-term | Long-term |
| $NO_2$ | 99.79 percentile of 1-hour means | Annual mean |
| NOx | 24-hour mean (1st high) | Annual mean |

## 3.2 Quantification of Emissions

The emission parameters applied in the modelling are provided in Table 3-2 below. The CHP emission parameters have been input based on manufacturer's design and specifications. The emission concentrations are compliant with the MCPD.

**Table 3-2**
**Emission Parameters**

| Parameter / Source | CHP (A1) | Boiler (A2) |
|---|---|---|
| Fuel | Natural gas | Natural gas |
| Size | 1.5 MWe | 3.9 MWth |
| Stack Location (NGR x,y) | 371169, 312175 | 371170, 312168 |
| Stack Height (m) | 23 | 13 |
| Stack diameter (m) | 0.50 | 0.40 |
| Velocity (m/s) | 14.30 | 17.75 |
| Actual Flow Rate ($Am^3/s$) (wet, at stack conditions) | 2.81 | 2.23 |
| Emission temperature (C) | 170.0 | 128.0 |
| Oxygen Content (% O2 dry gas) | 10.5 | 3.3 |
| Moisture content (% H2O) | 8.90 | 10.0 |
| Standardised Volume Flow ($Nm^3/s$) | 2.86^(A)^ | 1.31^(B)^ |
| $NO_x$ Emission Concentration ($mg/m^3$) | 95^(A)^ | 100^(B)^ |
| NOx emission g/s | 0.27 | 0.13 |

Table Note:
(A) Normalised to 273 K, dry, 101.3 kPa, 15% $O_2$
(B) Normalised to 273 K, dry, 101.3 kPa, 3% $O_2$

## 3.3 Model Setup

For this assessment the AERMOD model has been applied; this model is widely used and accepted by the EA for undertaking such assessments and is considered a suitable model for this type of assessment.

### 3.3.1 Model Domain / Receptors

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

A nested receptor grid extending 2.5km from the site was applied as follows:

- 200m from site at 20m grid resolution;
- 500m from site at 50m grid resolution;
- 1000m from site at 100m grid resolution; and
- 2500m from site at 200m grid resolution.

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

### 3.3.2 Building Downwash

Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. Building downwash has been considered for buildings that have a maximum height equivalent to at least 40% of the emission height and which are within a distance defined as five times the lesser of the height or maximum projected width of the building.

The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Structures input to the model are represented in Figure 3-1.

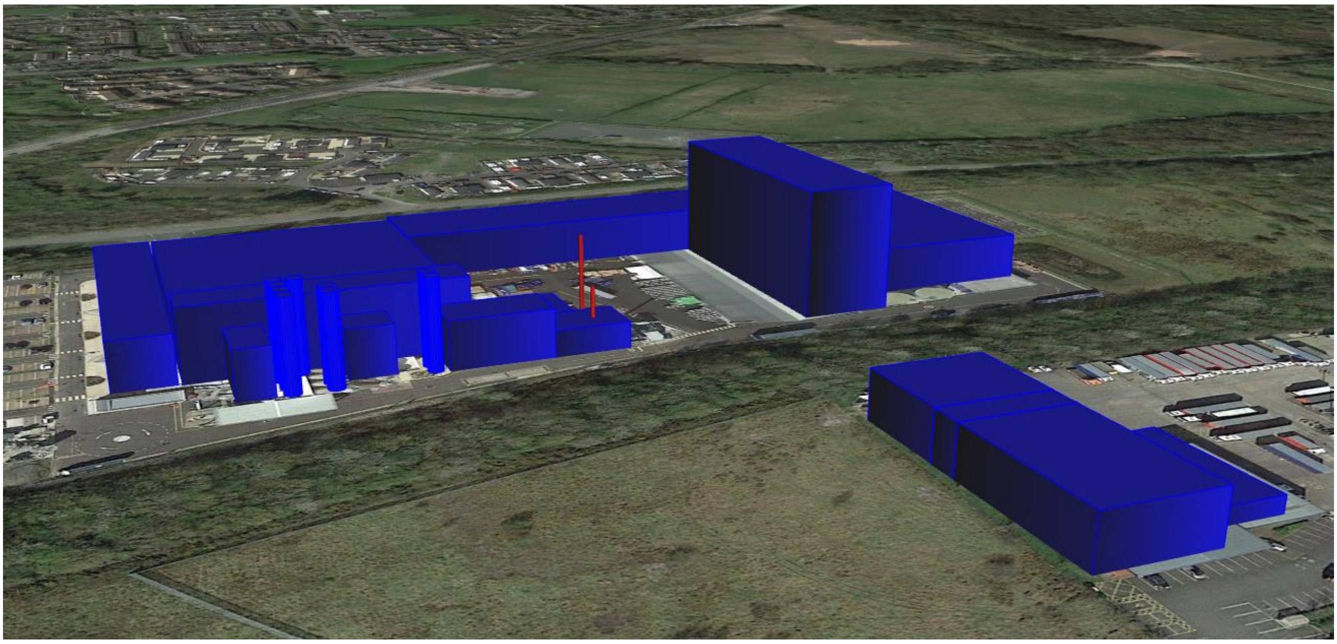

**Figure 3-1**
**Modelled Buildings and Structures**

### 3.3.3 Topography

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

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

The application site lies in a flat area at approximately 112m above ordnance datum (AOD). The land descends gently to the north and east to approximately 60mAOD within approximately 2.5km. Topography has been incorporated into the model and is illustrated in Figure 3-2.

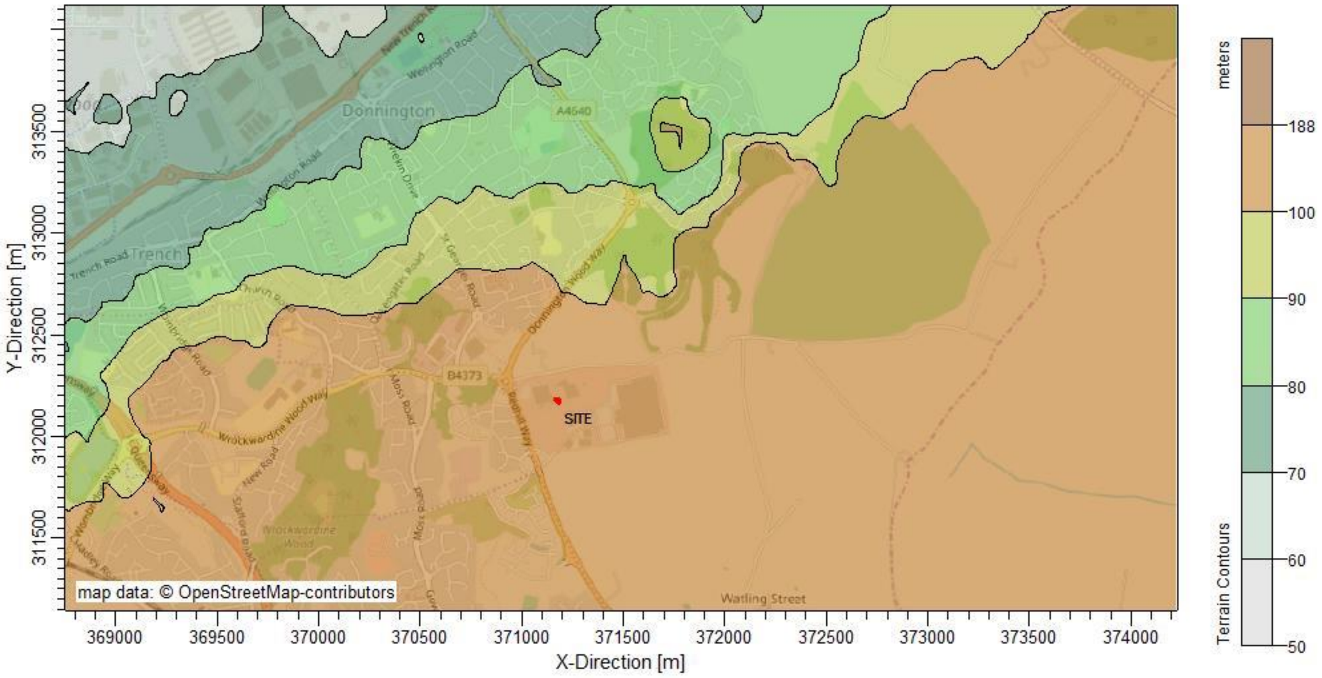


**Figure 3-2**
**Surrounding Topography**

### 3.3.4 Meteorological Data and Preparation

The meteorological data provider was consulted for the closest and most representative dataset appropriate to the study area recording all the parameters necessary for dispersion modelling. The closest observation site is Shawbury Airport approximately 19km north-west. A windrose, showing the frequency of wind speed and direction, used in the assessment is provided in Figure 3-3. The windrose shows winds from the southwest are most frequent.

The meteorological data (2016-2020) was obtained in .met format from the data supplier and converted to the required surface and profile formats for use in AERMOD using AERMET View meteorological pre-processor. Details specific to the site location were used to define surface roughness, albedo and bowen ratio in the conversion (see Table 3-3).

**Table 3-3**
**Applied Surface Characteristics**

| Zone (Start) | Zone (end) | Albedo | Bowen Ratio | Surface Roughness (m) |
|---|---|---|---|---|
| 0 | 110 | 0.28 | 0.75 | 0.114 |
| 110 | 160 | | | 0.073 |
| 160 | 315 | | | 0.071 |
| 315 | 0 | | | 0.075 |

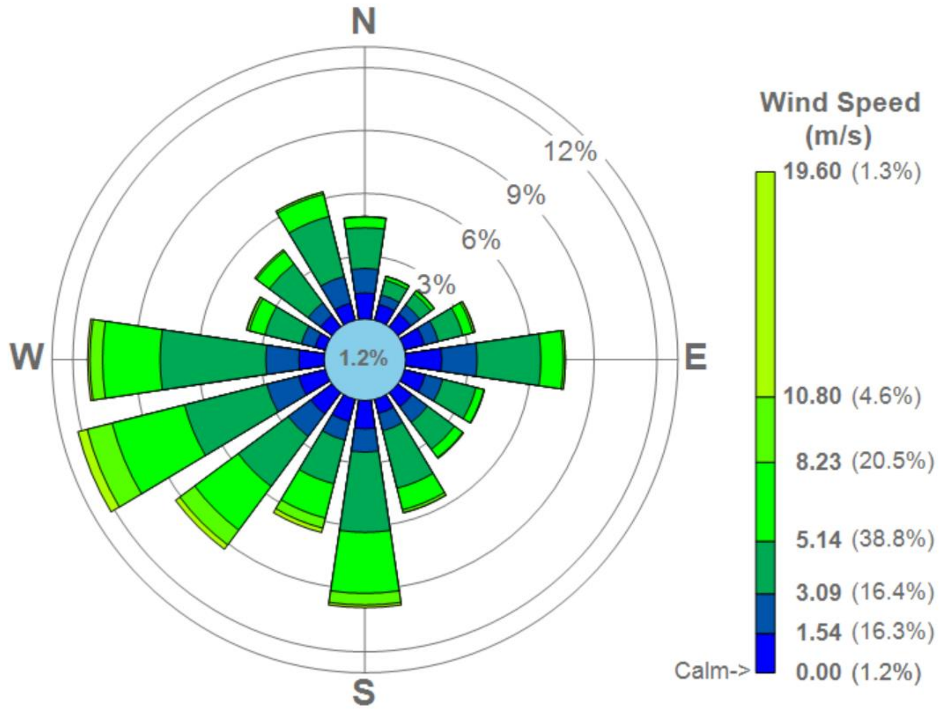


**Figure 3-3**
**Shawbury Windrose (2016-2020)**

### 3.3.5 Dispersion Coefficients

The 'rural' option for dispersion coefficients was selected in accordance with AERMOD guidance[5].

### 3.3.6 Dispersion Model Uncertainty

Model validation studies[6] for AERMOD generally suggest that these dispersion models are for the vast majority of cases able to predict maximum short term high percentiles concentrations well within a factor of two and the latest evaluation studies for AERMOD show the composite (geometric mean) ratio of predicted to observed short-term averages from 'test sites' (where real-time monitoring data is available to validate model performance), to be between 0.96 and 1.2.

[5] EPA, AERMOD Implementation Workgroup, Aermod Implementation Guide (August 3, 2015).
[6] US EPA, AERMOD: Latest Features and Evaluation Results, EPA-454/R-03-003, June 2003

## 3.4 Assessment of Impacts on Air Quality

### 3.4.1 Treatment of Model Output

With respect to $NO_x$ emissions, the EA Air Quality Modelling and Assessment Unit (AQMAU) guidance[7] on conversion ratio for $NO_x$ and $NO_2$ has been followed, i.e. a worst-case scenario has been applied in that 70% of $NO_x$ is present as $NO_2$ in relation to long-term impacts and 35% of $NO_x$ is present as $NO_2$ in relation to short-term impacts as described in Table 3-4 below.

**Table 3-4**
**Model Outputs**

| Averaging Period | Model Output – Process Contribution (PC) | Predicted Environmental Concentration (PEC) |
|---|---|---|
| 1 hour mean. Not to be exceeded more than 18 times a calendar year | 99.79%ile of 1-hour means for $NO_2$ | PC + 2 x annual mean background |
| $NO_x$ 24-hour maximum | Maximum 24-hour mean | PC + 2 x annual mean background |
| Calendar year | Annual mean from 5 met. years | PC + annual mean background |

### 3.4.2 Assessment of Impact and Significance

To assess the potential impact on air quality, the predicted exposure is compared to the standards and the results of the dispersion modelling have been presented in the form of tabulated concentrations at discrete receptor locations.

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

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

For PCs that cannot be considered insignificant further assessment has been undertaken against the Predicted Environmental Concentration (PEC).

## 3.5 Assessment of Impacts on Vegetation and Ecosystems

### 3.5.1 Calculation of Contribution to Critical Levels

Modelled PCs have been directly assessed as a percentage of the relevant $C_{Le}$'s relevant to this assessment, which are set out in Table 3-6 and Table 3-7.

**Table 3-5**
**Relevant Critical Levels for the Protection of Vegetation and Ecosystems**

| Pollutant | Critical Level (µg/m³) | Habitat and Averaging Period | Reference |
|---|---|---|---|
| NOx | 30 | Annual mean (all ecosystems) | AQSR |
| | 75 | Daily mean (all ecosystems) | AERA |

[7] Environment Agency, Air Quality Modelling and Assessment Unit, 'Conversion Ratios for NOx and $NO_2$' (no date)

### 3.5.2 Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA AQTAG06[8]. Dry deposition flux was calculated using the following equation:

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

Wet deposition occurs via the incorporation of the pollutant into water droplets which are then removed in rain or snow and is not considered significant over short distances[8] compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered. The applied deposition velocities are as shown in Table 3-6.

**Table 3-6**
**Applied Deposition Velocities**

| Chemical Species | Recommended deposition velocity (m/s) | |
|---|---|---|
| $NO_2$ | Grassland | 0.0015 |
| | Woodland | 0.0030 |

#### Critical Loads – Eutrophication

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

#### Critical Loads - Acidification

The predicted deposition rates are converted to units of equivalents (keq/ha/year), which is a measure of how acidifying the chemical species can be, by multiplying the dry deposition flux ($\mu g/m^2/s$) by standard conversion factor of 6.84.

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

The calculation of the process contribution of N to the acid 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*

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

*PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100'*[9]

### 3.5.3 Significance of Effect on Ecological Receptors

In addition to the AERA guidance, the EA's Operational Instruction 66_12[10] details how the air quality impacts on ecological sites should be assessed. This guidance provides risk-based screening criteria to determine whether impacts will have 'no likely significant effects (alone and in-combination)' for European sites, or 'no likely damage' for SSSI's, or no 'significant pollution' at a Local site. If the screening criteria are exceeded the dispersion modelling assessment is required. The criteria are as follows:

- PC does not exceed 1% long-term $C_{Le}$ and/or $C_{Lo}$ or that the PEC does not exceed 70% long-term $C_{Le}$ and/or $C_{Lo}$ for European sites and SSSIs;
- PC does not exceed 10% short-term $C_{Le}$ for NOx for European sites and SSSIs;
- PC does not exceed 100% long-term $C_{Le}$ and/or $C_{Lo}$ other conservation sites; and
- PC does not exceed 100% short-term $C_{Le}$ for NOx (if applicable) for other conservation sites.

Where impacts cannot be classified as resulting in 'no likely significant effect', more detailed assessment may be required depending on the sensitivity of the feature in accordance with EAs 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).

The guidance provides the following further criteria:

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

[9] S is excluded from consideration in this assessment given the CHP is fired on natural gas, in accordance with EA guidance.
[10] EA Working Instruction 66_12 - Simple assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation.

# 4.0 BASELINE ENVIRONMENT

## 4.1 Site Setting and Sensitive Receptors

The Site is located at the existing Muller dairy manufacturing facility, Donnington Wood Business Park, Granville Road, Telford, TF2 7QJ (NGR: x371168 y:312142). The Site is on the eastern edge of the Donnington area of Telford. To the north and west lie existing residential areas, whilst to the southeast and south lie commercial properties (offices and distribution centre). The closest residential properties are 190m north and 200m west. There are no AQMAs within a 10km distance. There are protected ecological sites within 2km which are detailed in the sections below.

### 4.1.1 Human Receptors

According to LAQM.TG(22), air quality standards should only apply to locations where members of the public may be reasonably likely to be exposed to air pollution for the duration of the relevant limit value. As such fourteen locations surrounding the application site have been selected to inform the risk assessment in terms of relevant annual mean exposure (shown in Figure 4-1 as R1 to R14). Further, the dispersion modelling has been completed using a receptor grid to allow potential short-term exposure to be assessed at all locations surrounding the application site.

**Table 4-1**
**Modelled Discrete Human Receptor Locations**

| Reference | Description |
|---|---|
| R1 | Residential |
| R2 | Residential |
| R3 | Residential |
| R4 | Residential |
| R5 | Residential |
| R6 | Residential |
| R7 | Residential |
| R8 | Residential |
| R9 | Residential |
| R10 | Residential |
| R11 | Residential |
| R12 | Residential |
| R13 | Residential |
| R14 | Residential |

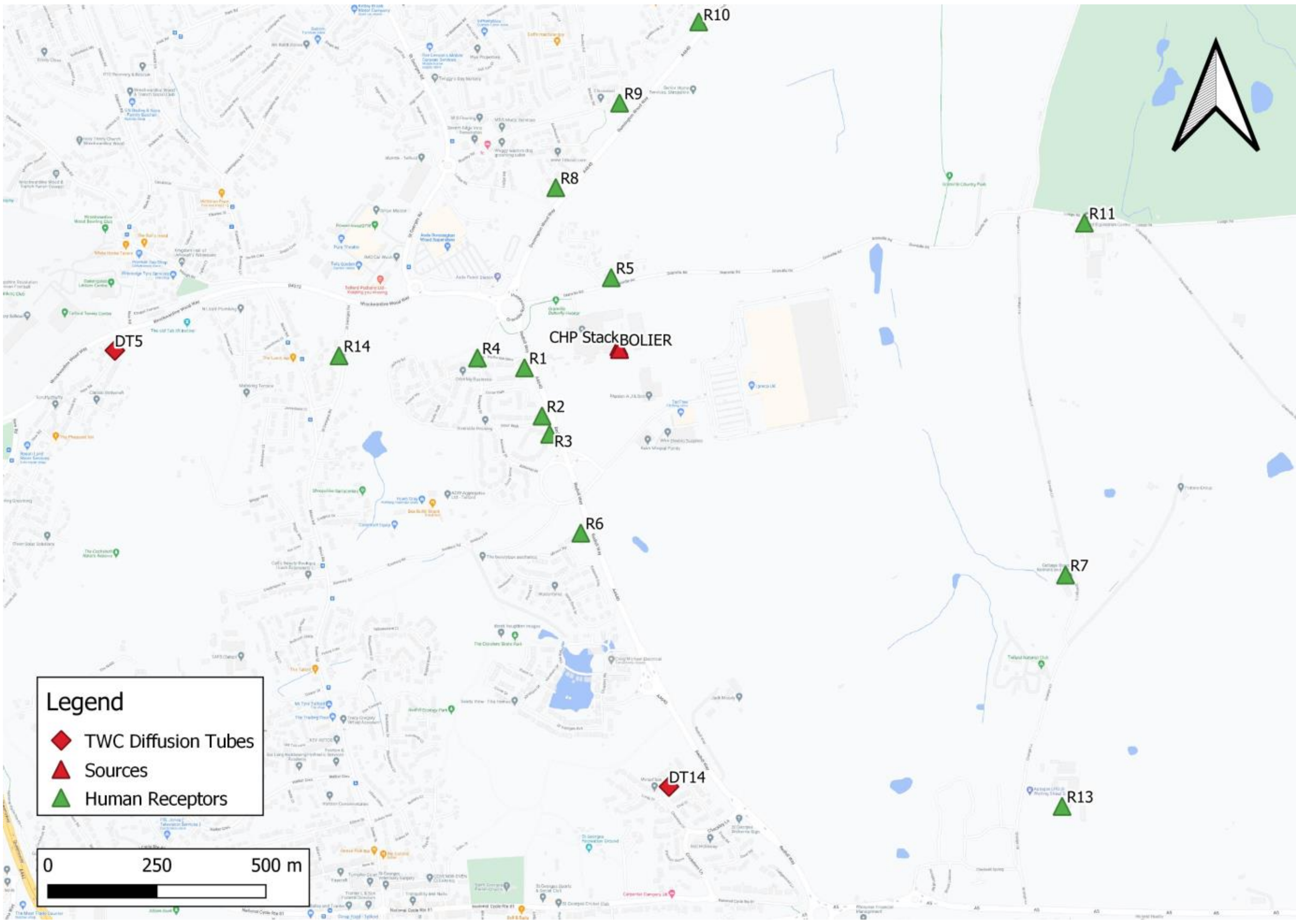


**Figure 4-1**
**Modelled Human Receptor Locations and Diffusion Tube Monitoring (DTs)**

### 4.1.2 Ecological Receptors

The AERA Guidance requires that designated ecological sites should be screened against relevant standards if they are located within the following set distances from the facility:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites within 10km of the installation; and
- Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNR), Local Nature Reserves (LNR), Local Wildlife Sites (LWS) and Ancient Woodland (AW) within 2km of the installation.

Details of the sites within these screening distances are presented in Table 4 2 and locations in Figure 4-2.

**Table 4-2**
**Designated Ecological Sites**

| Ref | Site | Designation | Most Sensitive Interest Feature |
|---|---|---|---|
| ER1 | Wrockwardine Wood | LWS | Woodland, scrub and rough grassland. |
| ER2 | Donnington Freehold and NE Telford | LWS | Grassland, marsh, scrub and spoil heaps. |
| ER3 | Granville Country Park | LNR and LWS | Grassland, marsh, scrub and spoil heaps. A Shropshire Wildlife Trust Reserve which includes a large portion of Muxton Marsh SSSI. |
| ER4 | Central Hall | LWS | Regenerating wet areas, scrub and grassy banks. |
| ER5 | Muxton Marsh | SSSI | Neutral grassland (Cynosurus cristatus - Caltha palustris grassland- Centaurea nigra grassland) |
| ER6 | Midlands Meres and Mosses Phase 2 | Ramsar | Based on Underlying SSSI Aqualate Mere. Broad-leaved, mixed and yew woodland (Alnus glutinosa - Urtica dioica woodland) Fen, marsh and swamp (Juncus effusus / acutiflorus - Galium palustre rush pasture) |

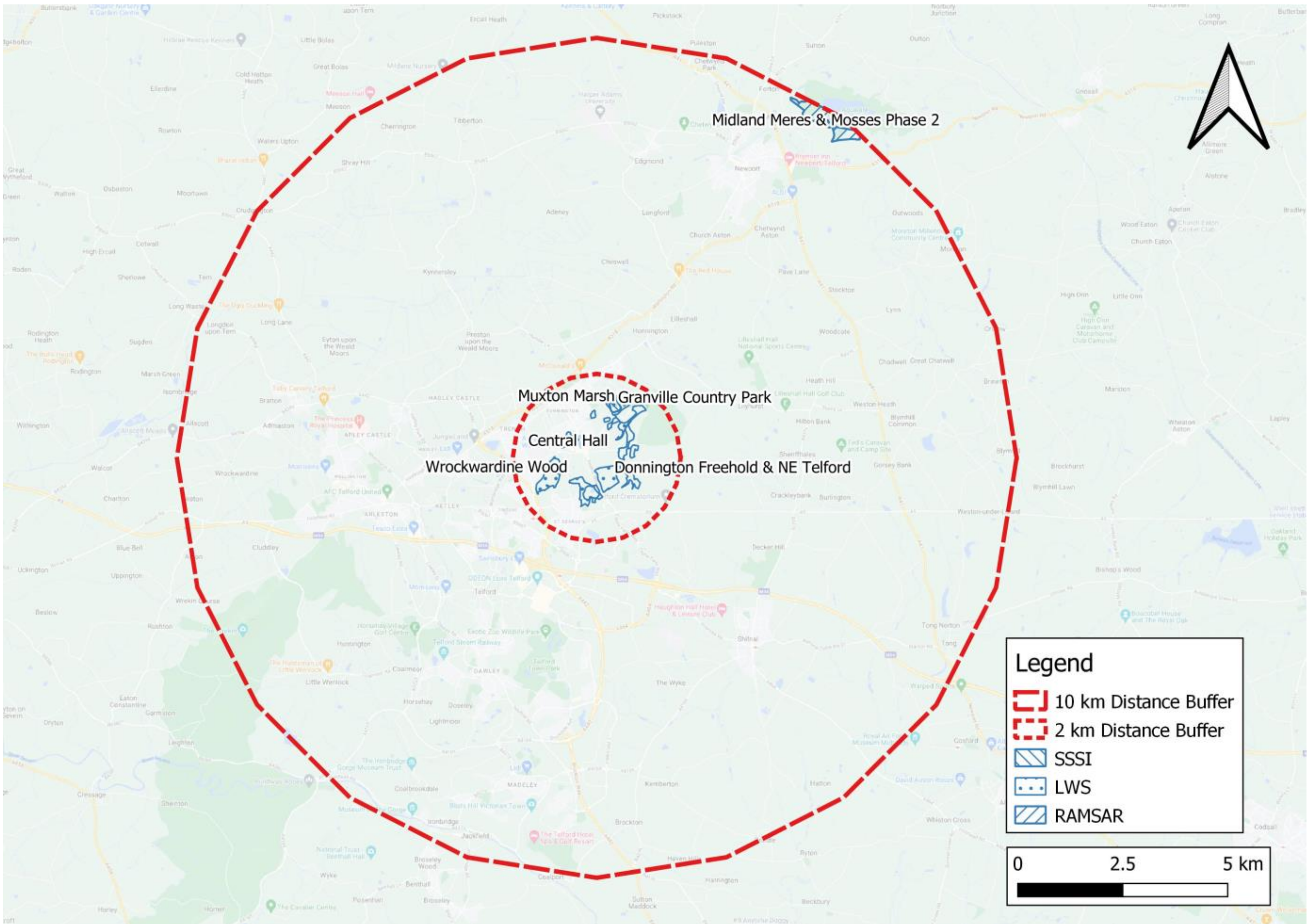


**Figure 4-2**
**Ecological Sites**

## 4.2 Ambient Air Quality

### 4.2.1 Local Air Quality Management

The application site lies within the administrative area of TWC. TWC have not designated any AQMAs. The monitoring TWC undertake is described below.

### 4.2.2 Monitoring Data

National networks and TWC monitoring have been reviewed for relevant data to inform the baseline assessment. TWC undertake monitoring using passive diffusion tubes (no automated monitors are operated). The closest NO2 monitoring locations are shown in Figure 4 1and recent results taken from the most recent published LAQM report are presented in Table 4-3.

**Table 4-3**
**Passive $NO_2$ Diffusion Tube Monitoring**

| Site | Type | Distance from kerb (m) | 2015 Annual Mean (µg/m³) | 2016 Annual Mean (µg/m³) | 2017 Annual Mean (µg/m³) | 2019 Annual Mean (µg/m³) |
|---|---|---|---|---|---|---|
| DT3 | Urban Background | 1.60 | 13.9 | 17.1 | No data | No data |
| DT4 | Urban Background | 1.34 | 16.6 | 15.1 | 17.0 | 16.5 |
| DT5 | Urban Background | 0.10 | 17.9 | 16.0 | 17.5 | 13.9 |
| DT14 | Urban Background | 1.00 | 21.5 | 21.6 | 22.1 | 18.9 |

### 4.2.3 Defra Modelled Background Concentrations

Background pollutant concentration data on a 1km x 1km spatial resolution is provided by Defra through the UK AIR website and is routinely used to support LAQM and Air Quality Assessments. Background pollutant concentrations for $NO_2$ are based upon a 2018 base year and projected to future years[11] (2019 is presented below).

The background concentrations for the grid squares containing the site and nearby receptors are shown in Table 4-4.

**Table 4-4**
**Defra 2019 Annual Mean Background Concentrations $NO_2$ (µg/m³)**

| X/Y (NGR) | X:370500 | X:371500 | X:372500 |
|---|---|---|---|
| Y:313500 | 13.05 | 9.44 | 7.34 |
| Y:312500 | 9.90 | 8.73* | 7.26 |
| Y:311500 | 9.13 | 8.53 | 8.84 |

Table note: * application site

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

### 4.2.4 Application of Baseline Data in the Assessment

On the basis of the baseline air quality review the highest measured annual mean at DT14 has been applied in the assessment as a precautionary approach (i.e. an $NO_2$ annual mean concentration of 22.1µg/m$^3$).

## 4.3 Baseline Conditions at Ecological Receptors

The APIS website[12], a support tool for assessment of potential effects of air pollutants on habitats and species developed in partnership by the UK conservation and regulatory agencies and the Centre for Ecology and Hydrology, has been used to provide information on baseline conditions at the considered ecological receptors (2018-2020 - 3-year average).

The existing concentration at the ecological designation are presented within Table 4-5 based upon the area of impact from the Site (i.e. the 5km$^2$ grid containing and centred on the closest area of designation) presented on APIS. In addition Critical Loads and current deposition rates for nutrient nitrogen and for acidity are presented in Table 4-6 and Table 4-7, respectively.

**Table 4-5**
**Baseline Concentrations – Ecological Receptors**

| Ref. | APIS Critical Load Class (most sensitive) | NOx Annual Mean (µg/m$^3$) | 24-hour Mean NOx (µg/m$^3$) (Calculated based upon 2x the annual mean concentration) |
|---|---|---|---|
| ER1 (LWS) | Broadleaved deciduous woodland | 14.0 | 28 |
| ER2 (LWS) | Low and medium altitude hay meadows | 16.5 | 33 |
| ER3 (LWS) | Broadleaved deciduous woodland | 15.7 | 31.4 |
| ER4 (LWS) | Low and medium altitude hay meadows | 15.7 | 31.4 |
| ER5 (SSSI) | Low and medium altitude hay meadows | 15.7 | 31.4 |
| ER6 (Ramsar) | Broadleaved deciduous woodland | 10.4 | 20.8 |

**Table 4-6**
**Nitrogen Critical Loads and Current Loads**

| Ref. | APIS Critical Load Class (most sensitive) | Critical Load Range (kg N/ha/yr) | Critical Load Applied in Assessment (kg N/ha/yr) | Current Load (kg N/ha/yr) |
|---|---|---|---|---|
| ER1 (LWS) | Broadleaved deciduous woodland | 10-20 | 10 | 36.96 |
| ER2 (LWS) | Low and medium altitude hay meadows | 20-30 | 20 | 21.56 |
| ER3 (LWS) | Broadleaved deciduous woodland | 10-20 | 10 | 36.96 |
| ER4 (LWS) | Low and medium altitude hay meadows | 20-30 | 20 | 21.56 |

[12] http://www.apis.ac.uk/, accessed December 2022

| Ref. | APIS Critical Load Class (most sensitive) | Critical Load Range (kg N/ha/yr) | Critical Load Applied in Assessment (kg N/ha/yr) | Current Load (kg N/ha/yr) |
|---|---|---|---|---|
| ER5 (SSSI) | Low and medium altitude hay meadows | 20-30 | 20 | 21.00 |
| ER6 (Ramsar) | Broadleaved deciduous woodland | 10-20 | 10 | 38.40 |

**Table 4-7**
**Acid Critical Load Functions and Current Loads**

| Ref. | APIS Critical Load Class (most sensitive) | Critical Load Function ($k_{eq}$/ha/yr) | | | Current Load ($k_{eq}$/ha/yr) | |
|---|---|---|---|---|---|---|
| | | CLmaxS | CLminN | CLmaxN | N | S |
| ER1 (LWS) | Broadleafed/Coniferous unmanaged woodland | 2.563 | 0.142 | 2.705 | 2.64 | 0.17 |
| ER2 (LWS) | Acid grassland | 4.000 | 0.856 | 4.856 | 1.54 | 0.14 |
| ER3 (LWS) | Acid grassland | 0.500 | 0.200 | 0.700 | 2.00 | 0.20 |
| ER4 (LWS) | Acid grassland | 0.880 | 0.223 | 1.103 | 1.52 | 0.14 |
| ER5 (SSSI) | Acid grassland | 0.880 | 0.223 | 1.103 | 1.50 | 0.10 |
| ER6 (Ramsar) | Acid grassland | 0.500 | 0.200 | 0.700 | 1.60 | 0.10 |

# 5.0 ASSESSMENT RESULTS

## 5.1 $NO_2$ Impacts – Human Receptors

Predicted annual mean $NO_2$ impacts at the modelled receptor locations are summarised in Table 5-1 (an isopleth plot is presented in Appendix B). The PECs are below the standard at all receptors.

**Table 5-1**
**Predicted $NO_2$ Annual Mean Impacts**

| Receptor | PC (µg/m$^3$) | PC as % of Standard | PEC (µg/m$^3$) | PEC as % of Standard |
|---|---|---|---|---|
| R1 | 0.7 | 1.8% | 19.6 | 49.1% |
| R2 | 0.4 | 0.9% | 19.3 | 48.2% |
| R3 | 0.3 | 0.8% | 19.2 | 48.1% |
| R4 | 0.6 | 1.6% | 19.5 | 48.9% |
| R5 | 1.9 | 4.8% | 20.8 | 52.1% |
| R6 | 0.2 | 0.5% | 19.1 | 47.8% |
| R7 | 0.1 | 0.2% | 19.0 | 47.5% |
| R8 | 0.6 | 1.5% | 19.5 | 48.7% |
| R9 | 0.4 | 0.9% | 19.3 | 48.2% |
| R10 | 0.2 | 0.5% | 19.1 | 47.8% |
| R11 | 0.3 | 0.8% | 19.2 | 48.0% |
| R12 | 0.1 | 0.2% | 19.0 | 47.4% |
| R13 | 0.1 | 0.2% | 19.0 | 47.4% |
| R14 | 0.3 | 0.8% | 19.2 | 48.1% |

Predicted 1-hour mean (99.8%ile) $NO_2$ PCs and PECs at the modelled receptor locations are summarised in Table 5-2 (an isopleth plot is presented in Appendix B). The PECs are below the standard at all receptors. The maximum PC outside the Site is 42.8µg/m$^3$ (although not a relevant exposure location) and with inclusion of background results in a PEC of 80.6 µg/m$^3$ therefore not exceeding the standard.

**Table 5-2**
**Predicted $NO_2$ 1-hr Mean (99.79%ile) Impacts**

| Receptor | PC (µg/m$^3$) | PC as % of Standard | PEC (µg/m$^3$) | PEC as % of Standard |
|---|---|---|---|---|
| Max. impact outside boundary | 42.8 | 21.4% | 80.6 | 40.3% |
| R1 | 13.3 | 6.7% | 51.1 | 25.6% |
| R2 | 14.1 | 7.1% | 51.9 | 26.0% |
| R3 | 13.1 | 6.6% | 50.9 | 25.5% |
| R4 | 11.9 | 5.9% | 49.7 | 24.8% |
| R5 | 16.1 | 8.1% | 53.9 | 27.0% |
| R6 | 5.1 | 2.5% | 42.9 | 21.4% |
| R7 | 2.5 | 1.3% | 40.3 | 20.2% |
| R8 | 9.4 | 4.7% | 47.2 | 23.6% |
| R9 | 5.7 | 2.8% | 43.5 | 21.7% |
| R10 | 3.3 | 1.7% | 41.1 | 20.6% |
| R11 | 5.4 | 2.7% | 43.2 | 21.6% |
| R12 | 2.0 | 1.0% | 39.8 | 19.9% |
| R13 | 2.3 | 1.1% | 40.1 | 20.0% |
| R14 | 7.5 | 3.8% | 45.3 | 22.7% |

## 5.2 Impacts on Ecological Receptors

The maximum change in impacts on the identified designated conservation sites from emissions to air are presented in the sections below.

### 5.2.1 Critical Levels

The results of the assessment of impacts on $C_{Le}$s are presented in Table 5-3. The findings are as follows:

- the annual mean PC's do not exceed 100% of the $C_{Le}$ for the LWS; and
- the short-term PC's (daily) do not exceed 100% of the $C_{Le}$ for the LWS.
- the PC exceeds do not exceed 1% of the long-term $C_{Le}$ at the SSSI and RAMSAR.
- the PC does not exceed 10% of the short-term $C_{Le}$ at the SSSI and RAMSAR.

Therefore, the impacts are considered to cause 'no likely significant effect' to the Ramsar and 'no likely damage' to the SSSI and LWS.

**Table 5-3**
**Impact on Long Term Critical Levels**

| Site | $C_{Le}$ Level | PC ($\mu g/m^3$) | PC as % of $C_{Le}$ | PEC ($\mu g/m^3$) | PEC as % of $C_{Le}$ |
|---|---|---|---|---|---|
| ER1 (LWS) | NOx Annual | 0.3 | 1.0% | 14.0 | 46.7% |
| ER2 (LWS) | NOx Annual | 1.0 | 3.4% | 16.5 | 55.0% |
| ER3 (LWS) | NOx Annual | 0.7 | 2.3% | 15.7 | 52.3% |
| ER4 (LWS) | NOx Annual | 0.3 | 1.1% | 15.7 | 52.3% |
| ER5 (SSSI) | NOx Annual | 0.2 | 0.7% | 15.7 | 52.3% |
| ER6 (Ramsar) | NOx Annual | <0.1 | <0.1% | 10.4 | 34.7% |

**Table 5-4**
**Impact on Short Term Critical Levels**

| Site | $C_{Le}$ Level | PC ($\mu g/m^3$) | PC as % of $C_{Le}$ | PEC ($\mu g/m^3$) | PEC as % of $C_{Le}$ |
|---|---|---|---|---|---|
| ER1 (LWS) | NOx 24 hour | 3.9 | 5.2% | 28.0 | 37.3% |
| ER2 (LWS) | NOx 24 hour | 10.2 | 13.5% | 33.0 | 44.0% |
| ER3 (LWS) | NOx 24 hour | 5.0 | 6.7% | 31.4 | 41.9% |
| ER4 (LWS) | NOx 24 hour | 3.9 | 5.2% | 31.4 | 41.9% |
| ER5 (SSSI) | NOx 24 hour | 1.4 | 1.9% | 31.4 | 41.9% |
| ER6 (Ramsar) | NOx 24 hour | 0.1 | 0.2% | 20.8 | 27.7% |

### 5.2.2 Impacts on Critical Loads

The results of the assessment are presented in Table 5-5 and Table 5-6. The findings are that the PC's do not exceed 1% of the $C_{Lo}$s at the SSSI and RAMSAR or 100% at the LWS; the impact is therefore considered 'insignificant'.

**Table 5-5**
**Impact on Nitrogen Critical Load**

| Site | Applied $C_{Lo}$ (kg N/ha/yr) | PC (kg N/ha/yr) | PC as % of $C_{Lo}$ |
|---|---|---|---|
| ER1 (LWS) | 10 | 0.06 | 0.63% |
| ER2 (LWS) | 20 | 0.10 | 0.51% |
| ER3 (LWS) | 10 | 0.14 | 1.39% |
| ER4 (LWS) | 20 | 0.03 | 0.17% |
| ER5 (SSSI) | 20 | 0.02 | 0.11% |
| ER6 (Ramsar) | 10 | <0.01 | 0.03% |

**Table 5-6**
**Impact on Acid Critical Load**

| Site | Applied $C_{Lo}$ ($kg_{eq}$ N/ha/yr) | N PC ($kg_{eq}$/ha/yr) | PC as % of $C_{Lo}$ |
|---|---|---|---|
| ER1 (LWS) | 2.705 | 0.005 | 0.17% |
| ER2 (LWS) | 4.856 | 0.007 | 0.15% |
| ER3 (LWS) | 0.700 | 0.005 | 0.71% |
| ER4 (LWS) | 1.103 | 0.002 | 0.22% |
| ER5 (SSSI) | 1.103 | 0.001 | 0.14% |
| ER6 (Ramsar) | 0.700 | <0.001 | 0.01% |

# 6.0 SUMMARY AND CONCLUSIONS

This AERA assessment has quantified and assessed the potential air quality impacts associated with combustion emissions from the proposed CHP and boiler using EA approved techniques against published standards for the protection of human health and designated ecological sites.

The conclusions of the AERA are as follows:

- the nitrogen dioxide process contribution does not lead to any exceedances of the standards (long-term or short-term) for the protection of human health at any location outside of the site;
- the impact on designated ecological receptors are considered to cause 'no likely significant effect' to the Ramsar and 'no likely damage' to the SSSI and LWS .

# APPENDIX A

## Modelling Checklist

| Item | Yes/No | Details / reason for omission |
|---|---|---|
| Location map | Yes | Figure 4-1 |
| Site plan | Yes | Figure 3-1 |
| Pollutants modelled and relevant EALs | Yes | Sections 2.0 and 3.0 |
| Details of modelled scenarios | Yes | Section 2.0 |
| Details of relevant ambient concentrations | Yes | Section 4.0 |
| Model description and justification | Yes | Section 3.3 |
| Special model treatment used | Yes | Section 3.3 and 3.4 |
| Table of emission parameters used | Yes | Section 2.0 |
| Details of modelled domain and receptors | Yes | Section 3.3.1 |
| Details of meteorological data used | Yes | Section 3.3.4 |
| Details of terrain treatment | Yes | Section 3.3.3 |
| Details of building treatment | Yes | Section 3.3.2 |
| Details of modelling deposition | Yes | Section 3.5.1 |
| Model uncertainty and sensitivity | Yes | Section 3.3.6 |
| Assessment of impacts | Yes | Section 5.0 |
| Contour plots | Yes | Appendix B |
| Model input files | Yes | Appendix C |

# APPENDIX B

## Isopleth Plots

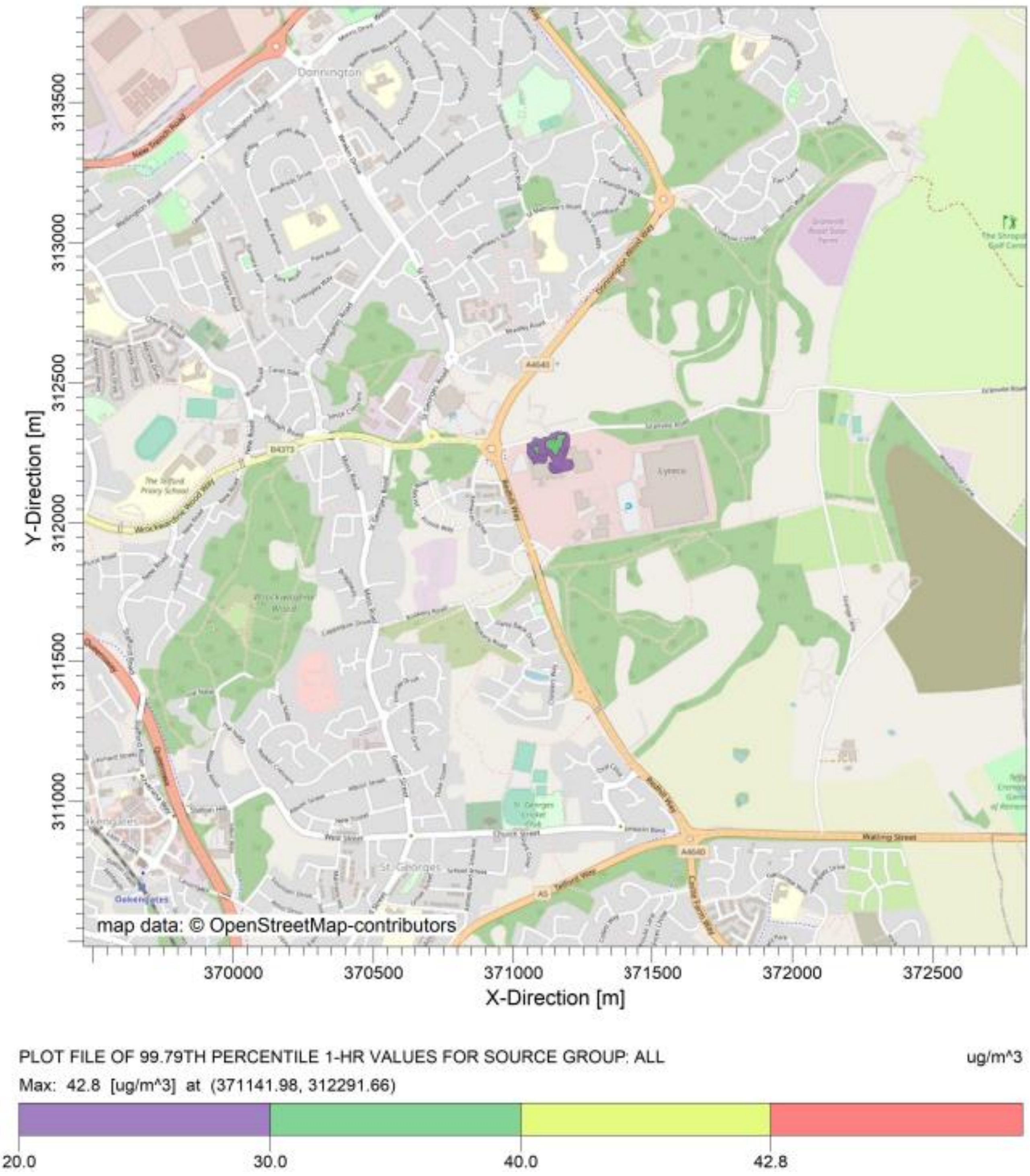


**Figure A-1**
**1-hour Mean (99.79%ile) Nitrogen Dioxide Process Contribution**

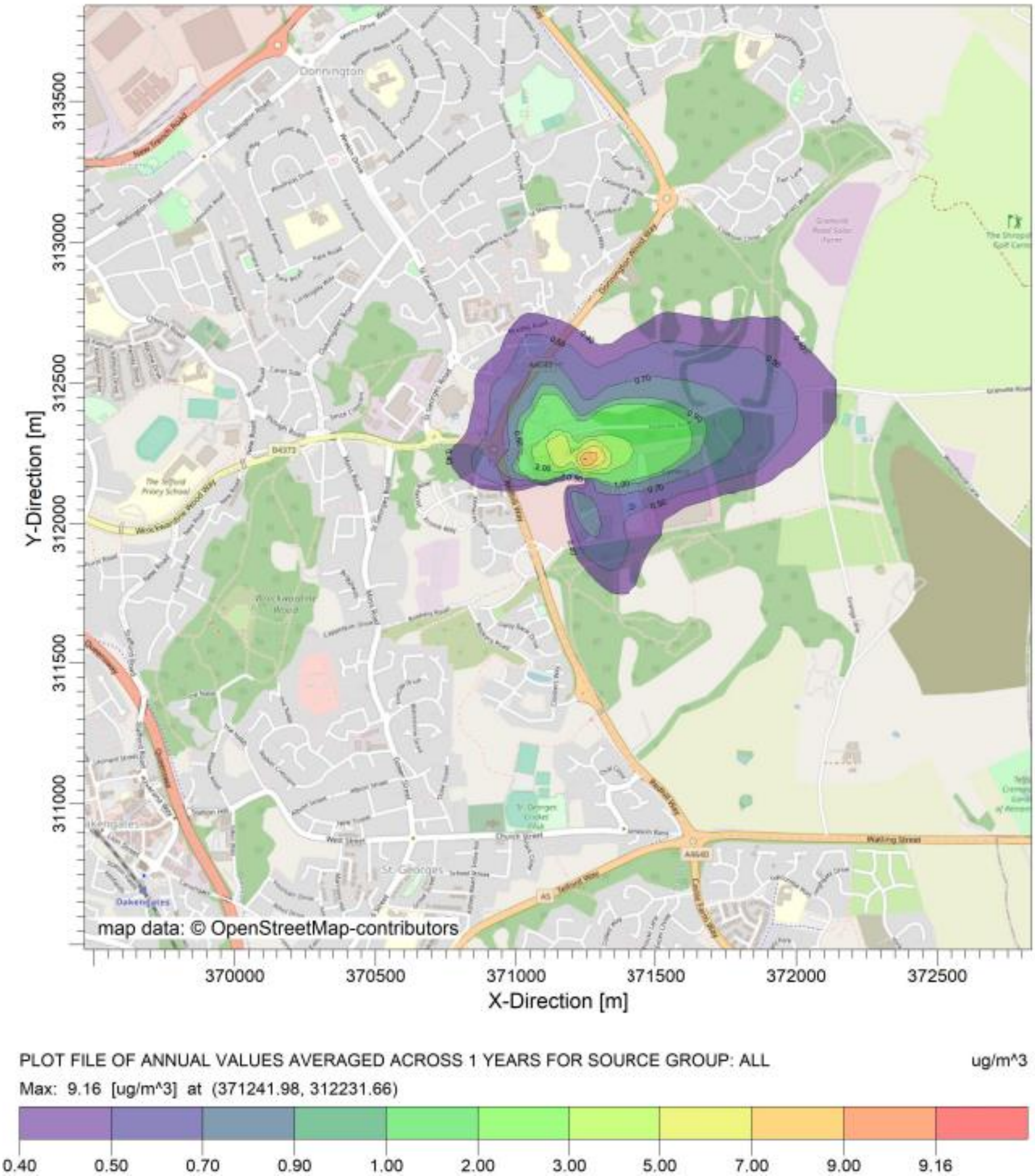


**Figure A-2**
**Annual Mean Nitrogen Dioxide Process Contribution**

# APPENDIX C

Model files (electronic only)

TELFORD_v4_17.zip

## EUROPEAN OFFICES

### United Kingdom


**AYLESBURY**
T: +44 (0)1844 337380

**BELFAST**
T: +44 (0)28 9073 2493

**BRADFORD-ON-AVON**
T: +44 (0)1225 309400

**BRISTOL**
T: +44 (0)117 906 4280

**CAMBRIDGE**
T: + 44 (0)1223 813805

**CARDIFF**
T: +44 (0)29 2049 1010

**CHELMSFORD**
T: +44 (0)1245 392170

**EDINBURGH**
T: +44 (0)131 335 6830

**EXETER**
T: + 44 (0)1392 490152

**GLASGOW**
T: +44 (0)141 353 5037

**GUILDFORD**
T: +44 (0)1483 889800

**LEEDS**
T: +44 (0)113 258 0650

**LONDON**
T: +44 (0)203 691 5810

**MAIDSTONE**
T: +44 (0)1622 609242

**MANCHESTER**
T: +44 (0)161 872 7564

**NEWCASTLE UPON TYNE**
T: +44 (0)191 261 1966

**NOTTINGHAM**
T: +44 (0)115 964 7280

**SHEFFIELD**
T: +44 (0)114 245 5153

**SHREWSBURY**
T: +44 (0)1743 23 9250

**STAFFORD**
T: +44 (0)1785 241755

**STIRLING**
T: +44 (0)1786 239900

**WORCESTER**
T: +44 (0)1905 751310


### Ireland


**DUBLIN**
T: + 353 (0)1 296 4667


### France


**GRENOBLE**
T: +33 (0)4 76 70 93 41