Caulmert Limited

Engineering, Environmental & Planning Consultancy Services

Deeside Power Station

Deeside Power (UK) Limited

Environmental Permit Variation Application

Non-Technical Summary

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Caulmert
engineering environmental planning

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Reviewer	Andy Stocks Director of Permitting	**Date**	23/09/2026
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Non-Technical Summary

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1.0 INTRODUCTION

1.1 Overview

1.1.1 Deeside Power (UK) Limited, whose registered office is at Saltend Power, Saltend Chemicals Park, Hedon Road, Hull, East Riding of Yorkshire, HU12 8GA, has prepared this Non-Technical Summary (NTS) to support its application to Natural Resources Wales (NRW) to vary Environmental Permit EPR/XP3131VK/V003 for Deeside Power Station at Weighbridge Road, Deeside Industrial Park, Deeside, Flintshire, CH5 2UL.

1.1.2 Environmental Permit EPR/XP3131VK/V003 authorises the operation of 11 natural gas-fired reciprocating engines that generate electricity for export to the National Grid. Each engine has a net rated thermal input of 9.896 MWth, giving a combined net rated thermal input of 108.856 MWth. The engines are available on standby 24 hours a day, seven days a week, throughout the year.

1.1.3 Operation is limited to fewer than 1,500 hours per year, averaged over a rolling five-year period, and to no more than 2,250 hours in any individual year. The engines typically operate between 08:00 and 22:00 when called upon by the National Grid to meet peak demand or compensate for reduced baseload generation.

1.1.4 Before the activities described in Section 1.1.2 commenced, Deeside Power Station operated as a natural gas-fired combined cycle gas turbine (CCGT) plant. It comprised two Alstom 13E2 gas turbines, each fitted with dry low-NOx burners, two CMI heat recovery steam generators (HRSGs) and one Alstom steam turbine. The HRSGs and steam turbine ceased operating in 2018, after which the gas turbines were converted to synchronous compensators.

1.1.5 The converted units do not burn fuel. Instead, they are supplied with electricity from the overhead lines and have provided inertia and reactive power to support the National Grid under contract since January 2020.

1.1.6 The proposed variation involves installing a second limited-hours peaking plant at the site, similar in design and operation to the existing plant within the permit boundary. The second plant will comprise 11 natural gas-fired reciprocating engines operating alongside the 11 engines in the existing peaking plant. Each engine has a net rated thermal input of 9.896 MWth, giving the 22 engines a combined net rated thermal input of approximately 217.712 MWth.

1.1.7 The engines will generate electricity for export to the National Grid and will operate as required to support electricity supply, system balancing and grid stability. Operation will be limited to no more than 1,500 hours per year on a 5-year rolling average with 2250 hours maximum, subject to the conditions specified in this permit variation application. The site layout is shown on drawing 7139-CAU-XX-XX-DR-V-1802.

1.2 Site Location

1.2.1 Deeside Power Station is located on Weighbridge Road within Deeside Industrial Park. The Site occupies a developed industrial plot within one of the largest industrial estates in North Wales. The surrounding area is characterised by heavy industrial, manufacturing, warehousing, logistics and energy-related operations, with neighbouring land predominantly comprising commercial and industrial premises. The nearest residential areas are located along Dee View Road, approximately 1.3 km south-south-west of the Site.

1.2.2 Figure 1 below shows the location of Deeside Power Station.

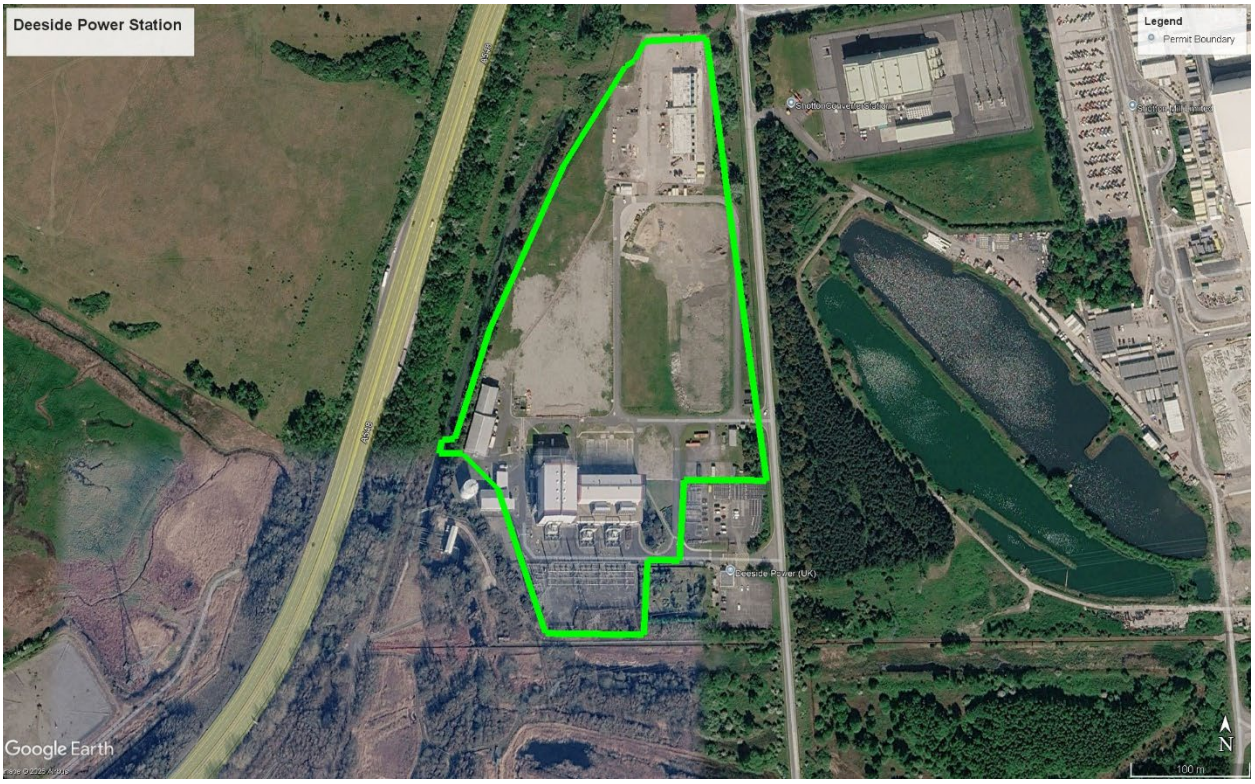


Figure 1: Site Location (Approximate Permit Boundary in Green; Source: Google Earth, 2026).

1.3 Sensitive Receptors

1.3.1 The sensitive receptors that have the potential to be impacted by the addition of a second peaking plant on site are summarised in **Table 1** below; these receptors have been considered, where appropriate within each risk assessment undertaken.

1.3.1 A Sensitive Receptors Plan (drawing ref. 7139-CAU-XX-XX-DR-V-1801) has been prepared for the area surrounding the site taking into account European sites within 10 km of the proposed plant and Sites of Special Scientific Interest (SSSIs) and non-statutory conservation sites within 2 km; as

well as human receptors, including residential properties, educational facilities, and commercial or industrial premises, within 2 km.

Table 1: Summary of Sensitive Receptors.

Receptor	Receptor Type	Distance/Direction
Groundwater: unproductive aquifer - bedrock	Groundwater receptor	–
Groundwater: unproductive aquifer - superficial deposits	Groundwater receptor	–
Shotton Mill Limited	Industrial	395m East
Shotton Lagoons and Reedbeds SSSI	Ecological receptor / SSSI	171m South
Dee Estuary / /Aber Afon Dyfrdwy SSSI	Ecological receptor / SSSI	321 – 558m west and 351m North
Afon Dyfrdwy (River Dee) SSSI	Ecological receptor / controlled water	844m SW
Inner Marsh Farm SSSI	Ecological receptor / SSSI	1.7km NE
Dee Estuary SAC/SPA/Ramsar	European site	110 m south, west and north
River Dee and Bala Lake SAC	European site	1.5km SE
Deeside and Bukley Newts SAC	European site	2.9km SSW
Halkyn Mountain SAC	European site	8.3km WSW to West
Fingerpost Gutter	Ecological	16m west
Shotton Converter Station	Industrial	97m east
Tata Steel UK Limited	Industrial	676m SSW
Exova	Commercial	627m south
Colorcoat	Commercial	534m south
Shotton Mill Limited	Industrial	395 m east
Map Recycling	Commercial	1 km SE
Properties off Quary Lane	Residential	1.1km SSW
Properties off Bank Road	Residential	1.2km SW
Properties along Dee View Road	Residential	1.3km SSW
Connah's Quay Power Station	Industrial	1.1km WSW
Parc Adfer EfW facility	Industrial	1.2km East
Dock Road Industrial Estate	Industrial	1.2km South
Converter Station	Industrial	1.2km SE
St. Mark's Parish Church	Recreational	1.3km SSW
Logistic Centre off Weighbridge Road	Industrial	1.4km ENE
Golftyn Primary School	Educational	1.7km SSW
Coleg Cambria - Deeside	Educational	1.8km SW
Bryn Deva Primary School	Educational	1.8km SSW
Deeside Sixth Form	Educational	1.9km SW
Connah's Quay High School	Educational	2km SW
Connah's Quay Cricket Club	Recreational	1.5km SSW
Toyota Deeside	Industrial/commercial	1.6km ESE
Commercial Complex off Dock Road	Commercial	1.7km SSW
O'brien	Commercial	580 m NE

Deeside Industrial Patk Zone 3	Industrial	1.8km ENE
Connah CV Campsite	Recreational	145 m NE
Deeside Model Aircraft Club	Recreational	751 m NW

1.4 Permitted Activities

1.4.1 The current permit covers 11 natural gas-fired reciprocating engines with a combined net rated thermal input of approximately 109 MWth, together with a standby diesel generator. The engines operate as a limited-hours plant, supplying electricity when required by the National Grid within the annual operating limits described in Section 1.1.2.

1.4.2 The two former gas turbines have been converted to synchronous compensators and no longer burn fuel or generate electricity. The former generation activity and associated equipment have been removed from the permit. The converted units remain within the installation solely to provide grid-stability support.

1.4.3 Each engine is housed in an individual enclosed building on impermeable concrete hardstanding and has dedicated ventilation, cooling, exhaust and noise-control equipment. The diesel generator provides emergency site power if the National Grid supply is lost.

1.4.4 Site surface water passes through an oil-water separator before being discharged to the River Dee via permitted discharge point W1. This arrangement controls oil and grease in surface-water runoff.

1.4.5 Table 2 summarises the scheduled activities following the proposed permit variation:

Table 2: Permitted Activities following Variation

Activity Reference	Activity listed in Schedule 1 of the EP Regulations	Description of specified activity	Limit of specified activity
AR1	Schedule 1 Part 2 Section 1.1 Part A(1) (a) : Burning any fuel in an appliance with a rated thermal input of 50 or more megawatts. Consisting of individual Schedule 25A: Medium Combustion Plant. Combustion of natural gas in 11 spark ignition engines for the purpose of electricity generation with a total thermal input of 109 MW.	22 engines - A9 - A19 (existing), and A20 – A30 (additional), comprising: • 22 x 9.9 MWth	From receipt of raw materials to combustion of fuel and release of exhaust gases to atmosphere. No more than 1500 operating hours per engine per year, as a five-year rolling average, with a maximum of 2250 hours per year in any one of those five years.
Directly Associated Activity (DAA)			
AR2	Stand-by emergency diesel generator	1.05 MWth diesel-fired generator	From receipt of raw materials to combustion of

			fuel and release of exhaust gases to atmosphere. To be used only in the case of a power outage on site, or for the purpose of testing.
AR3	Surface water drainage		Handling and storage of site drainage until discharge to the site surface water system.
AR4	Waste management	Storage of waste oil in 2x 10,000l tanks	Waste generation and handling - from generation of waste to despatch from the installation.
AR5	Storage and handling of raw materials and fuel	Storage of clean oil in 2x 10,000l tanks. Storage of antifreeze in 2x 2,000l IBCs Storage of diesel in 1x 1,000l tank and 1x 4,000l tank.	From receipt of raw materials to handling, storage and use to despatch from the installation.
AR6	Electricity transformers and 400kV banking compound.		From generator to the connection to the National Grid.

1.5 Proposed Activities

1.5.1 The proposed variation will add a second peaking plant, resulting in 22 identical Jenbacher J624 natural gas-fired reciprocating engines operating across the two plants. Together, the plants will provide an aggregate electrical output of approximately 99.8 MW, and the 22 engines will have a combined net rated thermal input of 217.712 MWth.

1.5.2 The new and existing engines will generate electricity for export when called upon to support electricity supply, system balancing and National Grid stability. Each engine will operate for no more than 1,500 hours per year on 5 year average with 2250 hours maximum, subject to the limits and conditions set out in this variation application.

1.5.3 Natural gas will be supplied on demand from the mains network; no bulk storage of natural gas is proposed on site.

1.5.4 Each engine will be installed in an enclosed, concrete-sided unit on impermeable hardstanding, with the necessary cooling, ventilation, exhaust and noise-control equipment. These measures will provide containment, safe access and control of potential emissions.

1.5.5 The new plant will be integrated with the site's existing distributed control system (DCS) and electrical infrastructure. Key operating parameters and alarms will be monitored from the continuously staffed control room. Electricity will pass through the existing transformers before export to the National Grid. The plant will be operated and maintained in accordance with the Operator's environmental management system, the manufacturer's requirements and permit conditions.

1.5.6 The activities listed in **Table 2** remain unchanged, except that the permitted generating plant will include 11 additional engines. Each engine has a net rated thermal input of 9.896 MWth, giving all 22 engines a combined net rated thermal input of 217.712 MWth.

1.5.7 The storage provisions associated with directly associated activities AR4 (waste oil management) and AR5 (storage and handling of raw materials and fuel) will be doubled, as shown in Table 2, to serve 22 engines. The diesel storage provision will remain unchanged.

1.6 Process Description

1.6.1 The natural gas-fired reciprocating engines will operate for approximately 1,500 hours per year on 5-year rolling average.

1.6.2 The second peaking plant will comprise the following components:

- 11 Jenbacher J624 natural gas-fired engines, each rated at 9.896 MW_{th} and served by an individual stack;

1.6.3 The engines will be fuelled by natural gas. Each engine has a net rated thermal input of 9.896 MW_{th}; together, the 11 engines will provide an aggregate export capacity of 49.9 MW and a combined net rated thermal input of 108.856 MW_{th}.

1.7 Management and Control

1.7.1 The Operator has an Environmental Management System (EMS), which will be updated to cover the new activities, plant and equipment.

1.7.2 The EMS is consistent with NRW's guidance on environmental management systems.

1.8 Point Source Emissions

1.8.1 The existing peaking plant comprises 11 generators, each with an individual stack, resulting in 11 point-source emissions to air (A9 to A19). The existing emergency generator discharges through emission point A3.

1.8.2 The proposed second peaking plant will add 11 point-source emissions to air (A20 to A30), one from each Jenbacher J624 natural gas-fired reciprocating engine.

1.8.3 Under Environmental Permit EPR/XP3131VK/V003, emission point W1 discharges uncontaminated site surface water, including rainwater, to the River Dee.

1.9 Plans for the Site

1.9.1 The following site plans are included with this application:

- 7065-CAU-XX-XX-DR-V-1802 – Site Layout Plan;
- 7065-CAU-XX-XX-DR-V-1801 – Sensitive Receptor Plan.

1.10 Environmental Risk Assessments

1.10.1 An Environmental Risk Assessment (Ref. 7139-CAU-XX-XX-RP-V-0302), included with this application, assesses the environmental risks associated with the proposed second peaking plant.

1.10.2 The environmental risks identified are consistent with those assessed for the first peaking plant in the February 2025 Environmental Risk Assessment (Document Ref. CRM.343.005.PE.R.005) submitted to Natural Resources Wales.

1.10.3 The Noise Impact Assessment (Ref. 33001048/01) concludes that noise effects from the proposed development would be low at both residential and ecological receptors.

1.10.4 The Air Quality Assessment (Ref. AIR32901399) concludes that operation of the second peaking plant at Deeside Power Station is not predicted to have significant effects on air quality at human or ecological receptors. Predicted concentrations of all regulated pollutants are below the relevant standards. Although small increases in nitrogen deposition are predicted at some ecological sites, these are not expected to result in significant adverse effects.

1.11 Operational Techniques and BAT Assessment

1.11.1 An Operational Techniques and Best Available Techniques (BAT) Assessment (Ref. 7139-CAU-XX-XX-RP-V-0306) has been prepared for the proposed second peaking plant and is included with this application. The proposed plant will be identical in design and operation to the existing plant. It will operate alongside the existing units, follow the same operating profile and share supporting infrastructure where practicable.

1.11.2 Following approval of this permit variation application, the 11 proposed engines will also be subject to the monitoring requirements specified by NRW.

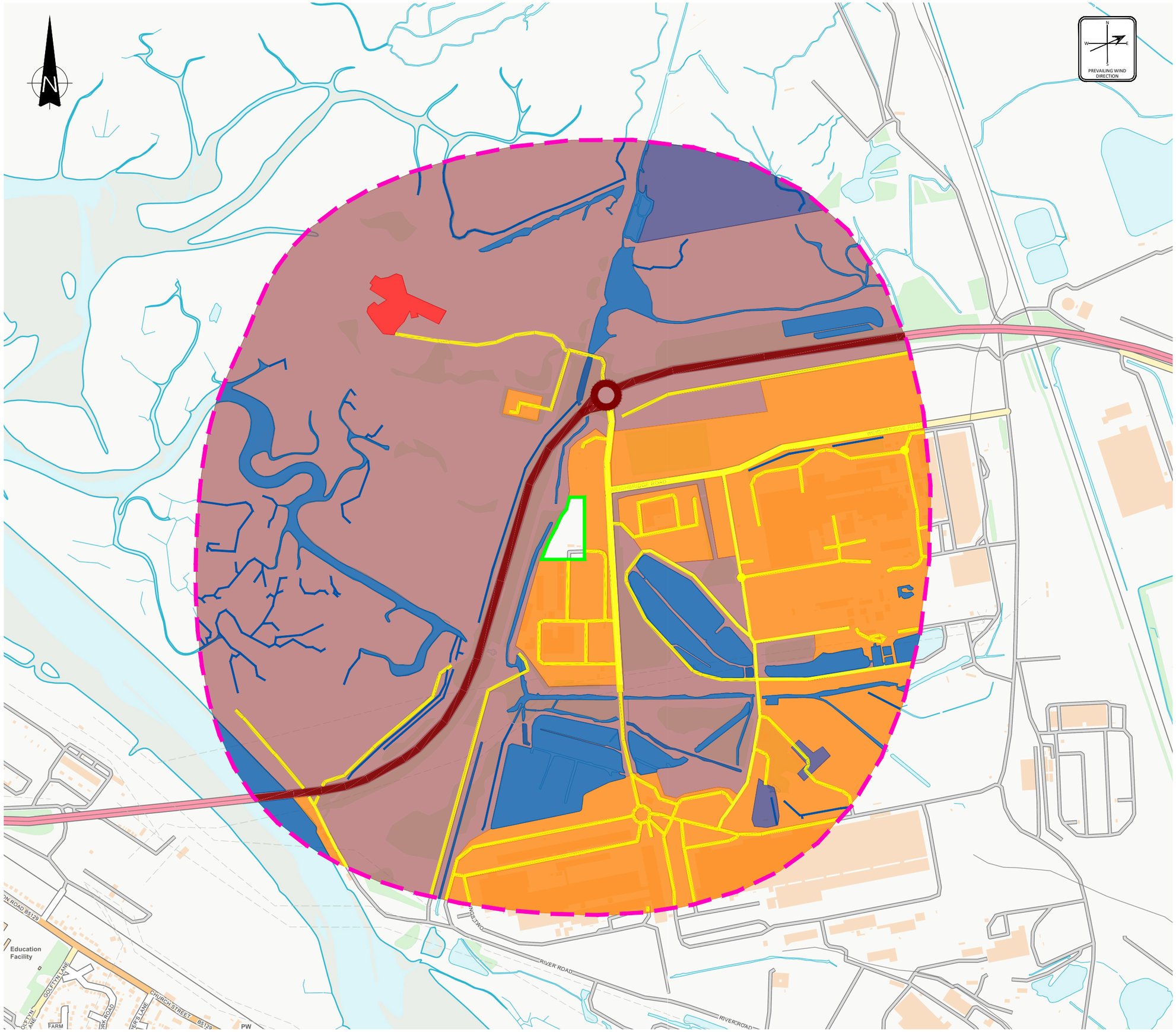
1.12 Closure and Decommissioning

1.12.1 If activities cease and the site requires decommissioning, the Operator will submit a detailed Closure Plan to NRW and, where applicable, the other relevant regulatory bodies.

1.12.2 The Closure Plan will explain how the site will be dismantled and how waste from decommissioning will be reused or recycled where practicable, or otherwise disposed of appropriately. Throughout the life of the permit, the Operator will maintain appropriate records and reporting procedures to support completion of the Site Condition Report. The Operator will also collect the information required under the lifetime approach to demonstrate, when the permit is surrendered, that the land is in a satisfactory condition.

DRAWINGS

7139-CAU-XX-XX-DR-V-1801	Sensitive Receptor Plan
7139-CAU-XX-XX-DR-V-1802	Site Layout Plan



LEGEND

- PERMIT BOUNDARY
- 1000m OFFSET
- SURFACE WATER
- WOODLAND / SCRUBLAND
- COMMERCIAL
- RECREATIONAL
- EDUCATIONAL FACILITY
- MEDICAL FACILITY
- INDUSTRIAL
- RESIDENTIAL
- AGRICULTURAL
- MAJOR ROAD
- MINOR ROAD
- RAIL

P01	FOR CLOPUD APPLICATION	EJD	JC	AS	09.11.26
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PURPOSE OF ISSUE: FOR CLOPUD APPLICATION

STATUS: S2

CLIENT:

DEESIDE POWER (UK) LTD
WEIGHBRIDGE ROAD, SEALAND.
DEESIDE, CH5 2UL

PROJECT:

DEESIDE POWER STATION
INSTALLATION OF
GAS POWERED PEAKING PLANT

TITLE:

SENSITIVE RECEPTOR PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
EJD	EJD	JC	JC
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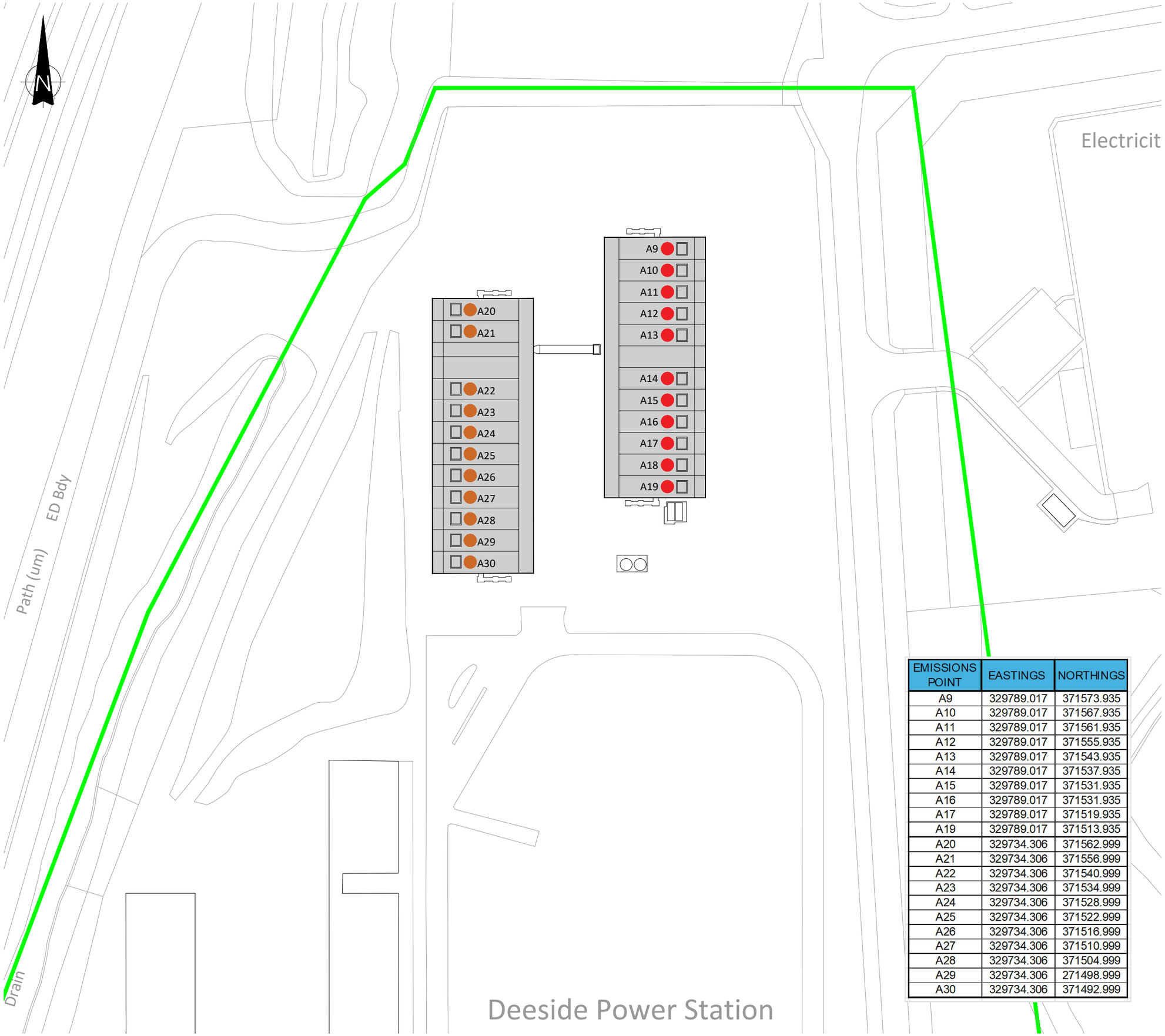
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NOTES

1. DO NOT SCALE FROM THIS DRAWING, WORK FROM FIGURED DIMENSIONS ONLY. ALL DIMENSIONS ARE IN METRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS.

LEGEND

- PERMIT BOUNDARY
- PROPOSED EMISSIONS POINTS
- EXISTING EMISSIONS POINTS

EMISSIONS POINT	EASTINGS	NORTHINGS
A9	329789.017	371573.935
A10	329789.017	371567.935
A11	329789.017	371561.935
A12	329789.017	371555.935
A13	329789.017	371543.935
A14	329789.017	371537.935
A15	329789.017	371531.935
A16	329789.017	371531.935
A17	329789.017	371519.935
A19	329789.017	371513.935
A20	329734.306	371562.999
A21	329734.306	371556.999
A22	329734.306	371540.999
A23	329734.306	371534.999
A24	329734.306	371528.999
A25	329734.306	371522.999
A26	329734.306	371516.999
A27	329734.306	371510.999
A28	329734.306	371504.999
A29	329734.306	271498.999
A30	329734.306	371492.999

REV					
P01	FOR CLOPUD APPLICATION	EJD	JC	AS	09.11.26
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PURPOSE OF ISSUE: FOR CLOPUD APPLICATION
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CLIENT:
DEESIDE POWER (UK) LTD
WEIGHBRIDGE ROAD, SEALAND.
DEESIDE, CH5 2UL

PROJECT:
DEESIDE POWER STATION
INSTALLATION OF
GAS POWERED PEAKING PLANT

TITLE:
SITE LAYOUT PLAN

DESIGNED BY	DRAWN BY	REVIEWED BY	AUTHORISED BY
EJD	EJD	JC	JC

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APPENDIX 1

Noise Impact Assessment

Caulmert
Deeside Power Station Peakers 2

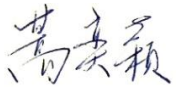
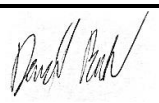
Noise Impact Assessment
33001048/01 – 22nd July 2026



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Executive Summary

Bureau Veritas was instructed by Caulmert Ltd to undertake an environmental noise impact assessment to support an Environmental Permit variation application for the installation of additional peakers at Deeside Power Station in Flintshire.

It is assumed that potential vibration impacts from operation of the new plant items will be negligible at the nearest receptors due to the separation distances, and this element has therefore been scoped out of the detailed assessment.

An assessment of the operational noise impact has been carried out in accordance with the relevant British Standard to consider the potential noise impact on the nearest noise sensitive receptors, including both residential receptors and ecological receptors.

A computational noise model of the proposed development was assembled and populated with noise emission data of the new sound sources and measured existing sound sources. Standard noise propagation calculations were used to predict the plant operation noise levels at the nearest noise sensitive receptors.

The assessment concludes that the noise impacts of the proposed site operation would Low for both residential receptors and ecological receptors. As such, no noise mitigation measures are required.

1. Introduction

1.1. Bureau Veritas was instructed by Caulmert Ltd to undertake an environmental noise impact assessment to support an Environmental Permit variation application for the installation of 11 additional peakers at Deeside Power Station in Flintshire.

1.2. The purpose of this assessment is to demonstrate that noise emissions from the additional peakers in combination with the consented plant, would not result in unacceptable impacts at the nearest Noise Sensitive Receptors.

1.3. The report also details the baseline noise surveys, assessment methods used, and mitigation measures required.

1.4. A glossary of acoustic terminology is included in **Appendix One**.

2. Site Location

2.1. The proposed site is located in Flintshire, North Wales, specifically in the vicinity of Connah's Quay. The site is situated roughly 10 km northwest of Chester, and 20 km north of Wrexham. The facility occupies an area within the mixed industrial and agricultural landscape characteristic of the North Wales/Cheshire border region. The River Dee runs to the south and west of the proposed site, with the shortest distance approximately 780m.

2.2. Vegetation across the wider area includes mixed agricultural land interspersed with industrial zones and scattered woodland patches. The nearest residential area is Connah's Quay village, located approximately 1–2 km to the south and southwest of the power station.

2.3. The nearest residential properties are the residential dwellings off Dee View Road, approximately 1.6 km southwest of the proposed site. They are identified as the nearest sensitive receptors (NSR1). Beyond this primary settlement, more residential dwellings are distributed further south and southwest to the proposed site.

2.4. The River Dee is a significant ecological feature in the Deeside area and represents an important bird habitat. The Deeside area, particularly in the vicinity of the River Dee and associated wetlands, may fall within or near designated sites of conservation importance. The locations of Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPA) near the proposed site are shown in **Appendix Two**.

2.5. Besides the residential receptors, the nearest sites of SSSI and SPA are identified as non-residential receptors (NSR2-NSR4). The locations of the NSRs are shown in **Appendix Two**.

3. Details of Development

3.1. The proposed development is to be located to the west of consented peaking plant. The Development consists of a number of acoustically insulated genset units and associated infrastructure including a gas skid, electrical switchgear, transformers and cooling plant.

3.2. The site operation is possible 24/7 due to the nature of the development.

3.3. The general arrangement drawing and the location of the proposed development are shown in **Appendix Three**.

4. Criteria for Assessment

Overview

4.1. The sounds caused by the proposed development are all considered as industrial noise, therefore British Standard 4142: 2014+A1: 2019 is the main guidance for the assessment, along with the other relevant references, to assess the potential noise impact on the nearby sensitive receptors.

4.2. The relevant guidance documents are listed below:

- Planning Policy Wales (Ed. 12, February. 2024); and Technical Advice Note (Wales) 11, Noise (TAN11);
- British Standard 4142; 2014+A1:2019, "Methods for rating and assessing industrial and commercial sound" (BS4142);
- TIDE Tool - Waterbird Disturbance & Mitigation Toolkit 2013;
- British Standard 8233: 2014, "Guidance on sound insulation and noise reduction for buildings"; and
- ISO 9613-2:2024 'Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation'.

Planning Policy

Planning Policy Wales (Ed. 12, February. 2024)

4.3. Planning Policy Wales (PPW) defines the latest land use planning policies of the Welsh Government. The consideration of noise impacts and the overall encouragement of good soundscapes is widely discussed within the document and, of particular importance to this report, paragraph 6.7.14 of PPW states:

> *"6.7.14 Proposed development should be designed wherever possible to prevent adverse effects to amenity, health and the environment but as a minimum to limit or constrain any effects that do occur. In circumstances where impacts are unacceptable, for example where adequate mitigation is unlikely to be sufficient to safeguard local amenity in terms of air quality and the acoustic environment it will be appropriate to refuse permission."*
>
> *6.7.15 For the purposes of this section, potentially polluting development includes commercial, industrial, energy and agricultural or transport infrastructure. Such development should be located in areas where there is low potential for public exposure, or where its impact can be minimised. Novel or new development types may potentially cause pollution and should be carefully considered, and where appropriate, decisions should be based on the precautionary principle.*
>
> *6.7.17 The location of potentially polluting development adjacent to sensitive receptors will be unacceptable where health and amenity impacts cannot be minimised through appropriate design and mitigation measures. It is the overall expectation that levels of pollution should be reduced as far as possible and for this reason the location of potentially polluting development should be taken into account as part of overall strategies in development plans to ensure it can be appropriately located and maximum environmental benefits can be gained through measures such as green infrastructure."*

4.4. PPW is supplemented by a series of Technical Advice Notes, including the TAN11 relating to the consideration of noise at the planning stage.

Technical Advice Note (Wales) 11, Noise (TAN11)

4.5. TAN 11 was introduced by the Welsh Government in October 1997. Paragraph 3 on page 1 of TAN11 indicates that it is intended to provide *"advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on development or adding unduly to the costs and*

administrative burdens of business. It outlines some of the main considerations which local planning authorities should take into account in drawing-up development plan policies and when determining planning applications for development which will either generate noise or be exposed to existing noise sources."

4.6. In relation to the assessment of new noise generating sources, TAN11 states that:

> *"8. Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions.*

4.7. Annex B of TAN 11 specifies that the assessment of potential noise disturbance from industrial and commercial developments should be undertaken in accordance with BS4142:1990 (superseded by 2019 version, see below).

4.8. Technical Advice Note (Wales) 11, Air Quality, Noise and Soundscape has been drafted and under consultation. This consultation ended 20 January 2023.

4.9. In Section 5.2 Assessing pollution impacts generated by development, TAN11 draft states that:

> *"An inappropriately located or poorly designed development may cause an air quality or noise problem where none previously existed or may make an existing air quality or noise problem worse. This should be avoided and is likely to result in planning permission being refused.*
>
> *Developers should identify all such potential adverse effects at an early stage, and demonstrate, using the steps identified in this TAN and in other appropriate guidance, that unacceptable outcomes will not occur as a result of the proposed development. What constitutes an unacceptable outcome sufficient for the planning authority to consider it appropriate to refuse planning permission will depend on the local context but will include:*
>
> …
>
> - *levels of industrial or commercial sound, including any domestic air source heat pump sound, at sensitive human receptor locations, predicted to result in significant adverse impacts according to BS 4142;*
> - *noise requiring people to close windows at times when they previously did not have to in order to meet the recommended internal sound levels specified in documents such as BS 8233, ProPG and Building Bulletin 93;*
> - *noise or other emissions preventing people from enjoying outdoor living spaces, such as gardens and balconies, to the extent that they could enjoy them prior to the proposed development;*
> - *the noticeable degradation of locally important sound environments, such as the predominantly natural soundscape of a tranquil green space or other appropriate soundscapes;*
> - *an increase in noise (whether an increase in loudness, an increase in unpleasantness or both) large enough to be perceived as a significant change by a typical listener in the local context, the magnitude of that perceived change rather than the absolute sound level resulting in a significant adverse impact on health (including annoyance and sleep disturbance) or amenity;*
> - *an adverse impact on a sensitive habitat (for example, from ammonia emissions creating or worsening exceedences of critical loads of nitrogen deposition);*
> - *an adverse impact on the local population health of a protected species (for example, noise disrupting the foraging of local populations of bats).*

Technical Guidance

British Standard 4142: 2014+A1: 2019 'Methods for rating and assessing industrial and commercial sound'

4.10. The Standard provides a method for assessing whether a sound from industrial or commercial premises (e.g. fixed mechanical and electrical (M&E) plant, loading activities etc.) is likely to cause a disturbance to persons living in the vicinity of the site.

4.11. BS 4142 assesses potential significance of effect by comparing the 'specific sound level' of an industrial source to the typically representative background sound level (L_{A90}). Certain acoustic features can increase the potential for a sound to attract attention, and therefore increase its relative significance than that expected from a simple comparison between the specific sound level and the background sound level. In particular, BS 4142 identifies noise that contains discrete impulses and/or audible tonal qualities and in these cases recommends that a correction be added to the specific sound level. The specific sound level along with any applicable correction is referred to as the 'rating level'.

4.12. The greater the difference between the rating level and the background sound level; the greater the likelihood of complaints. The assessment criteria given by BS 4142 are as follows:

- A difference of +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of +5 dB could be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background sound level, the less likely it is that there will be an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.
- Also to take into account the absolute level, risk that it will cause annoyance/interference with everyday activities, context of the sound, frequency and temporal variations to the sound.

4.13. During the daytime and evening, BS 4142 requires that sound levels are assessed over 1-hour periods. During the night-time, because sleep disturbance is the important issue and individual sound events are, therefore, more important, sound levels are assessed over 15-minute periods.

TIDE Tool - Waterbird Disturbance & Mitigation Toolkit

4.14. This toolkit has been developed using a combination of literature review information and field observation, tailored specifically for the purpose of defining disturbance impacts to avifauna from construction-type operations on or adjacent to intertidal areas. Although the power station noise is not construction noise, it may cause similar noise disturbance to waterbirds.

4.15. **Table 4.1** below is based on the collation of these data together with author observations of construction studies on the Humber Estuary and produced in Sutts & Allen, 1999.

Table 4.1: General Waterbird Disturbance Levels

Noise levels/L_{Aeq}	Disturbance Levels
Irregular piling noise (above 70 dB)	High to Moderate
Regular piling noise (above 70 dB)	Moderate
Irregular noise (50dB – 70 dB)	Moderate
Regular noise (50dB – 70 dB)	Moderate to Low
Noise below 50 dB	Low

British Standard 8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings

4.16. BS 8233:2014 provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use.

4.17. With regards to external sound sources affecting habitable residential spaces, Table 4 of BS 8233:2014 provides guideline values that it is desirable to not exceed during daytime and night-time periods. These guideline values are reproduced in **Table 4.2**.

Table 4.2: Indoor ambient sound levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

4.18. For traditional external areas that are used for amenity space, such as gardens and patios, BS8233 states that it is desirable that the external sound level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments.

4.19. BS8233:2014 does not provide specific guidance on sound levels for regular individual sound events, such as passing trains, which can cause sleep disturbance. Guidance on suitable sound levels for individual events is provided in the WHO Guidelines for Community Noise.

4.20. The WHO guidelines state that for a reasonable standard in bedrooms to be achieved individual sound events should not normally exceed 45dB L_{Amax} 10 to 15 times during the night-time period.

4.21. As listed in Table 2 of BS8233, the design range of the indoor ambient noise levels of open plan office is 45 – 50 dB $L_{Aeq,T}$. The design range of the indoor ambient noise levels of executive office is decided as 35 – 40 dB $L_{Aeq,T}$ in Table 6 of BS8233.

4.22. As such, to do a robust assessment, the assessment criteria for the indoor ambient noise levels of office is decided as 35 dB $L_{Aeq,T}$.

ISO 9613-2:1996 'Acoustics – Attenuation of Sound during Propagation Outdoors – Part 2: General Method of Calculation'

4.23. ISO 9613-2:1996 specifies methods for the description of sound outdoors in community environments. ISO 9613 can be applied to a wide variety of sound sources and includes methods to determine most of the major mechanisms of sound attenuation, such as:

- Geometric divergence (Adiv) – spherical spreading of sound energy;
- Atmospheric absorption (Aatm) – attenuation of sound due to interaction with the air (dependant on frequency of sound and negligible at short distances);
- Ground effect (Agr) – sound reflecting by the ground surface interfacing with the sound propagating directly from source to receiver;
- Reflection from surfaces (image source method, included in Agr calculation) – sound is reflected from hard surfaces such as building facades due to atmospheric impedance of the surface. This effect increases the sound level when compared to a location free of buildings (i.e. free field); and
- Screening by obstacles (Abar) – Hard obstacles such as close-boarded timber fences and varying topography, including hills attenuate the sound from a source due to the insertion loss properties of the obstacle. However, there is an element of the sound which will diffract around the obstacle, especially at lower frequencies. The diffraction effect is determined using the path differences between the direct and diffracted sound. It should be noted that the screening effect provided by trees and foliage is negligible in the majority of cases; the exception is large areas of dense forest or plantations.

5. Noise and Vibration Assessment

5.1. In order to ensure a robust assessment, the impact assessment considers operational noise of 11 additional peakers in combination with the consented plant on the existing environment covers. In total, there would be 22 peakers.

5.2. The sound levels of site operation at the nearest sensitive receptors are predicted by noise modelling, using CadnaA. Noise propagation was predicted using algorithms described in ISO 9613-2, as incorporated within the noise modelling software.

5.3. Ground absorption was assumed to be 0.5 for the mixed-use land. The reflection order was set up as 3. The reflection loss of buildings is set as 1 dB (Smooth facade). Atmospheric conditions are 10°C and 70% relative humidity. The barriers and the modified topology of the proposed development are also included in the model.

5.4. Due to the long distances between the proposed development and the NSRs, it is expected that operational activities would not result in perceptible vibration impacts on any of the sensitive receptors. Therefore, no further assessment of operational vibration was undertaken.

Identification of Sound Sources

5.5. Based on the site layout and plant information provided by the Client, the significant operational plant sound sources are all outdoor, including:

- 22no. Genset concrete enclosures: Sound power level 78 dB(A) per enclosure;
- 22no. Engine Exhausts: 65dB(A) @ 10 m from each silencer outlet (measured 90 degrees to
- the exhaust flow);
- 22no. Ventilation air intakes: 65 dB(A) @ 10 m from each intake louvre;
- 22no. Ventilation air outlets: 65 dB(A) @ 10 m from each outlet louvre; and
- 44no. Dry air coolers: 62 dB(A) @ 10 m from each radiator.

5.6. It is assumed that all the plants are operating simultaneously at full capacity 24/7 to inform the worst-case scenario.

5.7. For the purposes of noise modelling, an octave band frequency spectrum typical of each item of plant has been scaled to the sound power levels derived from the information provided in above. Regarding the transformer and gas skid, whilst not specified by the Client, these have been included to ensure a thorough & robust assessment.

5.8. The assumed spectrums of the sound sources are shown in **Appendix Four**. The sound sources are all modelled as point sources, given the long distances between the proposed development and the NSRs.

Predicted Sound levels

5.9. The predicted specific sound levels of all the operational and the proposed new plant noise at the nearest receptors are shown in **Table 5.1** below.

Table 5.1: Summary of Predicted Sound Levels of All Plant Operation

Receptor(s)	Sound Pressure Level, dB $L_{Aeq,T}$ – 1.5 m high	Sound Pressure Level, dB $L_{Aeq,T}$ – 4 m high
NSR1_Residential dwellings off Dee View Road	32*	32*
NSR2_Ecological habitats southwest of site	42	43

Table 5.1: Summary of Predicted Sound Levels of All Plant Operation		
Receptor(s)	**Sound Pressure Level, dB $L_{Aeq,T}$ – 1.5 m high**	**Sound Pressure Level, dB $L_{Aeq,T}$ – 4 m high**
NSR3_ Ecological habitats south of site	45	45
NSR4_Ecological habitats north of site	45	46

* The sound levels are the highest noise levels on the most exposed facades.

5.10. **Figures A5.1** and **A5.2** in **Appendix Five** show the predicted sound propagation grids of the operational plants and the proposed plants during daytime and night-time at 1.5 m and 4 m, respectively.

Residential Receptors

5.11. No baseline noise survey was conducted due to the low plant noise level and high ambient noise levels at the residential dwellings off Dee View Road (NSR1).

5.12. The main road B5129 is running approximately 30 m to the southwest of the residential dwellings and the railway connecting Flint and Shotton is located approximately 20 m to the northeast of the residential dwellings.

5.13. Based on the Environmental Noise Mapping 2022 by Welsh Government[1], at the residential dwellings off Dee View Road, the ambient noise levels due to road traffic noise are 55-60 dB $L_{Aeq,16h}$ and 40-45 dB $L_{Aeq,8h}$; the ambient noise levels due to railway noise are 55-60 dB $L_{Aeq,16h}$ and 50-55 dB $L_{Aeq,night}$. The noise maps are shown in **Appendix Six**.

5.14. Considering the long distance between the site and the receptors, no acoustic feature corrections should be applied to the specific sound levels, so the rating levels are the same as the special sound levels. Given the high ambient noise levels, the background sound levels L_{A90} are very unlikely to be lower than 32 dB. As such, the rating levels are very unlikely to exceed the background sound levels.

5.15. A sound reduction of 10-15 dB is expected through a partially open window for ventilation, therefore internal noise from the plant noise (17 – 22 dB) would be well below the BS8233 guidelines for bedrooms (35 dB $L_{Aeq,16h}$ and 30 dB $L_{Aeq,8h}$) at the residential dwellings.

5.16. Therefore, the predicted sound levels generated by the operational and proposed new plants would result in Low impacts on the residential NSRs.

Ecological Receptors

5.17. The River Dee is a significant ecological feature in the Deeside area and represents an important bird habitat. Noise assessment is conducted for the bird habitats in line with the Waterbird Disturbance Mitigation Toolkit.

5.18. Based on **Table 4.1**, 50 dB can be used as an assessment criterion for the noise impacts of the normal operation on birds.

5.19. The highest noise level of the plant noise is 46 dB at NSR4, as shown in **Table 5.1**, which is the closest location of SSSI and SPA to the site boundary.

5.20. The L_{Aeq} noise levels of the site operation have been illustrated in the contour maps in **Appendix Five**. The contour lines of 50 dB L_{Aeq} is not within any boundaries of SSSI or SPA.

5.21. Therefore, the predicted noise levels fall into the **Low** effect category from The Waterbird Disturbance Mitigation Toolkit.

[1] https://datamap.gov.wales/maps/new?layergroup=geonode:Environmental_Noise_Mapping_2022#/

6. Conclusion

6.1. Bureau Veritas was instructed by Caulmert Ltd to undertake an environmental noise impact assessment to support an Environmental Permit variation application for the installation of additional peakers at Deeside Power Station, in Flintshire.

6.2. It is assumed that potential vibration impacts from operation of the new plant items will be negligible at the nearest receptors due to the separation distances, and this element has therefore been scoped out of the detailed assessment.

6.3. An assessment of the operational noise impact has been carried out in accordance with the relevant British Standard to consider the potential noise impact on the nearest noise sensitive receptors, including both residential receptors and ecological receptors.

6.4. A computational noise model of the proposed development was assembled and populated with noise emission data of the new sound sources and measured existing sound sources. Standard noise propagation calculations were used to predict the plant operation noise levels at the nearest noise sensitive receptors.

6.5. The assessment concludes that the noise impacts of the proposed site operation would Low for both residential receptors and ecological receptors. As such, no noise mitigation measures are required.

Appendix One – Glossary of Acoustic Terminology

Sound power level	A logarithmic measure of the power of a sound relative to a reference value.
"A" Weighting (dB(A))	The human ear does not respond uniformly to different frequencies. "A" weighting is commonly used to simulate the frequency response of the ear. It is used in the assessment of the risk of damage to hearing due to noise.
Decibel (dB)	The range of audible sound pressures is approximately 2 x 10^{-5} Pa to 200 Pa. Using decibel notation presents this range in a more manageable form, 0 dB to 140 dB.
Ambient sound level, $L_{Aeq,T}$	equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T. NOTE The ambient sound level is a measure of the residual sound and the specific sound when present.
Background sound level, $L_{90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.
Maximum sound level, $L_{Amax,T}$	The maximum RMS A-weighted sound pressure level occurring within a specified time period.
Noise	Unwanted sound.
Ambient sound	Totally encompassing sound in a given situation at any given time composed of noise from many sources, near and far.
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
Rating level	Specific sound level plus any adjustment for the characteristic features of the sound.

Appendix Two – Site and NSRs Locations

Figure A2.1 – Indicative Site location and NSR locations

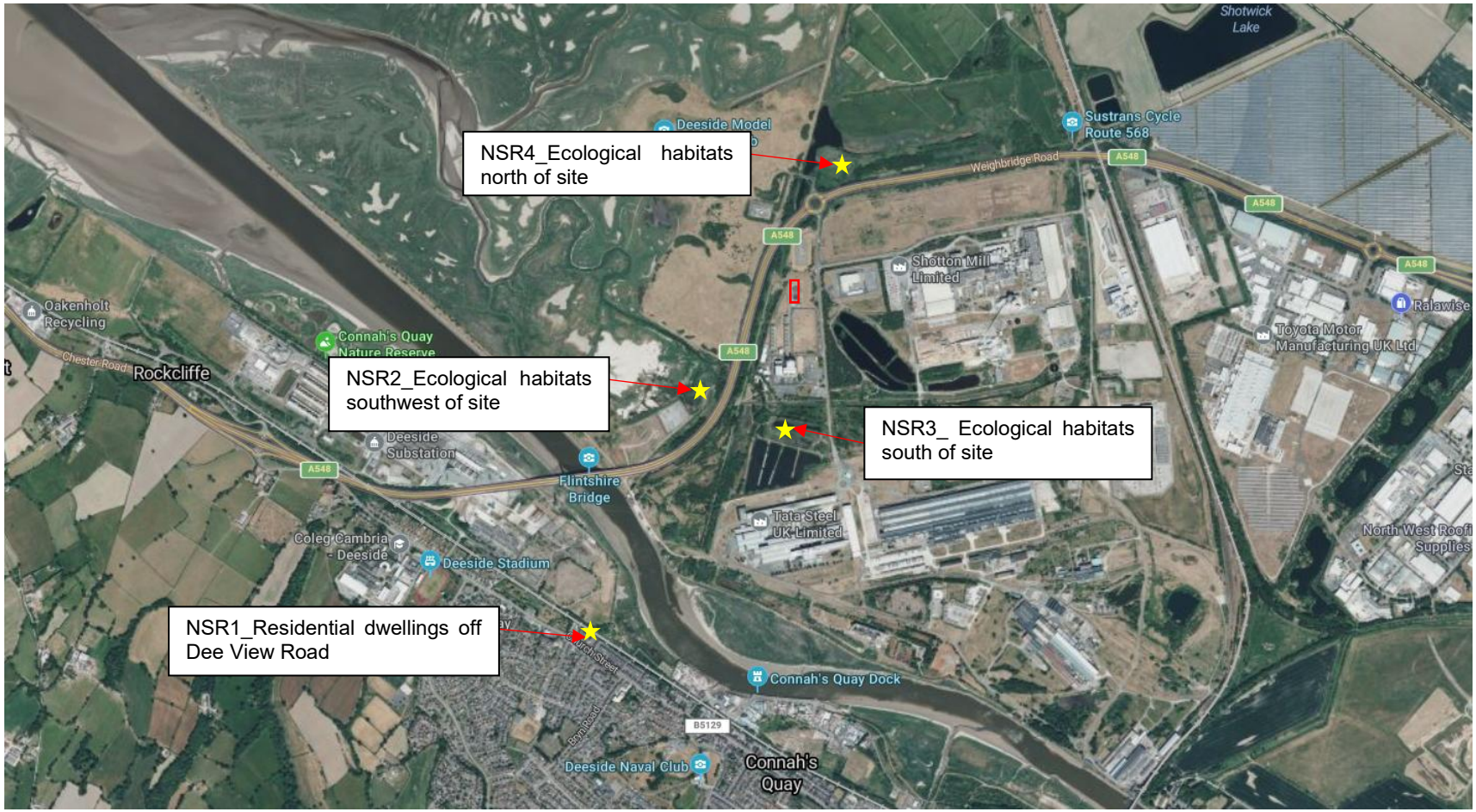


Figure A2.2 - Special Scientific Interest (SSSI) near the proposed site

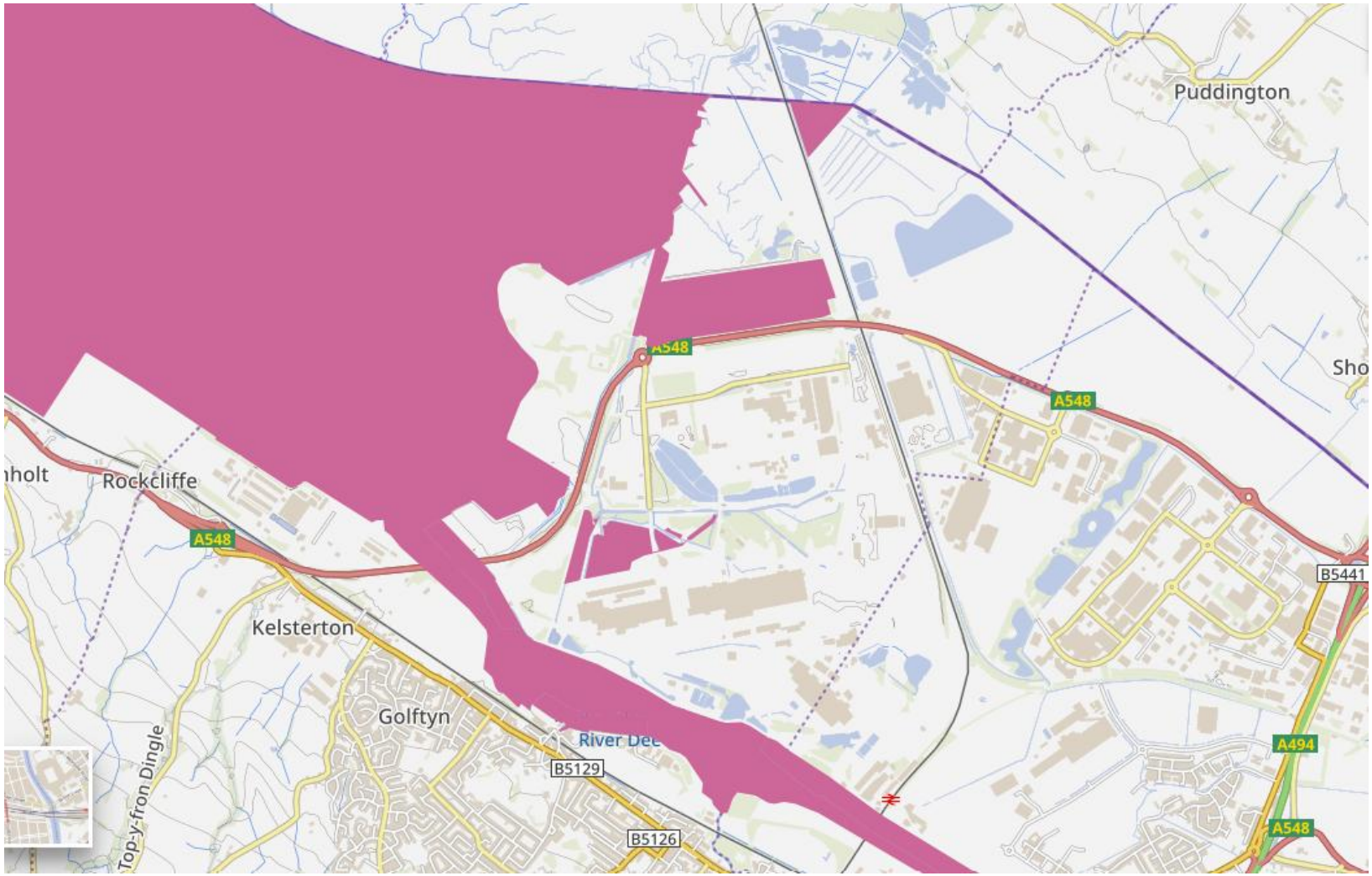
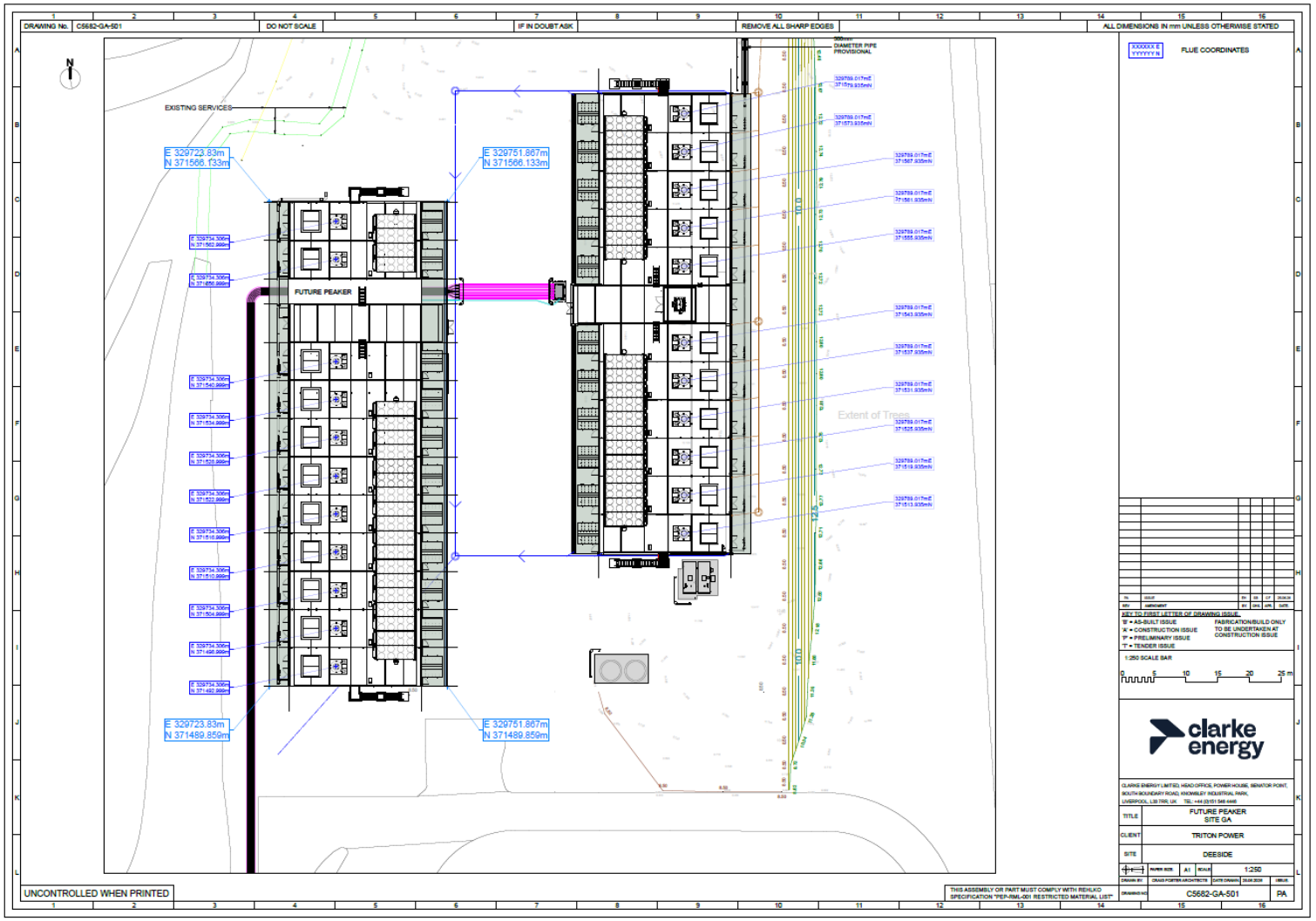


Figure A2.3 - Special Protection Areas (SPA) near the proposed site



Appendix Three – Plant Details



Appendix Four – Sound Source Spectrums

Plant	Sound Power Level SWL (dBA)	Octave Band Sound Power Level SWL (dB)							
		63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz
Air Intake (Edge Louvre)	96	106	104	95	92	89	85	85	90
Exhaust Outlet (Stack)	96	115	103	93	91	88	84	87	80
Radiator (Dry Air Coolers)	93	67	82	84	87	91	85	79	72
Transformer	86	82	87	86	86	80	75	70	63
Gas Skid	82	89	76	70	77	69	67	75	79
Genset enclosure	78	95	90	81	74	65	57	51	51
Air Outlet	96	107	107	98	89	86	83	84	90

Appendix Five – Noise Contours

Figure A5.1 Predicted noise propagation of the operational and the proposed plants – at 1.5 m high

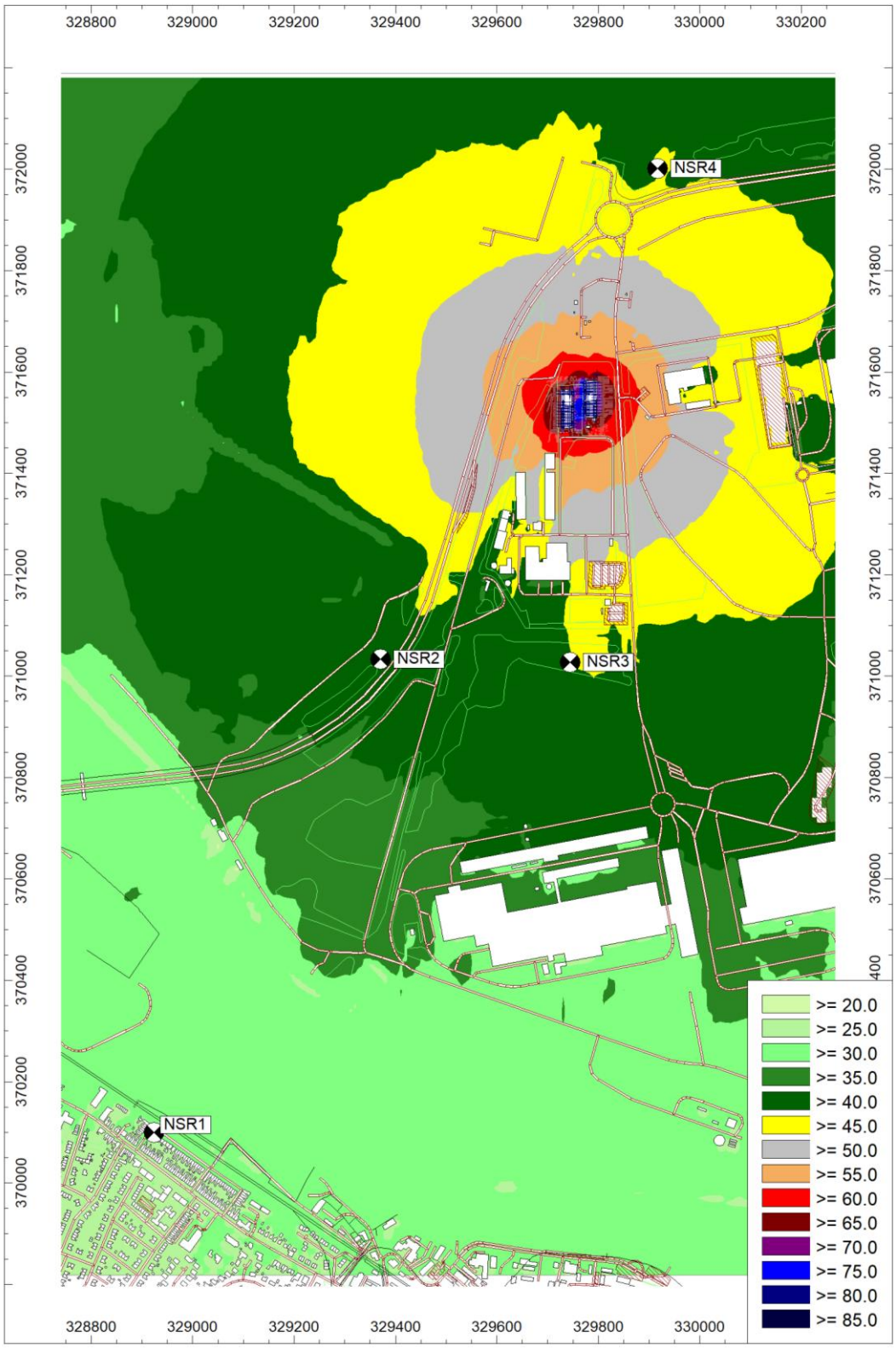
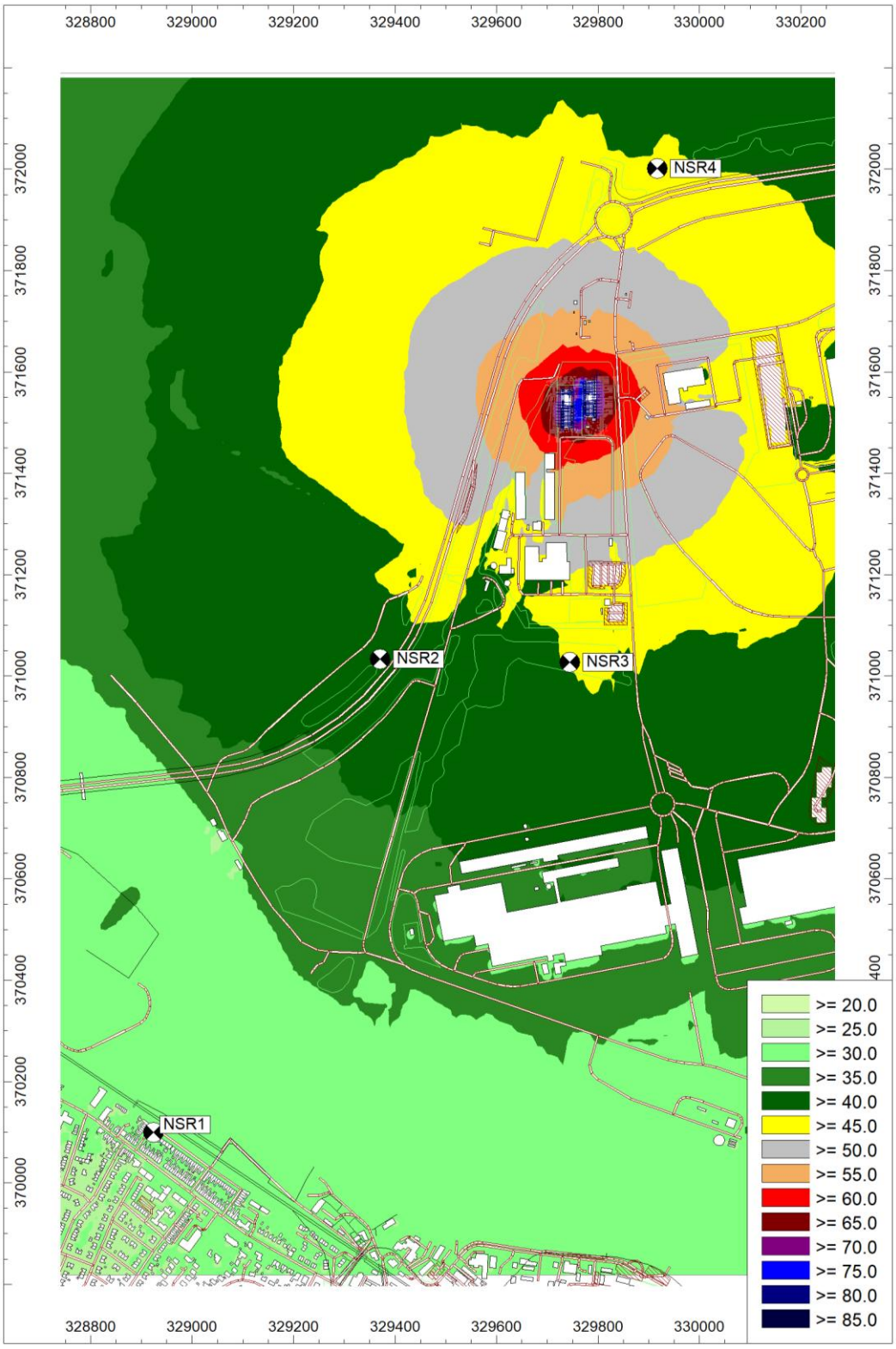


Figure A5.1 Predicted noise propagation of the operational and the proposed plants – at 4 m high



Appendix Six – Noise Maps from DataMap Wales

Figure A6.1 Road Traffic Noise $L_{Aeq,16h}$

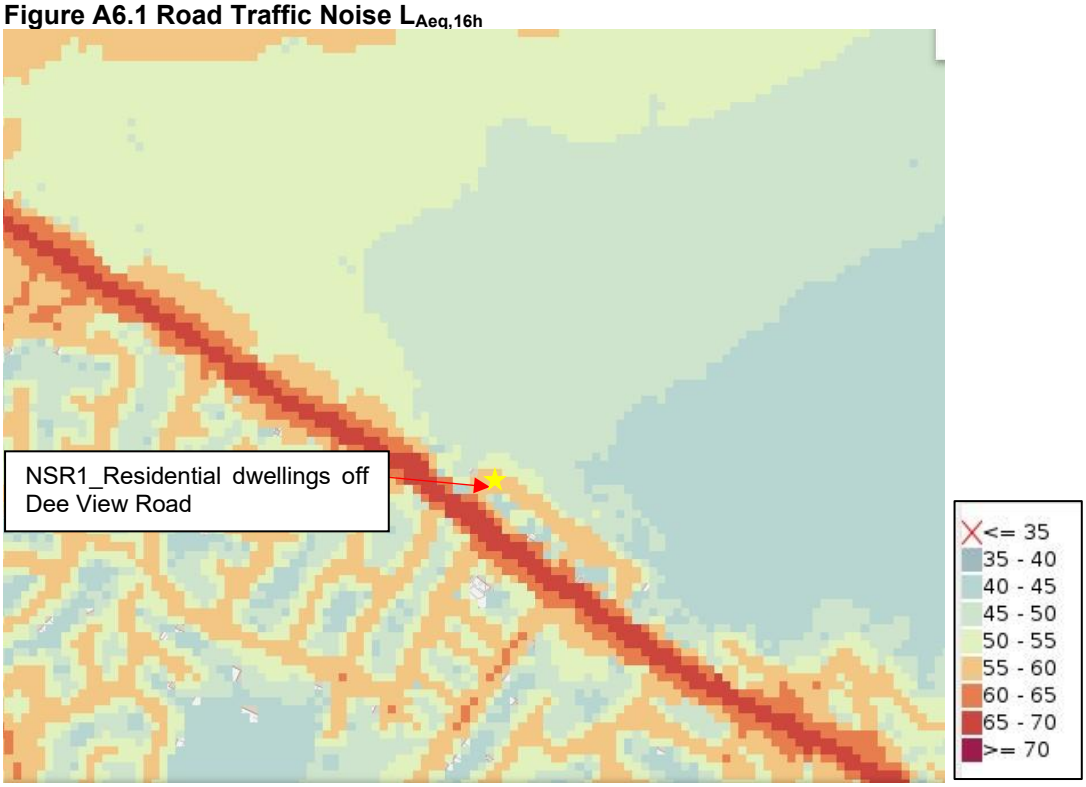


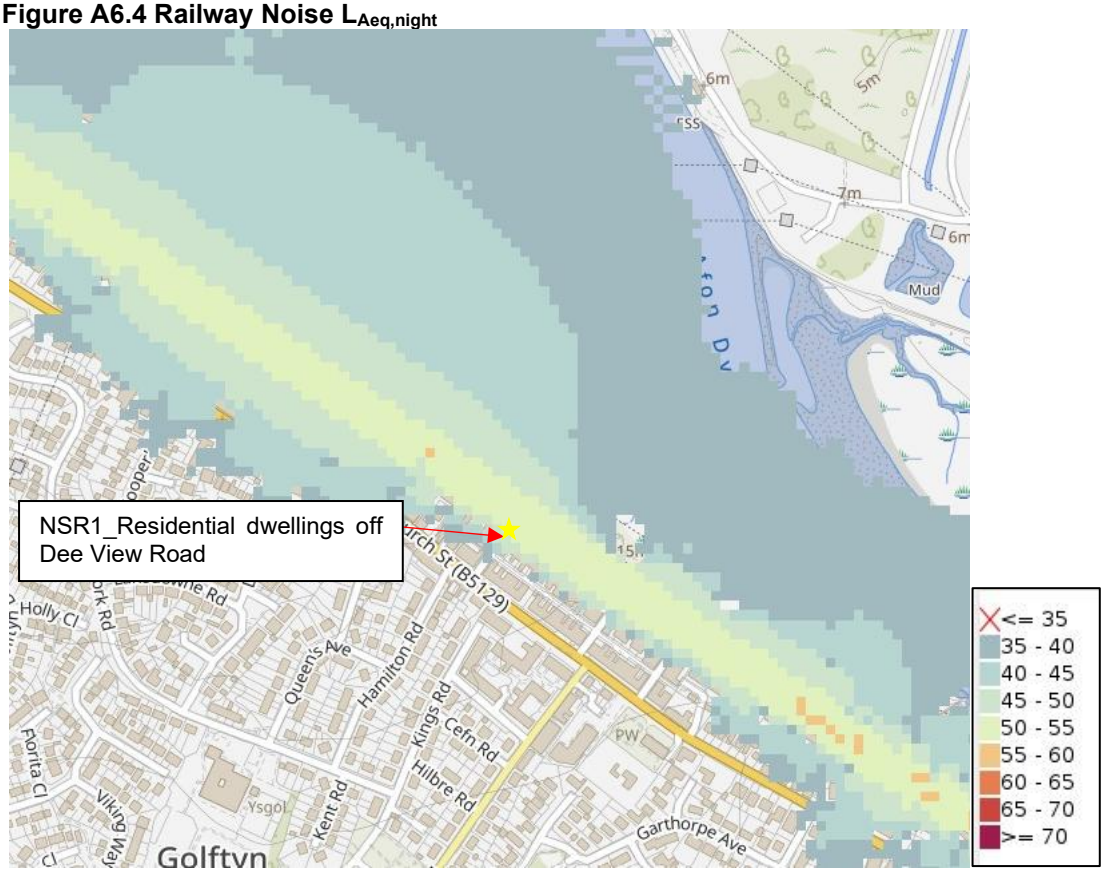
Figure A6.2 Road Traffic Noise $L_{Aeq,8h}$



Figure A6.3 Railway Noise $L_{Aeq,16h}$



Figure A6.4 Railway Noise $L_{Aeq,night}$



APPENDIX 2

Air Quality Assessment

Caulmert Limited

Deeside Power Station Peakers 2

Air Dispersion Modelling Report

Permit Variation (EPR/XP3131VK)

October 2026



Document Control Sheet

Identification	
Client	Caulmert
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Version	Date	Author	Reason for Issue/Summary of Changes	Status
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	Name	Job Title	Signature
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EXECUTIVE SUMMARY

Purpose of Report

Bureau Veritas has been commissioned by Caulmert for support with Environmental Permitting requirements for the proposed Peaking Power Plant at the former Deeside Power Plant. This document provides supporting technical information for the application of an Environmental Permit in accordance with the Industrial Emissions Directive (IED) to operate the site. This permit variation includes twenty-two gas-fired generators with a split of 11 generators each in two separate buildings, with a combined thermal input of 110 MW_{th}. Each generator discharges out of its own independent stack at up to 15 m from the ground.

The assessment has used detailed dispersion modelling to undertake a study of emissions to air during the operation for two scenarios:

- Scenario 1 (11 generators on site) – Existing Scenario covered by EPR/XP3131VK
- Scenario 2 (22 generators on site) – proposed scenario to be covered by Permit Variation

The generators are operated using natural gas as the fuel; hence, the following pollutants were included in the assessment: nitrogen oxides (NO_x) and carbon monoxide (CO). Release rates for NO_x and CO were derived using information provided by the generator manufacturers and emission limits legislation.

Summary of Conclusions

The assessment has resulted in the following conclusions:

- Considering annual mean results, all results at both human and ecological receptors were below the relevant assessment metrics.
- The results for nitrogen deposition show exceedances at nine ecological receptors for scenario 2. Where the contribution from the plant is less than 1% of the PC, this can be considered not significant. However, it is observed that three SSSIs contain exceedances within their contributing over 1% PC of critical load respectively, the eastern area within the Dee Estuary has five exceedances (E18, E19, E20, E25 and E26). The Shotton Lagoons and Reedbeds contains three exceedances at receptors (E57, E58, E59), and the Afon Dyfrdwy (River Dee) has one exceedance directly south of the site (E2). The 1% screening criterion is not a threshold of harm and exceeding this threshold does not, of itself, imply damage to a habitat.
- An ecological report was conducted by Rachel Hacking Ecology[1] to further investigate the exceedance of the 1% threshold, in which for all designation exceedances states that any additional atmospheric nitrogen deposition has the potential for an adverse impact, but the additional process contribution is unlikely to be significant given the existing background levels causing the exceedance.
- As the modelled results of the acid deposition PC are less than 1% of the PEC at all considered ecological receptors, these can be described as not significant.
- Considering short-term results, all results at human and ecological receptors were below the relevant assessment metrics.

[1] Ecological Assessment Peaking Plant Nitrogen Exceedance Assessment

Due to conservative conditions being employed throughout the assessment, the modelled predictions are expected to represent the upper limit of concentrations.

1 INTRODUCTION

Bureau Veritas has been commissioned by Caulmert for support with Environmental Permitting requirements for the proposed Peaking Power Plant at the former Deeside Power Plant. This document provides supporting technical information for the application of an Environmental Permit in accordance with the Industrial Emissions Directive (IED) to operate the site. This permit variation includes twenty-two gas-fired generators with a split of 11 generators in two separate peaker plants, with a combined thermal input of 110 MWth. Each generator discharges out of its own independent stack at up to 15 m from the ground.

Each of the generators utilise natural gas, hence, the following pollutants were included in the assessment: nitrogen oxides (NO_x (as NO_2)) and carbon monoxide (CO).

This report presents the methodology and the subsequent results of the dispersion modelling of emissions to air.

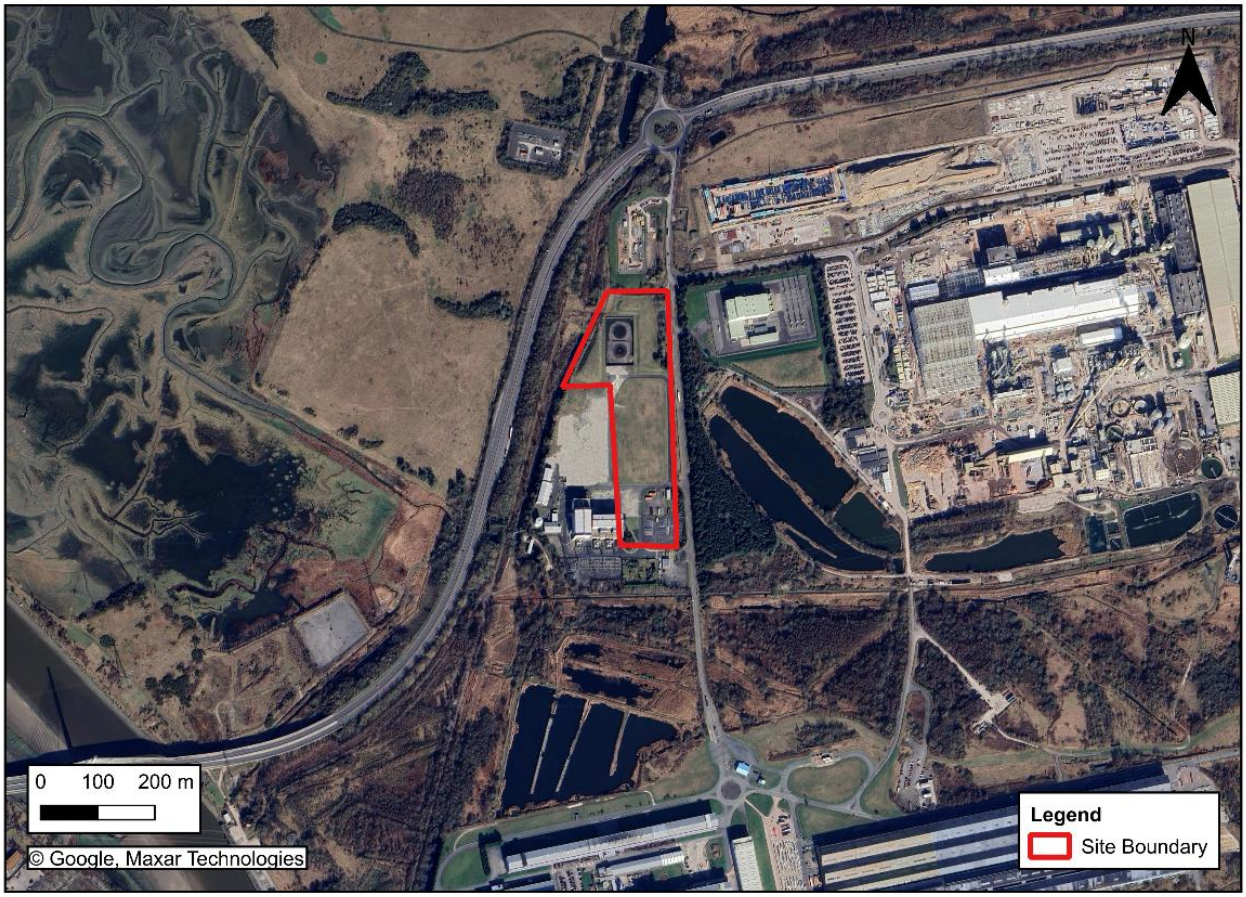
1.1 Site location

The site is located off the A548, about 1.5 km north of Connah's Quay High Street. The area around the site is primarily industrial in nature with areas of ecological designations, as well as residential areas at a greater distance. The site location is shown in Figure 1.1.

The closest human receptors to the site are residential properties at Connah's Quay, located approximately 1.2 km of the site boundary to the south. The closest ecological receptor, designated as a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) (Dee Estuary), is located approximately 350 m west of the site.

In terms of existing air quality conditions in the area, there are no Air Quality Management Area (AQMA) declared within the jurisdiction of the North Wales Authorities. The closest AQMA to the site is the Chester City Centre, located 11.2 km west of the Site. This AQMA is declared for exceedances of the annual mean nitrogen dioxide (NO_2) objective. Due to the distance between the site and the AQMA, it is unlikely that the sites activities will affect NO_2 concentration within the AQMA.

Figure 1.1 – Site Location



2 DISPERSION MODELLING METHODOLOGY

ADMS 6 version 6.0.2.1 modelling software was used for this study. ADMS 6 is an advanced atmospheric dispersion model that has been developed and validated by Cambridge Environmental Research Consultants (CERC). The model was used to predict ground level concentrations of combustion products emitted to atmosphere from the combustion plant at the site. The model is used extensively throughout the UK for regulatory compliance purposes. It is accepted as an appropriate air quality modelling tool by the Environment Agency (EA) and local authorities.

ADMS 6 parameterises stability and turbulence in the Atmospheric Boundary Layer (ABL) by the Monin-Obukhov length and the boundary layer depth. This approach allows the vertical structure of the ABL to be more accurately defined than by the stability classification methods of earlier dispersion models such as R91 or ISCST3. In ADMS, the concentration distribution follows a symmetrical Gaussian profile in the vertical and crosswind directions in neutral and stable conditions. However, the vertical profile in convective conditions follows a skewed Gaussian distribution to take account of the inhomogeneous nature of the vertical velocity distribution in the Convective Boundary Layer (CBL).

A range of input parameters is required for the model. This includes, but is not limited to, data describing the local area, meteorological measurements, and emissions data. The data utilised within the modelling assessment is detailed in the following sections of this chapter.

2.1 Process Emissions

Details of the generators at the site have been provided to Bureau Veritas by Caulmert.

The assessment evaluates two scenarios:

- **Scenario 1** models the existing permit (EPR/XP3131VK), comprising 11 generators located on the north side of the site.

- **Scenario 2** models an additional 11 generators located in a separate building unit, a total of 22 generators distributed across two building units on the north side of the site have been assessed.

The model input parameters for each type of combustion plant are detailed in Table 2.1. Release rates for NO_x and CO were derived using information provided by the generator manufacturers and emission limits legislation. All generators have been modelled as vertical point sources. The data input into the calculations which have been undertaken to derive pollutant emission rates from information provided by Caulmert are detailed in Table 2.1.

Table 2.2 presents the coordinates for all 22 modelled generator locations. Generator IDs 1–11 represent the existing permitted generators, while Generator IDs 12–22 represent the additional proposed generators for the permit variation.

Table 2.1 – Exhaust Parameters

Parameter	Gens 1 – 22
Stack Height (m) [a]	15.0
Stack Diameter (m) [a]	0.8
Rated Electrical Output (kW)	4,500
Electrical Efficiency (%)	45.5
Volume Flow (Nm^3/s)	8.30
Volume Flow (Am^3/s)	11.96
Actual Oxygen Content (%)	10.46
Efflux Velocity ($m\ s^{-1}$) [b]	23.79
Efflux Temperature (°C) [a]	351
NO_X (mg/m^3)	95
CO (mg/m^3)	100
NO_X (g/s)	0.79
CO (g/s)	0.83

Reference conditions: 273 K, 101.3 kPa, 15% O_2, dry gas

Table 2.2 – Generator Locations

Generator	X (m)	Y (m)
1	329789	371514
2	329789	371520
3	329789	371526
4	329789	371532
5	329789	371538
6	329789	371544
7	329789	371556
8	329789	371562
9	329789	371568
10	329789	371574
11	329789	371580
12	329734	371493
13	329734	371499
14	329734	371505
15	329734	371511
16	329734	371517
17	329734	371523
18	329734	371529
19	329734	371535
20	329734	371541
21	329734	371557
22	329734	371563

Table 2.3 – Modelled Scenarios

Scenario Name	Operations
Scenario 1	11 generators running placed at the north end of the site
Scenario 2	22 generators running placed at the north end of the site

Since the exact time during the year when the gensets will operate is currently unknown, the model was run for 8760 hours. This is a conservative estimate, as exact operating hours is unknown. Results have been post-processed to account for short-term averaging periods, according to the following:

- For annual averaging periods, result have been post-processed using the factor n/8760, where ‘n’ is the total operating hours within an annual period.
- For averaging periods of 24 hours or 8 hours, results have been post-processed using the factor n/24, or n/8, where ‘n’ is the total operating hours within the relevant period.
- The annual averaging periods were post-processed for a total of 2000 hours of operation.

The buildings and emission points included in the modelled scenarios are displayed in Figure 2.1 and Figure 2.1.

Figure 2.1 – Emission Points Visualisation (Scenario 1)

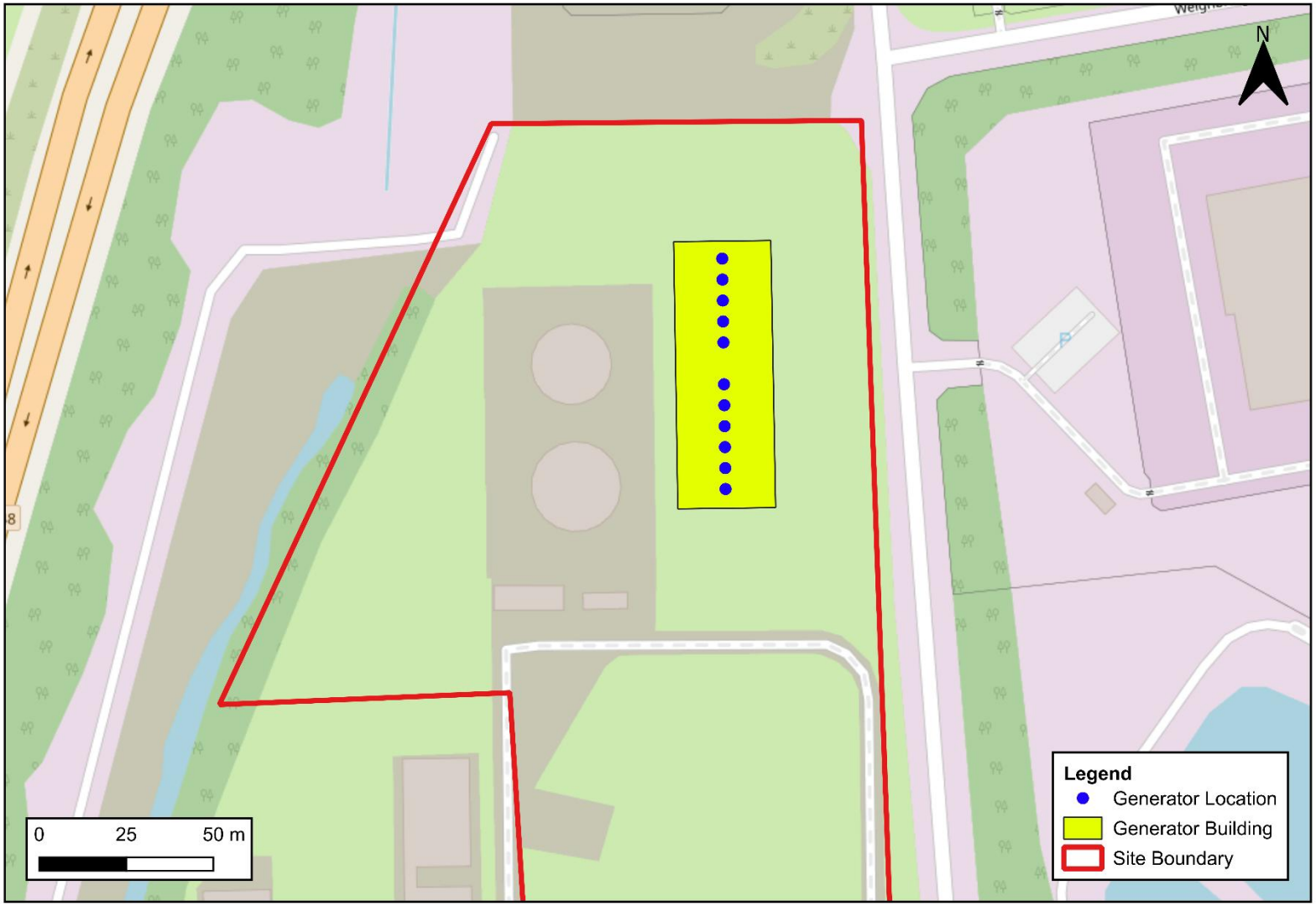
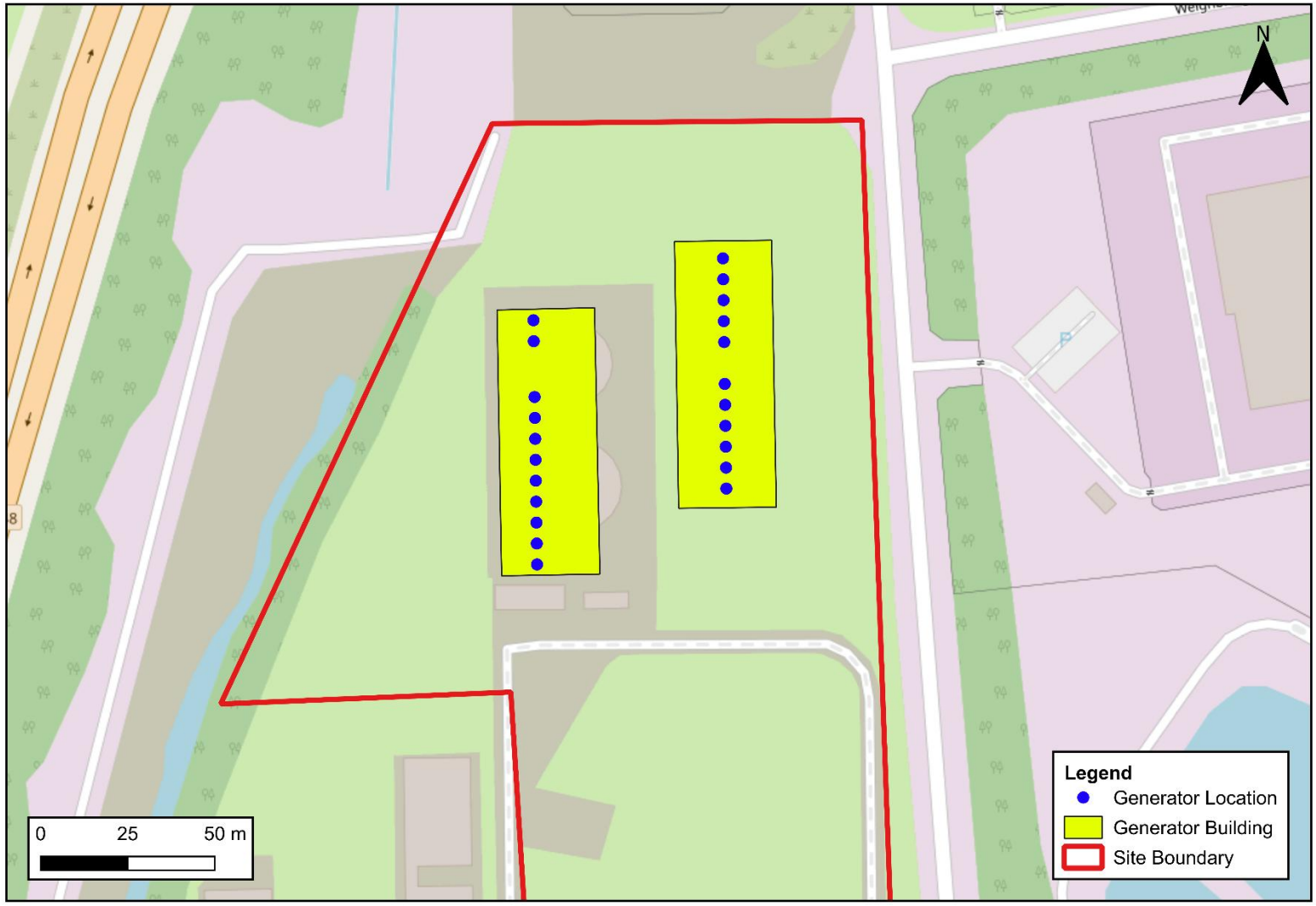


Figure 2.2 – Emission Points Visualisation (Scenario 2)



2.2 Meteorology

For meteorological data to be suitable for dispersion modelling purposes, a number of meteorological parameters need to be measured on an hourly basis. These parameters include wind speed, wind direction, cloud cover and temperature. There are only a limited number of monitoring sites where the required meteorological measurements are made. The year of meteorological data that is used for a modelling assessment can also have a significant effect on ground level concentrations.

This assessment has utilised meteorological data recorded at the Hawarden meteorological station during across a five-year period (2021 to 2025). The Hawarden meteorological station is located approximately 7.9 km to the southeast of the site and offers data in a suitable format for the model. Figure 2.3 – Figure 2.7 illustrate the frequency of wind directions and wind speeds for the years considered.

ADMS cannot, as standard, model calm weather conditions, since this results in a discontinuity produced by a 'divide by zero' calculation. Most Gaussian plume models simply skip lines of meteorological data where calm conditions occur. Met lines will also be skipped where any of the required meteorological input parameters are missing. The generally accepted best practice requirement is to ensure that no more than 10% of meteorological data is omitted from the model run.

Table 2.4 demonstrates that this requirement was satisfied for all the meteorological 'met' data years proposed for the assessment. This is presented in Table 2.4.

Table 2.4 – Meteorological Data Capture

Year	Number of met lines used	Number of lines with calm conditions 0	Number of lines with inadequate data -999	Number of non-calm met lines with wind speed less than the minimum value of 0.75 m/s	Percentage of lines used
2021	8565	102	93	549	98%
2022	8547	205	8	442	98%
2023	8535	216	9	409	97%
2024	8231	225	328	462	94%
2025	8341	313	106	530	95%

Figure 2.3 – 2021 Hawarden Wind Rose

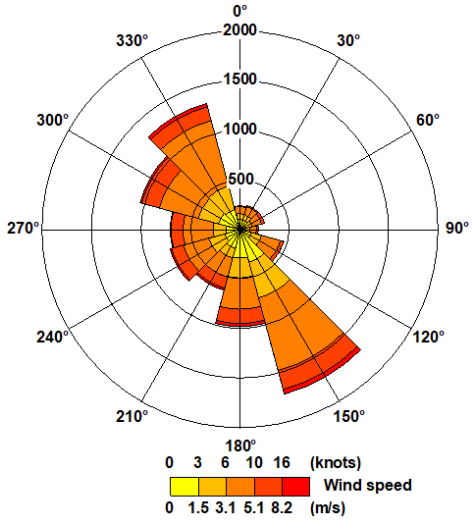


Figure 2.4 – 2022 Hawarden Wind Rose

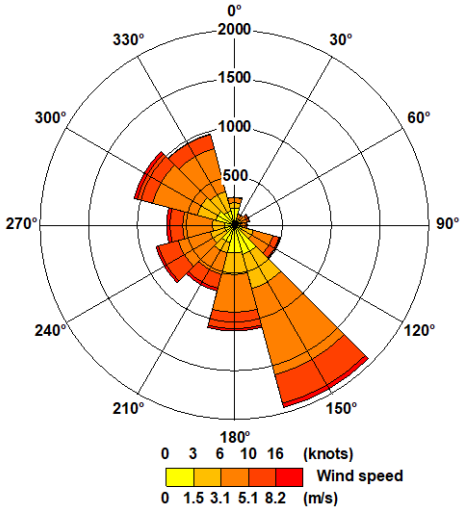


Figure 2.5 – 2023 Hawarden Wind Rose

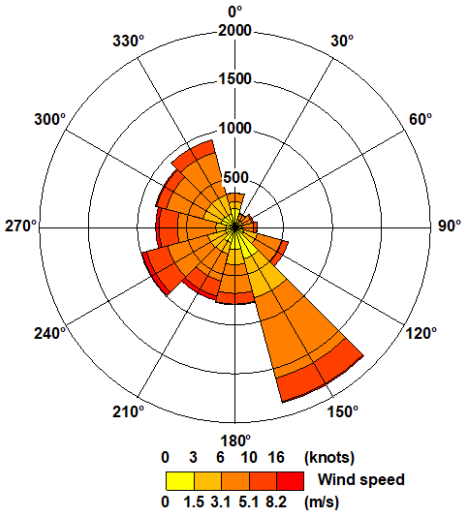


Figure 2.6 – 2024 Hawarden Wind Rose

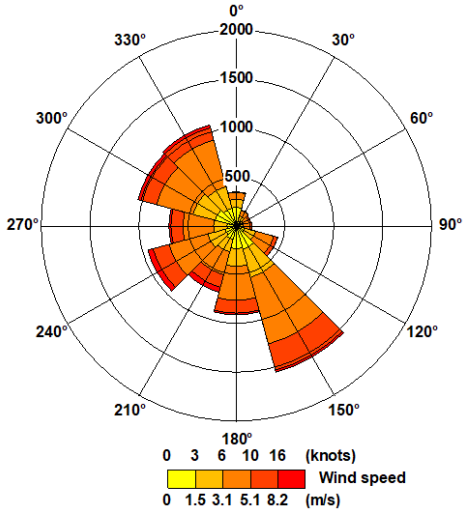
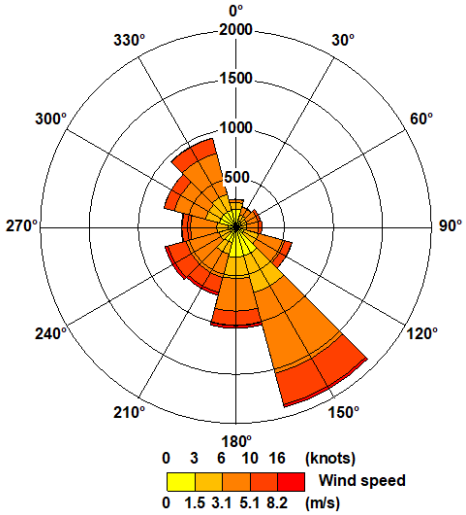


Figure 2.7 – 2025 Hawarden Wind Rose



2.3 Surface Characteristics

The predominant surface characteristics and land use in a model domain have an important influence in determining turbulent fluxes and, hence, the stability of the boundary layer and atmospheric dispersion. Factors pertinent to this determination are detailed below.

2.3.1 Surface Roughness

Roughness length, z_0, represents the aerodynamic effects of surface friction and is physically defined as the height at which the extrapolated surface layer wind profile tends to zero. This value is an important parameter used by meteorological pre-processors to interpret the vertical profile of wind speed and estimate friction velocities which are, in turn, used to define heat and momentum fluxes and, consequently, the degree of turbulent mixing.

The surface roughness length is related to the height of surface elements; typically, the surface roughness length is approximately 10% of the height of the main surface features. Thus, it follows that surface roughness is higher in urban and congested areas than in rural and open areas. Oke (1987) and CERC (2003) suggest typical roughness lengths for various land use categories (Table 2.5).

Table 2.5 – Typical Surface Roughness Lengths for Various Land Use Categories

Type of Surface	z_0 (m)
Ice	0.00001
Smooth snow	0.00005
Smooth sea	0.0002
Lawn grass	0.01
Pasture	0.2
Isolated settlement (farms, trees, hedges)	0.4
Parkland, woodlands, villages, open suburbia	0.5-1.0
Forests/cities/industrialised areas	1.0-1.5
Heavily industrialised areas	1.5-2.0

Increasing surface roughness increases turbulent mixing in the lower boundary layer. This can often have conflicting impacts in terms of ground level concentrations:

- The increased mixing can bring portions of an elevated plume down towards ground level, resulting in increased ground level concentrations closer to the emission source; however;
- The increased mixing increases entrainment of ambient air into the plume and dilutes plume concentrations, resulting in reduced ground level concentrations further downwind from an emission source.

The overall impact on ground level concentration is, therefore, strongly correlated to the distance and orientation of a receptor from the emission source.

2.3.2 Surface Energy Budget

One of the key factors governing the generation of convective turbulence is the magnitude of the surface sensible heat flux. This, in turn, is a factor of the incoming solar radiation. However, not all solar radiation arriving at the Earth's surface is available to be emitted back to atmosphere in the form of sensible heat. By adopting a surface energy budget approach, it can be identified that, for fixed values of incoming short and long wave solar radiation, the surface sensible heat flux is inversely proportional to the surface albedo and latent heat flux.

The surface albedo is a measure of the fraction of incoming short-wave solar radiation reflected by the Earth's surface. This parameter is dependent upon surface characteristics and varies throughout the year. Oke (1987) recommends average surface albedo values of 0.6 for snow covered ground and 0.23 for non-snow covered ground, respectively.

The latent heat flux is dependent upon the amount of moisture present at the surface. The Priestly-Taylor parameter can be used to represent the amount of moisture available for evaporation:

$$\alpha = \frac{1}{S(B+1)}$$

Where:

α = Priestly-Taylor parameter (dimensionless)

$$S = \frac{s}{s+\gamma}$$

$$s = \frac{de}{dT}$$

e_s = Saturation specific humidity (kg H_2O / kg dry air)

T = Temperature (K)

$$\gamma = \frac{c_{pw}}{\lambda}$$

c_{pw} = Specific heat capacity of water (kJ kg^{-1} K^{-1})

λ = Specific latent heat of vaporisation of water (kJ kg^{-1})

B = Bowen ratio (dimensionless)

Areas where moisture availability is greater will experience a greater proportion of incoming solar radiation released back to atmosphere in the form of latent heat, leaving less available in the form of sensible heat and, thus, decreasing convective turbulence. Holstag and van Ulden (1983) suggest values of 0.45 and 1.0 for dry grassland and moist grassland respectively.

2.3.3 Selection of Appropriate Surface Characteristic Parameters for the Site

A detailed analysis of the effects of surface characteristics on ground level concentrations by Auld et al. (2002) led them to conclude that, with respect to uncertainty in model predictions:

> *"…the energy budget calculations had relatively little impact on the overall uncertainty"*

In this regard, it is not considered necessary to vary the surface energy budget parameters spatially or temporally, and annual averaged values have been adopted throughout the model domain for this assessment.

As snow covered ground is only likely to be present for a small fraction of the year, the surface albedo of 0.23 for non-snow-covered ground advocated by Oke (1987) has been used whilst the model default α value of 1.0 has also been retained.

From examination of 1:10,000 Ordnance Survey maps, it can be seen that within the immediate vicinity of the site, land use is predominately industrial to the west with more open land to the east and south. Consequently, a composite surface roughness length of 0.3 m has been deemed appropriate to take account of the respective land use categories in the model domain. For the meteorological site, a surface roughness of 0.3 m has been utilised given the representative land use categories in this area.

2.4 Buildings

Any large, sharp-edged object has an impact on atmospheric flow and air turbulence within the locality of the object. This can result in maximum ground level concentrations that are significantly different (generally higher) from those encountered in the absence of buildings. The building 'zone of influence' is generally regarded as extending a distance of 5L (where L is the lesser of the building height or width) from the foot of the building in the horizontal plane and three times the height of the building in the vertical plane.

The main building specifications, where the generators are situated were provided by Caulmert. The specifications for seven other buildings situated to the west and south of the main generator building were also inputted into the model. Details of the buildings included in the model are provided in Table 2.6.

Table 2.6 – Modelled Buildings

Name	Centre Easting (m)	Centre Northing (m)	Height (m)	Length / Diameter (m)	Width (m)
Main Generator Building	329739	371528	5	76.2	28.1
Building 1	329789	371547	5	76.2	28.1
Building 2	329819	371145	5	12.67	11.42
Building 3	329712	371206	22	36.43	64.11
Building 4	329666	371212	28	48.1	28.18
Building 5	329667	371246	19	18.42	28.2
Building 6	329617	371209	8	16	22.75
Building 7	329606	371268	10	18.5	36.32
Building 8	329612	371299	8	14.95	24.29

2.5 Terrain

The concentrations of an emitted pollutant found in elevated, complex terrain differ from those found in simple level terrain. There have been numerous studies on the effects of topography on atmospheric flows. A summary of the main effects of terrain on atmospheric flow and dispersion of pollutants are summarised below:

- Plume interactions with windward facing terrain features;
    - Plume interactions with terrain features whereby receptors on hills at a similar elevation to the stack experience elevated concentrations.
    - Direct impaction of the plume on hill slopes in stable conditions.

- Flow over hills in neutral conditions can experience deceleration forces on the upwind slope, reducing the rate of dispersion and increasing concentrations.

- Plume interactions with lee sides of terrain features; and
    - Regions of recirculation behind steep terrain features can rapidly force pollutants towards the ground culminating in elevated concentrations.
    - Releases into the lee of a hill in stable conditions can also be recirculated, resulting in increased ground level concentrations.

- Plume interactions within valleys.
    - Releases within steep valleys experience restricted lateral dispersion due to the valley sidewalls. During stable overnight conditions, inversion layers develop within the valley essentially trapping all emitted pollutants. Following sunrise and the erosion of the inversion, elevated ground level concentrations can result during fumigation events.
    - Convective circulations in complex terrain due to differential heating of the valley side walls can lead to the impingement of plumes due to crossflow onto the valley sidewalls and the subsidence of plume centrelines, both having the impact of increasing ground level concentrations.

These effects are most pronounced when the terrain gradients exceed 1 in 10, i.e., a 100 m change in elevation per 1 km step in the horizontal plane. In the model domain the terrain around the site does not exceed this criterion and terrain has therefore been excluded within the model.

2.6 Modelled Domain and Receptors

2.6.1 Modelled Domain

A 4 km x 4 km Cartesian grid centred on the site was modelled, with an approximate receptor resolution of 13 m, to assess the impact of atmospheric emissions from the site on local air quality. This grid resolution has been selected to ensure that all local receptors are within the gridded area, and the resolution is such that the maximum impact will be identified.

2.6.2 Human Receptors

The receptors considered were chosen based on locations where people may be located and judged in terms of the likely duration of their exposure to pollutants and proximity to the site, following the guidance given in Section 4 of this report. Details of the locations of human receptors are given in Table 2.7 and illustrated Figure 2.8 below. Human receptors have been modelled at a height of 1.5 m, representative of the normal ‘breathing zone’ height.

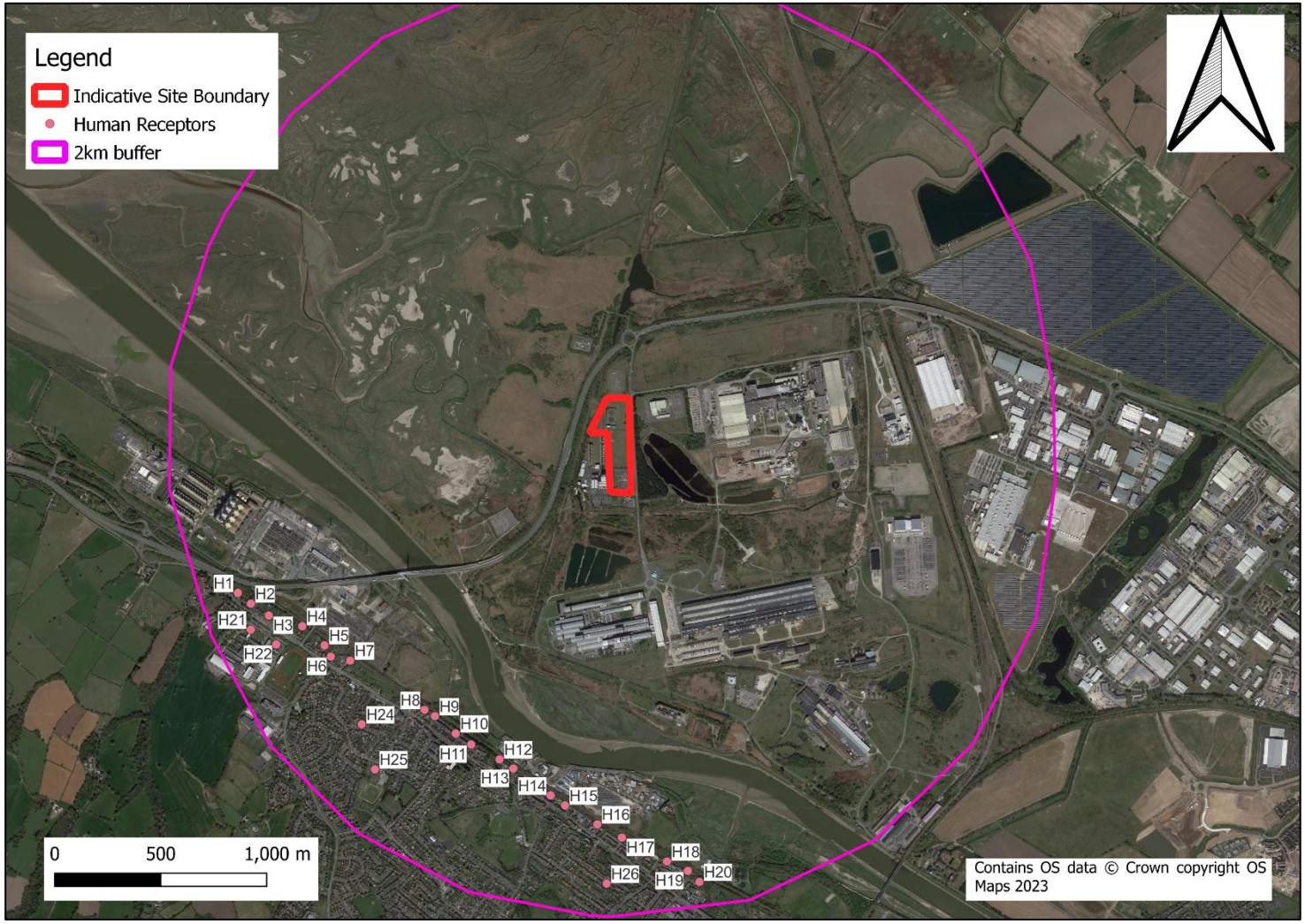
The majority of human receptors are locations where both long-term and short-term pollutant averaging periods will apply (see Table 4.2).

Workplace locations have been excluded in accordance with the guidance from Environmental Protection UK and the Air Quality Standards Regulations 2010. These guidance documents are detailed in Section 4 of this report.

Table 2.7 – Modelled Human Receptors

ID	Receptor Description	Easting (m)	Northing (m)	Height (m)
H1	Residential	327983	370701	1.5
H2	Residential	328045	370650	1.5
H3	Residential	328130	370594	1.5
H4	Residential	328288	370544	1.5
H5	Residential	328392	370453	1.5
H6	Residential	328422	370401	1.5
H7	Residential	328513	370382	1.5
H8	Residential	328864	370150	1.5
H9	Residential	328913	370120	1.5
H10	Residential	329011	370038	1.5
H11	Residential	329084	369986	1.5
H12	Residential	329218	369916	1.5
H13	Residential	329283	369873	1.5
H14	Residential	329459	369746	1.5
H15	Residential	329527	369699	1.5
H16	Residential	329679	369610	1.5
H17	Residential	329795	369547	1.5
H18	Residential	330008	369435	1.5
H19	Residential	330106	369390	1.5
H20	Residential	330161	369338	1.5
H21	Residential	328044	370528	1.5
H22	Residential	328165	370457	1.5
H23	Residential	328568	370081	1.5
H24	Residential	328630	369869	1.5
H25	Residential	329723	369330	1.5
H26	Residential	327983	370701	1.5

Figure 2.8 – Location of Modelled Human Receptors



2.6.3 Ecological Receptors

The Environment Agency's AER Guidance provides the following detail regarding consideration of ecological receptors:

- Check if there are any of the following within 10 km of your site (within 15 km if you operate a large electric power station or refinery):
    - Special Protection Areas (SPAs)
    - Special Areas of Conservation (SACs)
    - Ramsar Sites (protected wetlands)
- Check if there are any of the following within 2 km of your site:
    - Sites of Special Scientific Interest (SSSIs)
    - Local Nature Sites (ancient woods, Local Wildlife Sites (LWS), Sites of Nature Conservation Importance (SNCIs) and national and Local Nature Reserves (LNR)).

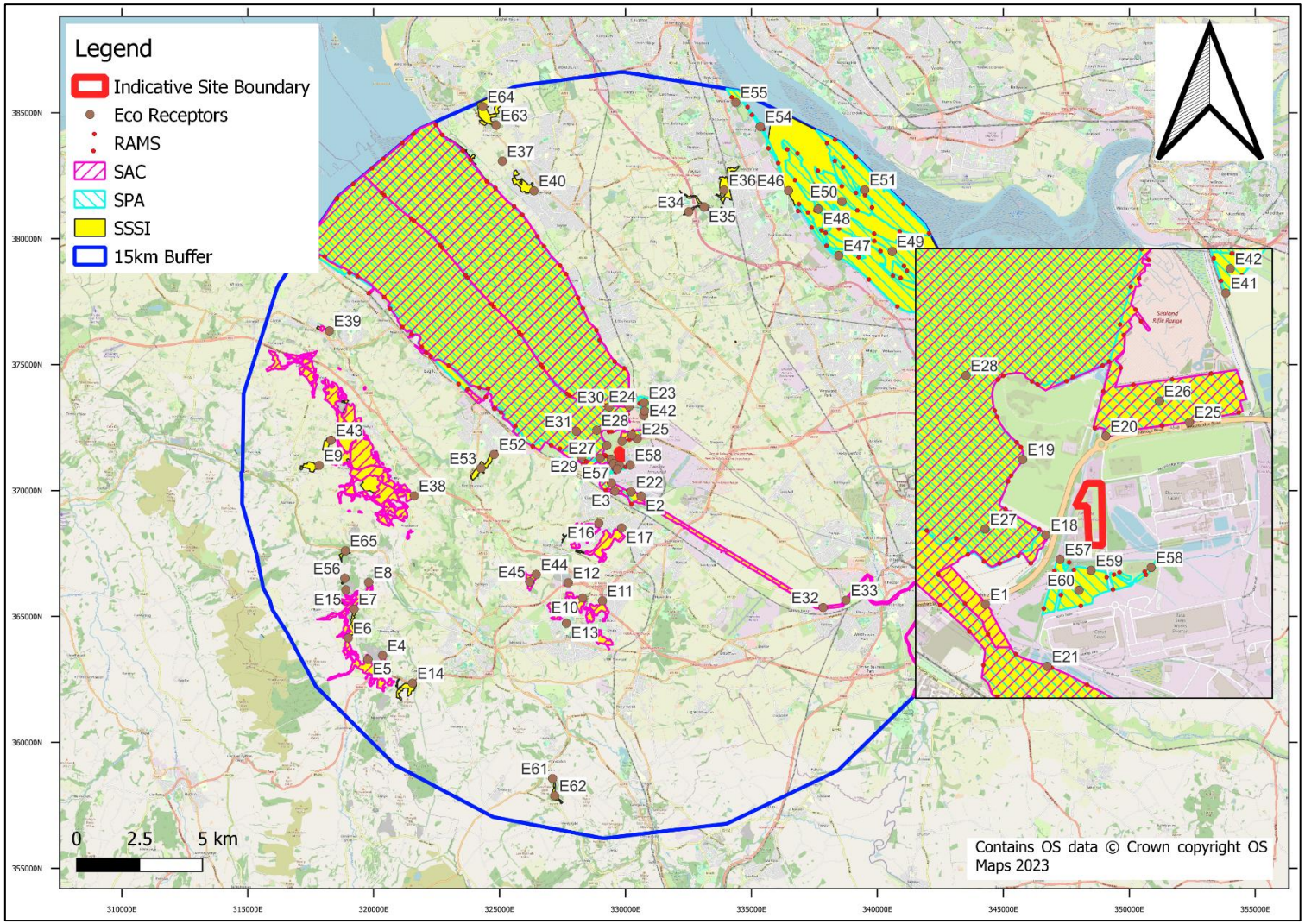
Following the above guidance, Table 2.8 and Figure 2.9 provide details of sixty-five ecological receptor points which have been considered within this assessment.

Table 2.8 – Modelled Ecological Receptors

ID	Receptor Description	Easting (m)	Northing (m)	Height (m)
E1	River Dee SSSI/SAC	328996	370750	0
E2	River Dee SSSI/SAC	330622	369775	0
E3	River Dee SSSI/SAC	329577	369974	0
E4	Alyn Valley SSSI/SAC	320357	363452	0
E5	Alyn Valley SSSI/SAC	319771	363294	0
E6	Alyn Valley SSSI/SAC	318992	364142	0
E7	Alyn Valley SSSI/SAC	319223	365292	0
E8	Alyn Valley SSSI/SAC	319802	366348	0
E9	Parc Bodlondeb SSSI	317835	370994	0
E10	Buckley Claypits SSSI/SAC	328306	365733	0
E11	Buckley Claypits SSSI/SAC	329085	365621	0
E12	Buckley Claypits SSSI/SAC	327724	366335	0
E13	Buckley Claypits SSSI	327655	364728	0
E14	Cambrian Quarry SSSI	321541	362345	0
E15	Cefn Meadow SSSI	318892	366055	0
E16	Connah's Quay SSSI/SAC	328940	368703	0
E17	Connah's Quay SSSI/SAC	329849	368513	0
E18	Dee Estuary SSSI/SPA/SAC/RAMS	329430	371247	0
E19	Dee Estuary SSSI/SPA/SAC	329263	371790	0
E20	Dee Estuary SSSI/SPA/SAC/RAMS	329861	371958	0
E21	Dee Estuary SSSI/SPA/SAC/RAMS	329439	370304	0
E22	Dee Estuary SSSI/SPA/SAC/RAMS	330224	369943	0
E23	Dee Estuary SSSI/SAC/RAMS	330742	373480	0
E24	Dee Estuary SSSI/SPA/SAC/RAMS	330148	373343	0
E25	Dee Estuary SSSI/SPA/SAC/RAMS	330461	372058	0
E26	Dee Estuary SSSI/SPA/SAC/RAMS	330246	372209	0
E27	Dee Estuary SSSI/SPA/SAC/RAMS	328993	371290	0

E28	Dee Estuary SSSI/SPA/SAC/RAMS	328856	372392	0
E29	Dee Estuary SSSI/SPA/SAC/RAMS	328265	371334	0
E30	Dee Estuary SSSI/SPA/SAC/RAMS	329346	373312	0
E31	Dee Estuary SSSI/SPA/SAC/RAMS	328044	372351	0
E32	Dee Estuary SSSI/SPA	337849	365350	0
E33	Dee Estuary SSSI/SPA	338760	365643	0
E34	Dibbinsdale SSSI	332516	381069	0
E35	Dibbinsdale SSSI	333121	381262	0
E36	Dibbinsdale SSSI	333912	381933	0
E37	The Dungeon SSSI	325111	383079	0
E38	Halkyn Mountains SSSI/SAC	321612	369788	0
E39	Halkyn Mountains SSSI/SAC	318242	376338	0
E40	Heswall Dales SSSI	326366	381899	0
E41	Inner Marsh SSSI/SPA/RAMS	330722	372985	0
E42	Inner Marsh SSSI/SPA/RAMS	330754	373160	0
E43	Parc Linden SSSI	318309	371997	0
E44	Maes SSSI/SAC	326455	366663	0
E45	Maes SSSI/SAC	326196	366373	0
E46	Mersey Estuary SSSI	336473	381910	0
E47	Mersey Estuary SSSI/SPA/RAMS	338470	379334	0
E48	Mersey Estuary SSSI/SPA/RAMS	337653	381177	0
E49	Mersey Estuary SSSI/SPA/RAMS	340591	379496	0
E50	Mersey Estuary SSSI/SPA/RAMS	338594	381478	0
E51	Mersey Estuary SSSI/SPA/RAMS	339496	381941	0
E52	Flint Mountain SSSI	324783	371432	0
E53	Flint Mountain SSSI	324262	370884	0
E54	Mersey Estuary SSSI/SPA/RAMS	335350	384456	0
E55	New Ferry SSSI/SPA/RAMS	334374	385412	0
E56	New Ferry SSSI/SPA/RAMS	318855	366516	0
E57	Shotton RAMS/SSSI/SPA	329531	371073	0
E58	Shotton RAMS/SSSI/SPA	330186	371014	0
E59	Shotton RAMS/SSSI/SPA	329755	370993	0
E60	Shotton RAMS/SSSI/SPA	329668	370851	0
E61	Talon Marsh SSSI	327106	358562	0
E62	Talon Marsh SSSI	327184	357881	0
E63	Thurstaston SSSI	324864	384510	0
E64	Thurstaston SSSI	324339	385246	0
E65	Tyddyn SSSI	318874	367606	0

Figure 2.9 – Location of Assessed Ecological Receptors



2.7 Deposition

The predominant route by which emissions to air will affect land in the vicinity of a process is by deposition of atmospheric emissions. Potential ecological receptors can be sensitive to the deposition of pollutants, particularly nitrogen and sulphur compounds, which can affect the character of the habitat through eutrophication and acidification.

Deposition processes in the form of dry and wet deposition remove material from a plume and alter the plume concentration. Dry deposition occurs when particles are brought to the surface by gravitational settling and turbulence. They are then removed from the atmosphere by deposition on the land surface. Wet deposition occurs due to rainout (within cloud) scavenging and washout (below cloud) scavenging of the material in the plume. These processes lead to a variation with downwind distance of the plume strength and may alter the shape of the vertical concentration profile as dry deposition only occurs at the surface.

Near to sources of pollutants (< 2 km), dry deposition is the predominant removal mechanism (Fangmeier et al. 1994). Dry deposition may be quantified from the near-surface plume concentration and the deposition velocity (Chamberlin and Chadwick, 1953);

$$F_d = v_d C(x, y, 0)$$

where:

F_d = dry deposition flux (µg m^{-2} s^{-1})

v_d = deposition velocity (m s^{-1})

$C(x, y, 0)$ = ground level concentration (µg/m^3)

Assuming irreversible uptake, the total wet deposition rate is found by integrating through a vertical column of air;

$$F_w = \int_0^z \Lambda C \, dz$$

where;

F_w = wet deposition flux (µg m^{-2} s^{-1})

Λ = washout co-efficient (s^{-1})

C = local airborne concentration (µg/m^3)

Z = height (m)

The washout co-efficient is an intrinsic function of the rate of rainfall.

Environment Agency guidance AQTAG06 (Environment Agency, 2014) recommends deposition velocities for various pollutants, according to land use classification (Table 2.9).

Table 2.9 – Recommended Deposition Velocities

Pollutant	Deposition Velocity (m s^{-1})	
	Short Vegetation	Long Vegetation/Forest
NO_x	0.0015	0.003
SO_2	0.012	0.024
Source: Environment Agency (2014) 'Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air', AQTAG06 Updated Version (March 2014)'		

In order to assess the impacts of deposition, habitat-specific critical loads and critical levels have been created. These are generally defined as (e.g. Nilsson and Grennfelt, 1988):

> *"a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge"*

It is important to distinguish between a critical load and a critical level. The critical load relates to the quantity of a material deposited from air to the ground, whilst critical levels refer to the concentration of a material in air. The UK Air Pollution Information System (APIS) provides critical load data for ecological sites in the UK.

The critical loads used to assess the impact of compounds deposited to land which result in eutrophication and acidification are expressed in terms of kilograms of nitrogen deposited per hectare per year (kg N ha^{-1} y^{-1}) and kilo equivalents deposited per hectare per year (keq ha^{-1} y^{-1}). To enable a direct comparison against the critical loads, the modelled total wet and dry deposition flux (µg m^{-2} s^{-1}) must be converted into an equivalent value.

For a continuous release, the annual deposition flux of nitrogen can be expressed as:

$$F_{NTot} = \left(\frac{K_2}{K_3}\right) \cdot t \cdot \sum_{i=1}^{T} F_i \left(\frac{M_N}{M_i}\right)$$

where:

F_{NYot} = Annual deposition flux of nitrogen (kg N ha^{-1} y^{-1})

K_2 = Conversion factor for m^2 to ha (= 1x104 m^2 ha^{-1})

K_3 = Conversion factor for µg to kg (= 1x109 µg kg^{-1})

t = Number of seconds in a year (= 3.1536x107 s y^{-1})

i = 1,2,3…….T

T = Total number of nitrogen containing compounds

F = Modelled deposition flux of nitrogen containing compound (µg m^{-2} s^{-1})

M_N = Molecular mass of nitrogen (kg)

M = Molecular mass of nitrogen containing compound (kg)

The unit eq (1 keq ≡ 1,000 eq) refers to molar equivalent of potential acidity resulting from e.g. sulphur, oxidised and reduced nitrogen, as well as base cations. Conversion units are provided in AQTAG(06):

- 1 keq ha^{-1} y^{-1} = 14 kg N ha^{-1} y^{-1}
- 1 keq ha^{-1} y^{-1} = 32 kg S ha^{-1} y^{-1}

Wet deposition has not been assessed since this is not a significant contributor to total deposition over shorter ranges (Fangmeier et al., 1994; Environment Agency, 2006).

2.8 Other Treatments

Specialised model treatments, for short-term (puff) releases, coastal models, fluctuations or photochemistry were not used in this assessment.

2.9 Conversion of NO to NO_2

Emissions of NO_x from combustion processes are predominantly in the form of nitric oxide (NO). Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO_2. NO_x chemistry in the lower troposphere is strongly interlinked in a complex chain of reactions involving Volatile Organic Compounds (VOCs) and Ozone (O_3). Two of the key reactions interlinking NO and NO_2 are detailed below:

$$NO_2 + h\nu \xrightarrow{O_2} NO + O_3 \qquad (R_1)$$

$$NO + O_3 \longrightarrow NO_2 + O_2 \qquad (R_2)$$

Where *hv* is used to represent a photon of light energy (i.e., sunlight).

Taken together, reactions R_1 and R_2 produce no net change in O_3 concentrations, and NO and NO_2 adjust to establish a near steady state reaction (photo-equilibrium). However, the presence of VOCs and CO in the atmosphere offer an alternative production route of NO_2 for photolysis, allowing O_3 concentrations to increase during the day with a subsequent decrease in the NO_2:NO_x ratio.

However, at night, the photolysis of NO_2 ceases, allowing reaction R_2 to promote the production of NO_2, at the expense of O_3, with a corresponding increase in the NO_2:NO_x ratio. Similarly, near to an emission source of NO, the result is a net increase in the rate of reaction R_2, suppressing O_3 concentrations immediately downwind of the source, and increasing further downwind as the concentrations of NO begin to stabilise to typical background levels (Gillani and Pliem, 1996).

Given the complex nature of NO_x chemistry, the Environment Agency's Air Quality Modelling and Assessment Unit (AQMAU) have adopted a pragmatic, risk-based approach in determining the conversion rate of NO to NO_2 which dispersion model practitioners can use in their detailed assessments[2]. The AQMAU guidance advises that the source term should be modelled as NO_x (as NO_2) and then suggests a tiered approach when considering ambient NO_2:NO_x ratios:

- **Screening Scenario:** 50% and 100% of the modelled NO_x process contributions should be used for short-term and long-term average concentration, respectively. That is, 50% of the predicted NO_x concentrations should be assumed to be NO_2 for short-term assessments and 100% of the predicted NO_x concentrations should be assumed to be NO_2 for long-term assessments;

[2] http://www.environment-agency.gov.uk/static/documents/Conversion_ratios_for__NOx_and_NO2_.pdf

- **Worst Case Scenario:** 35% and 70% of the modelled NO_x process contributions should be used for short-term and long-term average concentration, respectively. That is, 35 % of the predicted NO_x concentrations should be assumed to be NO_2 for short-term assessments and 70% of the predicted NO_x concentrations should be assumed to be NO_2 for long-term assessments; and

- **Case Specific Scenario:** Operators are asked to justify their use of percentages lower than 35% for short-term and 70% for long-term assessments in their application reports.

In line with the AQMAU guidance, this assessment has therefore used a NO_x to NO_2 ratio of 70% for long term average concentrations, 35% for short term concentrations.

3 Existing Ambient Data

3.1 Local Air Quality Management

Flintshire County Council ("the Council") under its Local Air Quality Management (LAQM) obligations, continually reviews and assesses concentrations of key air pollutants in the borough to ascertain the requirement, or otherwise, to declare an AQMA.

Due to the historical trend of pollution levels, the Council has declared no AQMA within its jurisdiction. The most recent publicly available monitoring data has been collated from the Council's Air Quality 2025 Annual Status Report[3], which is now a North Wales Authorities Collaborative Project progress report, containing monitoring data for 2024.

3.1.1 Monitoring Data

The Council did not undertake automatic (continuous) monitoring. Flintshire County Council undertook non-automatic (passive) monitoring at 59 locations in 2024. Two of the passive monitoring locations are within 2 km of the Deeside Power Station site. Table 3.1 contains the annual mean NO_2 concentration result for the diffusion tubes sites within 2 km of the site, for the year 2024, on its first year of commissioning.

Current monitoring results show that recent and current concentrations of NO_2 in the area local to the Deeside Power Station site are compliant with the annual mean NO_2 Air Quality Strategy objective.

Table 3.1 – NO_2 Diffusion Tube Monitoring Results

Site Name	X	Y	Site Type	Annual Mean Concentration (µg/m³)				
				2020	2021	2022	2023	2024
ADDC-125	330027	369295	Kerbside	-	-	-	-	19.7
ADDC-126	328895	370063	Kerbside	-	-	-	-	15.5
N.B. Data taken from North Wales Authorities Collaborative Project Annual Progress Report 2024.								

3.2 Defra Mapped Background Concentrations

Defra maintains a nationwide model of existing and future background air quality concentrations at a 1 km grid square resolution. The datasets include annual average concentration estimates for NO_x, NO_2, PM_{10}, $PM_{2.5}$, CO and SO_2 and benzene. The model used is empirical in nature: it uses the National Atmospheric Emissions Inventory (NAEI) emissions to model the concentrations of pollutants at the centroid of each 1 km grid square but then calibrates these concentrations in relation to actual monitoring data.

3.2.1 Background Concentrations used in the Assessment

Annual mean background concentrations at the assessed human and ecological receptor locations have been derived from the Defra background maps for the 1 km grid square in which they are located.

The annual average process contribution is added to the annual average background concentration to give a total concentration at each receptor location. This total concentration can then be compared against the relevant Air Quality Standard/Objective (AQS/O) and the likelihood of an exceedance determined.

[3] https://www.wrexham.gov.uk/sites/default/files/2026-06/north-wales-annual-progress-report-2025.pdf

It is not technically rigorous to add predicted short-term or percentile concentrations to ambient background concentrations not measured over the same averaging period, since peak contributions from different sources would not necessarily coincide in time or location. Without hourly ambient background monitoring data available it is difficult to make an assessment against the achievement or otherwise of the short-term AQS/O. For the current assessment, conservative short-term ambient levels have been derived by applying a factor of two to the annual mean background data as per the recommendation in Environment Agency guidance. That background annual mean concentrations used in the assessment are detailed in Table 3.2.

Table 3.2 – Background Annual Mean Concentrations used in the Assessment

Receptor	2026 Annual Mean Pollutant Concentrations (µg/m^3)		
	NO_x [a]	NO_2 [a]	CO [b]
E1	8.4	6.6	522.0
E2	8.8	6.9	576.0
E3	8.9	7.0	552.0
E4	4.0	3.2	418.0
E5	3.8	3.1	406.0
E6	3.7	3.0	406.0
E7	4.0	3.2	414.0
E8	4.0	3.3	416.0
E9	3.9	3.2	398.0
E10	8.8	6.9	558.0
E11	8.9	7.0	572.0
E12	7.2	5.7	540.1
E13	8.6	6.8	526.0
E14	4.5	3.6	436.0
E15	3.9	3.1	412.0
E16	7.6	6.1	552.0
E17	8.0	6.3	574.0
E18	8.6	6.8	518.0
E19	8.6	6.8	518.0
E20	8.6	6.8	518.0
E21	11.3	8.7	540.1
E22	8.8	6.9	576.0
E23	7.6	6.0	534.0
E24	7.6	6.0	534.0
E25	9.0	7.1	530.1
E26	9.0	7.1	530.1
E27	7.3	5.8	530.1
E28	7.0	5.6	530.1
E29	7.3	5.8	518.0
E30	6.9	5.5	518.0
E31	7.0	5.6	518.0
E32	8.4	6.6	602.0
E33	9.8	7.6	654.0
E34	10.4	8.1	700.1
E35	9.9	7.7	740.1
E36	9.9	7.7	740.1
E37	6.4	5.1	560.1
E38	4.7	3.8	444.0
E39	5.7	4.5	456.0
E40	7.3	5.8	564.0
E41	9.0	7.1	530.1
E42	7.6	6.0	534.0
E43	4.1	3.3	434.0
E44	5.8	4.7	520.1
E45	5.8	4.7	520.1
E46	15.7	11.8	730.1
E47	14.9	11.2	730.1
E48	13.6	10.4	730.1

E49	14.9	11.2	730.1
E50	13.6	10.4	730.1
E51	13.6	10.4	730.1
E52	6.3	5.0	500.1
E53	5.6	4.5	500.1
E54	13.9	10.5	730.1
E55	13.3	10.2	730.1
E56	3.9	3.1	412.0
E57	8.6	6.8	518.0
E58	8.9	7.0	536.0
E59	11.3	8.7	540.1
E60	11.3	8.7	540.1
E61	4.8	3.9	450.1
E62	4.7	3.8	444.0
E63	6.0	4.8	524.0
E64	5.9	4.7	534.0
E65	4.2	3.4	412.0
H1	7.5	6.0	512.0
H2	7.5	6.0	522.0
H3	7.5	6.0	522.0
H4	7.5	6.0	522.0
H5	7.5	6.0	522.0
H6	7.5	6.0	522.0
H7	7.5	6.0	522.0
H8	7.5	6.0	522.0
H9	7.5	6.0	522.0
H10	7.5	6.0	540.1
H11	8.3	6.6	552.0
H12	8.3	6.6	552.0
H13	8.3	6.6	552.0
H14	8.3	6.6	552.0
H15	8.3	6.6	552.0
H16	8.3	6.6	552.0
H17	8.3	6.6	552.0
H18	8.3	6.6	576.0
H19	8.3	6.6	576.0
H20	8.3	6.6	576.0
H21	7.5	6.0	522.0
H22	7.5	6.0	522.0
H24	7.5	6.0	522.0
H25	8.3	6.6	534.0
H26	8.3	6.6	552.0

[a] 2021 reference year annual mean background concentration of NO and, NO_x, taken from Defra's UK Air Quality Archive (1 km x 1 km grid squares). Due to ecological receptors not being assessed for annual and hourly NO_2, the background concentration has not been included.

[b] Background concentration of CO taken from Defra's UK Air Quality Archive (1 km x 1 km grid squares) 2001 background maps.

3.3 Background Deposition Rates

Estimated background deposition rates of nutrient nitrogen and total acid deposition for the UK are available via the Air Pollution Information Service (APIS) website (http://www.apis.ac.uk). Table 3.3 provides estimated deposition rates for the ecological receptors considered in this study, as obtained from the APIS website. It should be noted that the level of uncertainty associated with these modelled estimates is relatively high and the results are presented from the model across the UK on a 5 km grid square resolution.

Table 3.3 – Estimated Background Deposition Rates

ID	Background Nitrogen Deposition (kg N ha^{-1} y^{-1})	Background Nitric Acid Deposition (keq ha^{-1} y^{-1})	Background Sulphuric Acid Deposition (keq ha^{-1} y^{-1})
E1	16.80	1.29	0.33
E2	17.20	1.29	0.33
E3	17.20	1.29	0.33
E4	17.20	1.45	0.17
E5	17.50	1.45	0.17
E6	17.70	1.45	0.17
E7	17.20	1.45	0.17
E8	17.00	1.45	0.17
E9	16.60	1.35	0.16
E10	17.90	1.47	0.19
E11	17.90	1.47	0.19
E12	18.20	1.47	0.19
E13	18.20	1.47	0.19
E14	17.00	2.16	0.21
E15	16.70	1.39	0.17
E16	17.40	1.45	0.20
E17	17.60	1.45	0.20
E18	16.10	1.29	0.33
E19	16.40	1.29	0.33
E20	16.60	1.29	0.33
E21	16.70	1.29	0.33
E22	16.70	1.29	0.33
E23	16.20	1.29	0.33
E24	16.20	1.29	0.33
E25	16.60	1.29	0.33
E26	16.60	1.29	0.33
E27	16.20	1.29	0.33
E28	15.80	1.29	0.33
E29	15.80	1.29	0.33
E30	15.80	1.29	0.33
E31	15.90	1.29	0.33
E32	21.30	0.71	0.19
E33	21.30	0.71	0.19
E34	16.40	0.77	0.23
E35	16.60	0.77	0.23
E36	16.50	0.77	0.23
E37	25.90	1.19	0.17
E38	16.60	1.25	0.16
E39	16.60	1.25	0.16
E40	26.60	1.22	0.17
E41	16.20	1.30	0.24
E42	16.20	1.30	0.24
E43	16.60	1.35	0.17
E44	17.50	1.43	0.19
E45	17.50	1.43	0.19
E46	17.10	0.92	0.24
E47	17.10	0.92	0.24
E48	17.10	0.92	0.24
E49	17.10	0.92	0.24
E50	17.10	0.92	0.24
E51	17.10	0.92	0.24
E52	16.10	1.33	0.22
E53	16.40	1.33	0.22
E54	16.00	1.32	0.25
E55	15.70	1.32	0.25
E56	16.70	1.39	0.17
E57	16.40	0.82	0.20
E58	16.70	0.82	0.20
E59	16.80	0.82	0.20

ID	Background Nitrogen Deposition (kg N ha^{-1} y^{-1})	Background Nitric Acid Deposition (keq ha^{-1} y^{-1})	Background Sulphuric Acid Deposition (keq ha^{-1} y^{-1})
E60	16.80	0.82	0.20
E61	17.60	2.30	0.22
E62	17.60	2.30	0.22
E63	14.10	0.60	0.17
E64	14.10	0.60	0.17
E65	16.40	1.36	0.16
Source: Air Pollution Information Service (APIS) website (http://www.apis.ac.uk)			

3.4 Sensitivity Analysis and Uncertainty

Wherever possible, this assessment has used worst-case scenarios, which will exaggerate the impact of the emissions on the surrounding area, including emissions, operational profile, ambient concentrations, meteorology and surface roughness. This assessment has considered the years predicting the highest ground-level concentrations at the nearest sensitive receptor for comparison with the AQS objectives.

Sensitivity analysis has been undertaken for a number of model input parameters to investigate the results of the model with respect to changes in buildings and surface roughness.

3.4.1 Buildings

A sensitivity analysis has been undertaken to investigate the impact of modelling with and without buildings on the modelled results. Results have been normalised by the value obtained from the parameter resulting in the highest ground level process contribution at any modelled receptor location and are presented in Table 3.4.

Table 3.4 – Building Inclusion Sensitivity Analysis

Buildings	Normalised Maximum Ground Level Concentration	
	NO_x Annual Mean	NO_x 99.79 Percentile of 1-Hour Mean
With Buildings	1.00	1.00
Without Buildings	0.99	0.99

From the above predicted ground level concentration ratios, inclusion of buildings results in worst case concentrations for the 1-hour mean NO_x and for the annual mean NO_x averaging periods. Thus, the model has included building in the assessment.

3.4.2 Surface Roughness

A sensitivity analysis has been undertaken to investigate the impact of modelling with different surface roughness lengths. Results have been normalised by the value obtained from the parameter resulting in the highest ground level process contribution at any modelled receptor location and are presented below.

Table 3.5 – Surface Roughness Sensitivity Analysis

Surface Roughness Length	Normalised Maximum Ground Level Concentration	
	NO_x Annual Mean	NO_x 99.79 Percentile of 1-Hour Mean
0.3 m	1.00	1.00
0.5 m	0.97	0.98
1 m	0.91	0.78
1.5 m	0.83	0.61

From the above predicted ground level concentration ratios, it can be seen that a surface roughness length of 0.3 m results in the highest results for both long-term and short-term averaging periods. A surface roughness length of 0.3 m has been used in the assessment to provide a conservative approach.

3.4.3 Meteorological Year Sensitivity Testing

Results in this assessment are presented for the meteorological year resulting in the highest concentrations at any receptor location, as a worst-case assumption. The worst-case meteorological year was determined separately for long and short-term concentrations at the worst-case receptor location for each pollutant; thus, the worst-case data has been reported within Section 5.

For information, a table showing the inter-year variability of meteorological conditions at the worst-case human receptor is provided below. The results have been normalised against the maximum value. At the worst-case receptor, it demonstrates that 2021 provides the worst-case conditions for long-term and 2025 for the short-term means. However, this can vary by receptor, hence the consideration of the worst-case meteorological year by individual receptor, as described above.

Table 3.6 – Inter-year Variability in Concentration (Normalised)

Annual Mean NO_2					1-hour Mean NO_2				
2021	2022	2023	2024	2025	2021	2022	2023	2024	2025
1.00	0.47	0.62	0.51	0.90	0.89	0.57	0.70	0.83	1.00

3.4.4 Model Uncertainty

Dispersion modelling is inherently uncertain but is nonetheless a useful tool in plume footprint visualisation and prediction of ground level concentrations. The use of dispersion models has been widely used in the UK for both regulatory and compliance purposes for a number of years and is an accepted approach for this type of assessment.

In addition to all available input data. this assessment has incorporated a number of worst-case assumptions, as described above, which may result in an overestimation of the predicted ground level concentrations from the process. Therefore, the actual predicted ground level concentrations would be expected to be lower than this and, in some cases, significantly lower.

4 RELEVANT LEGISLATION AND GUIDANCE

4.1 UK Legislation

4.1.1 The Air Quality Standards Regulations 2010

The Air Quality Standards Regulations 2010 (the 'Regulations') came into force on the 11th June 2010 and transpose EU Directive 2008/50/EC into UK legislation. The Directive's limit values are transposed into the Regulations as 'Air Quality Standards' (AQS) with attainment dates in line with the Directive.

These standards are legally binding concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects of sensitive groups or on ecosystems.

Similar to Directive 2008/50/EC, the Regulations define ambient air as;

> *"…outdoor air in the troposphere, excluding workplaces where members of the public do not have regular access."*

With direction provided in Schedule 1, Part 1, Paragraph 2 as to where compliance with the AQS' does not need to be assessed:

> *"Compliance with the limit values directed at the protection of human health does not need to be assessed at the following locations:*
>
> *a) any location situated within areas where members of the public do not have access and there is no fixed habitation;*
>
> *b) on factory premises or at industrial locations to which all relevant provisions concerning health and safety at work apply;*
>
> *c) on the carriageway of roads and on the central reservation of roads except where there is normally pedestrian access to the central reservation."*

4.1.2 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

The 2023 Air Quality Strategy for England provides a framework for improving air quality at a national and local level and supersedes the previous strategy published in 2007 for England.

Central to the Air Quality Strategy are health-based criteria for certain air pollutants; these criteria are based on medical and scientific reports on how and at what concentration each pollutant affects human health. The objectives derived from these criteria are policy targets often expressed as a maximum ambient concentration not to be exceeded, without exception or with a permitted number of exceedances, within a specified timescale.

The AQOs, based on a selection of the objectives in the Air Quality Strategy, were incorporated into UK legislation through the Air Quality Regulations 2000, as amended.

Paragraph 4(2) of The Air Quality (England) Regulations 2000 states:

> *"The achievement or likely achievement of an air quality objective prescribed by paragraph (1) shall be determined by reference to the quality of air at locations –*

a) *which are situated outside of buildings or other natural or man-made structures above or below ground; and*

b) *where members of the public are regularly present*

Consequently, compliance with the AQOs should focus on areas where members of the general public are present over the entire duration of the concentration averaging period specific to the relevant objective.

4.1.3 Environment Act 2021

The Environment Act 2021 came into force on 9th November 2021, with Part 4 of the Act (and associated Schedules 11 and 12) reserved for matters pertaining to air quality.

The Environment Act 2021 includes amendments to Environment Act 1995 (further detail in Section 4.3) the Clean Air Act 1993 to give Local Authorities more power. It also requires the Secretary of State to set at least one long-term target in relation to air quality and, in addition, a short-term legally binding target to reduce $PM_{2.5}$.

4.2 Environmental Permitting Regulations (EPR)

The Environmental Permitting Regulations (England and Wales)[4], which came into force on 6 April 2010 (replacing the 2007 Regulations), were amended in 2013 to transpose the EU Industrial Emissions Directive (IED). The IED (Directive 2010/75/EU) targets industrial activities, including large combustion plants and other Schedule 1 installations with significant emissions potential. Through regulating emissions of SO_2, NO_2 dust, and other pollutants into air and water, the IED aims to reduce air pollution, minimise contamination, and lessen risks to human health.

Today, the Environmental Permitting Regulations 2016 framework transposes these core requirements alongside the Medium Combustion Plant Directive (MCPD) into domestic UK legislation.

4.3 Local Air Quality Management

Part IV of the Environment Act 1995 requires that Local Authorities periodically review air quality within their individual areas. As previously discussed, this Act has now been amended and supplemented by the Environment Act 2021 Schedule 11. Defra have said: “Responsibility for tackling local air pollution will now be shared with designated relevant public authorities, all tiers of local government and neighbouring authorities.”

This process of Local Air Quality Management (LAQM) is an integral part of delivering the Government’s AQOs.

To carry out an air quality Review and Assessment under the LAQM process, the Government recommends a three-stage approach. This phased review process uses initial simple screening methods and progresses through to more detailed assessment methods of modelling and monitoring in areas identified to be at potential risk of exceeding the objectives in the Regulations.

Review and assessments of local air quality aim to identify areas where national policies to reduce vehicle and industrial emissions are unlikely to result in air quality meeting the Government’s AQOs by the required dates.

[4] The Environmental Permitting Regulations (England and Wales) 2010, Statutory Instrument No 675, The Stationary Office Limited

For the purposes of determining the focus of Review and Assessment, Local Authorities should have regard to those locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective.

Where the assessment indicates that some or all of the objectives may be potentially exceeded, the Local Authority has a duty to declare an AQMA. The declaration of an AQMA requires the Local Authority to implement an Air Quality Action Plan (AQAP), to reduce air pollution concentrations so that the required AQOs are met.

Flintshire County Council proactively considers the impact of air quality on the area through policies and decisions[5]. The Council works alongside the Public services Board, to help encourage a multi-agency approach to addressing air quality, whilst noting the contents of the North Wales Combined Authority Air Quality Report.

In the Flintshire Local Development Plan (2015-2030), Policy STR1 highlights the need to minimise pollution to land, water and air when proposing new developments and Policy STR7 examines the need to safeguard the natural environment[6].

4.4 Other Guideline Values

In the absence of statutory standards for the other prescribed substances that may be found in the emissions, there are several sources of applicable air quality guidelines.

4.4.1 Air Quality Guidelines for Europe, the World Health Organisation (WHO)

The updated WHO Global Air Quality Guidelines (WHO, 2021) provides a basis for protecting public health from adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or well-being. These guidelines are intended to provide guidance and information to international, national and local authorities making risk management decisions, particularly in setting air quality standards.

4.4.2 Environmental Assessment Levels (EALs)

The Environment Agency's AER Guidance provides methods for quantifying the environmental impacts of emissions to all media. The AER guidance contains long and short-term Environmental Assessment Levels (EALs) and Environmental Quality Standards (EQS) for releases to air derived from a number of published UK and international sources. For the pollutants considered in this study, these EALs and EQS are equivalent to the AQS and AQOs set in force by the Air Quality Strategy for England, Scotland Wales and Northern Ireland.

4.5 Air Quality Impacts of the Process

The atmospheric emissions of a number of pollutants have been identified as requiring detailed dispersion modelling. The emitted pollutants of primary concern to the local environment are:

- Oxides of nitrogen (NO_x as NO_2); and
- Carbon monoxide (CO).

A brief description of each pollutant is given in Table 4.1.

[5] Flintshire County Council, Air Quality in Flintshire (2018)

[6] North Wales Combined Authority, Annual Progress Report (2017)

Table 4.1 – Summary of the Pollutants Assessed

Pollutant	Description and effect on human health and the environment	Principal Sources
Oxides of Nitrogen (NO_X) [A, B, C]	Nitrogen dioxide (NO_2) and Nitric oxide (NO) are both collectively referred to as oxides of Nitrogen (NO_X). It is NO_2 that is associated with adverse effects on human health. Most atmospheric emissions are in the form of NO which is converted to NO_2 in the atmosphere through reactions with Ozone. The oxidising properties of NO_2 theoretically could damage lung tissue, and exposure to very high concentrations of NO_2 can lead to inflammation of lung tissue, affect the ability to fight infection. The greatest impact of NO_2 is on individuals with asthma or other respiratory conditions, but consistent impacts on these individuals is at levels of greater than 564 µg/m^3, much higher than typical UK ambient concentrations.	All combustion processes produce NO_X emissions, and the principal source of NO_X is road transport, which accounted for 32% of total UK emissions in 2008. Emissions from power stations contributed a further 20%.
Carbon Monoxide (CO) [B, C]	The toxicity of CO results in it binding avidly to haemoglobin and thus reducing the oxygencarrying capacity of the blood. In very high doses, the restriction of oxygen to the brain and heart can be fatal. At lower concentrations, CO can affect higher cerebral function, heart function and exercise capacity.	The principal source of CO is emissions from petrol vehicles, accounting for 54% of total UK emissions in 2008.

A Defra, 2022, Part IV of the Environment Act 1995 Local Air Quality Management: Technical Guidance LAQM.TG(22).

B Harrison, R.M., *Air Pollution: Sources, Concentrations and Measurements*. In: Harrison, R.M., 2000, *Pollution: Causes, Effects and Controls*, 4th Edition Royal Society of Chemistry.

C Walters, S. and Ayers, J., *The Health Effects of Air Pollution*. In: Harrison, R.M., 2000, *Pollution: Causes, Effects and Controls*, 4th Edition Royal Society of Chemistry.

4.6 Criteria Appropriate to the Assessment

Table 4.2 sets out those AQS, AQOs and EALs that are relevant to the assessment with regard to human receptors.

Table 4.2 – Air Quality Standards, Objectives and Environmental Assessment Levels

Pollutant	AQS/AQO/ EAL	Averaging Period	Value (µg/m^3)
Nitrogen dioxide (NO_2)	AQS	Annual mean	40
	AQS	1-hour mean, not more than 18 Exceedances a year (equivalent of 99.79 Percentile)	200
Carbon monoxide (CO)	AQS	8-hour mean	10,000
	EAL	1-hour mean	30,000

4.7 Critical Levels and Critical Loads Relevant to the Assessment of Ecological Receptors

A summary of the relevant AQS and EAL that apply to the emissions from the plant and their impact on ecological receptors are given in Table 4.3.

Table 4.3 – Relevant Air Quality Standards and Environmental Assessment Levels for Ecological Receptors

Pollutant	AQS/EAL	Averaging Period	Value (µg/m^3)
Oxides of nitrogen (NO_x)	AQS	Annual mean	30
Oxides of nitrogen (NO_x)	Target	Daily mean	75
	WHO Assessment Level	Daily mean	200*
*Where O_3 and SO_2 are not present above their respective critical levels.			

The Air Pollution Information System (APIS) website[7] provides specific information on the potential effects of nitrogen deposition on various habitats and species. This information, relevant to habitats of some of the ecological receptors considered in this assessment, is presented in Table 4.4.

Table 4.4 – Typical Habitat and Species Information Concerning Nitrogen Deposition from APIS

Habitat and Species Specific Information	Critical Load (kg N ha^{-1} yr^{-1})	Specific Information Concerning Nitrogen Deposition
Saltmarsh	30-40	Many saltmarshes receive large nutrient loadings from river and tidal inputs. It is unknown whether other types of species-rich saltmarsh would be sensitive to nitrogen deposition. Increase in late-successional species, increased productivity but only limited information available for this type of habitat.
Littoral Sediments	20 - 30	Increase late successional species, increase productivity increase in dominance of graminoids.
Coastal Stable Dune Grasslands	10-20	Foredunes receive naturally high nitrogen inputs. Key concerns of the deposition of nitrogen in these habitats relate to changes in species composition.
Alkaline Fens and Reed beds	10-35	Nitrogen deposition provides fertilization. Increase in tall graminoids (grasses or Carex species) resulting in loss of rare species and decrease in diversity of subordinate plant species.
Temperate and boreal forests	10-20	Increased nitrogen deposition in mixed forests increases susceptibility to secondary stresses such as drought and frost, can cause reduced crown growth. Also can reduce the diversity of species due to increased growth rates of more robust plants.
Hay Meadow	20-30	The key concerns are related to changes in species composition following enhanced nitrogen deposition. Indigenous species will have evolved under conditions of low nitrogen availability. Enhanced Nitrogen deposition will favour those species that can increase their growth rates and competitive status e.g. rough grasses such as false brome grass (Brachypodium pinnatum) at the expense of overall species diversity. The overall threat from competition will also depend on the availability of propagules
Acid Grasslands	10-25	Nitrogen deposition provides fertilization to acid grasslands, this increase robust grass growth that may limit other species reducing diversity.
Raised bog and blanket bog	5-10	Nitrogen deposition provides fertilization, this increase robust vegetation growth that may limit other species reducing diversity
Oak Woodland	10-15	Increased nitrogen deposition in Oak forests increases susceptibility to secondary stresses such as drought and frost, can cause reduced crown growth

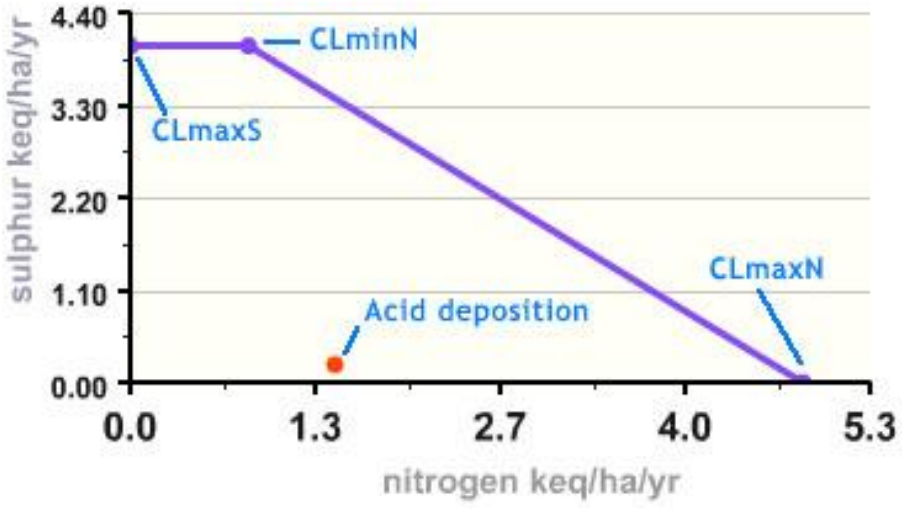
[7] http://www.apis.ac.uk/

Information relating specifically to acid deposition is provided using three critical load parameters:

- $CL_{max}S$: the maximum critical load of sulphur, above which sulphur alone would be considered to cause an exceedance;
- $CL_{min}N$: a measure of the ability of the habitat/ecosystem to 'consume' deposited nitrogen; and
- $CL_{max}N$: the maximum critical load of nitrogen, above which nitrogen alone would be considered to cause an exceedance.

These three parameters define the critical load function, as illustrated in Figure 4.1. The region under the three-node line represents results where critical loads are not exceeded, whereas combinations of deposition above this line would be considered an exceedance.

Figure 4.1 – Critical Load Function (sourced from APIS)



Source: http://www.apis.ac.uk/clf-guidance

5 ASSESSMENT RESULTS

This section sets out the results of the dispersion modelling and compares predicted ground level concentrations to ambient air quality standards. The predicted concentrations resulting from the process are presented with background concentrations and the percentage contribution that the predicted environmental concentrations would make towards the relevant Air Quality Assessment Level (AQAL), i.e., the relevant Air Quality Standard or Objective (AQS/AQO) or Environmental Assessment Level (EAL).

Results are presented for the meteorological year resulting in the highest concentrations at any receptor location, as a worst-case assumption. Results that exceed the relevant AQAL are underlined within the results tables, contour plots have been provided for Nitrogen Deposition at ecological receptors within Appendix A.

5.1 Model Results for Annual Mean Metrics

Results assessed against annual mean metrics for NO_x and NO_2, need to consider total annual running hours, as they can all take place over the corresponding proportion of the year. Results assessed against hourly mean metrics for CO, consider both hourly and 8-hourly running hours.

As such, results for annual mean metrics have been presented separately to short-term metrics, taking account of the cumulative annual operating hours. Summary results are presented in Table 5.1 for the worst-case receptor for each parameter. Full results tables are contained in Appendix B.

5.1.1 Concentrations in Air

The summary results show that annual and short term mean results for NO_2, CO (8-hour rolling) and CO (1-hour) at human receptors and annual mean results for NO_x at ecological receptors are all comfortably below the relevant AQAL for both scenarios.

In terms of human receptors, the maximum long-term results were at receptor H7 (in terms of PEC) for annual mean NO_2. For ecological receptors, the maximum result of annual mean NO_X (in terms of PEC) is predicted to occur at Shotton 2.

Table 5.1 – Maximum Annual Mean Concentrations in Air at Human and Ecological Receptors

Parameter	Annual Mean Results				
	AQAL µg/m³	PC µg/m³	PEC µg/m³	% PC OF AQAL	% PEC OF AQAL
Scenario 1					
Human Receptors					
Annual mean NO_2 (H7)	40	0.05	6.0	0.1%	15.0%
Ecological Receptors					
Annual mean NO_x (Shotton 2)	30	1.1	10.0	3.6%	33.4%
Scenario 2					
Human Receptors					
Annual mean NO_2 (H7)	40	0.1	6.1	0.2%	15.2%
Ecological Receptors					
Annual mean NO_x (Shotton 2)	30	2.1	11.0	7.0%	36.7%

Parameter	Annual Mean Results				
	AQAL µg/m^3	PC µg/m^3	PEC µg/m^3	% PC OF AQAL	% PEC OF AQAL
AQAL = Air Quality Assessment Level PC = Process Contribution PEC = Predicted Environmental Concentration (PC + background)					

5.1.2 Deposition

The impact assessment for ecological receptors also includes an assessment of pollutants deposited to land in the form of nitrogen deposition and acid deposition. These are also based on annual mean metrics, as such, these results are presented in full in Table 5.2 for nitrogen deposition and Table 5.3 for acid deposition.

The results for acid deposition are presented in line with the Critical Load Function Tool as contained on the Air Pollution Information System (APIS) website[8]. As described on APIS: "the Critical Load Function is a three-node line on a graph representing the acidity critical load. Combinations of deposition above this line would exceed the critical load, while all areas below or on the line represent an "envelope of protection" where critical loads are not exceeded". Therefore, where 'no exceedance' is stated with regards to acid deposition, it denotes no exceedance of the critical load function.

The results for nitrogen deposition show exceedances at all ecological receptors considered in the assessment. However, this is due to the background deposition rate at all receptors exceeding the minimum critical load (CL). When taking the PC into account, this makes up less than 1% of the overall result at all ecological receptors, except for E2 (Afon_2), E18 (Dee_1), E19 (Dee_2), E20 (Dee_3), E25 (Dee_8), E26 (Dee_9), E57 (Shotton_1), E58 (Shotton_2) and E59 (Shotton_3) where the minimum critical loads were predicted to be over the 1% threshold, respectively for Scenario 2. Due to the nitrogen deposition exceedances, it is determined that further assessment was required at these ecological receptor locations. The 1% screening criterion is not a threshold of harm and exceeding this threshold does not, of itself, imply damage to a habitat.

An ecological report was conducted by Rachel Hacking Ecology[9] to further investigate the exceedance of the 1% threshold, which for all designation exceedances states that any additional atmospheric nitrogen deposition has the potential for an adverse impact, but the additional process contribution is unlikely to be significant given the magnitude of existing background exceedance levels.

Where the PC is less than 1% of the overall result, the contribution from the plant can be considered not significant. In the same manner, all results for acid deposition can be described as not significant.

Table 5.2 – Nitrogen Deposition Rates at Ecological Receptors

Receptor ID	CL (kg N ha^{-1} yr^{-1})	PC (kg N ha^{-1} yr^{-1})	%PC of CL$_{min}$ (%)	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%PEDR of CL$_{min}$
Scenario 1						
E1	5	<0.1	0.3%	16.8	17.2	344.3%
E2	5	<0.1	0.5%	17.2	17.0	340.5%
E3	5	<0.1	0.2%	17.2	17.6	352.2%
E4	10	<0.1	<0.1%	17.2	17.5	175.0%

[8] http://www.apis.ac.uk/critical-load-func0tion-tool

[9] Ecological Assessment Peaking Plant Nitrogen Exceedance Assessment

Receptor ID	CL (kg N ha^{-1} yr^{-1})	PC (kg N ha^{-1} yr^{-1})	%PC of CL_{min} (%)	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%PEDR of CL_{min}
E5	10	<0.1	<0.1%	17.5	17.5	175.0%
E6	10	<0.1	<0.1%	17.7	17.1	171.0%
E7	10	<0.1	<0.1%	17.2	17.1	171.0%
E8	10	<0.1	<0.1%	17.0	17.1	171.0%
E9	5	<0.1	<0.1%	16.6	16.1	322.0%
E10	5	<0.1	<0.1%	17.9	16.7	334.0%
E11	5	<0.1	<0.1%	17.9	16.4	328.0%
E12	5	<0.1	<0.1%	18.2	16.7	334.0%
E13	5	<0.1	<0.1%	18.2	16.8	336.0%
E14	10	<0.1	<0.1%	17.0	16.6	166.0%
E15	5	<0.1	<0.1%	16.7	17.1	342.0%
E16	6	<0.1	0.1%	17.4	17.9	298.4%
E17	6	<0.1	0.1%	17.6	18.2	303.4%
E18	10	<0.1	0.5%	16.1	16.8	168.5%
E19	10	0.1	0.7%	16.4	17.3	172.7%
E20	10	0.1	**1.2%**	16.6	17.3	173.2%
E21	10	<0.1	0.1%	16.7	16.6	166.1%
E22	10	<0.1	0.2%	16.7	17.9	179.2%
E23	10	<0.1	0.2%	16.2	17.0	170.2%
E24	10	<0.1	0.2%	16.2	16.7	167.2%
E25	10	0.1	0.7%	16.6	17.5	174.7%
E26	10	0.1	0.6%	16.6	17.7	176.6%
E27	10	<0.1	0.2%	16.2	16.1	161.2%
E28	10	<0.1	0.5%	15.8	16.4	164.5%
E29	10	<0.1	0.1%	15.8	14.1	141.1%
E30	10	<0.1	0.5%	15.8	14.1	141.5%
E31	10	<0.1	0.2%	15.9	16.4	164.2%
E32	10	<0.1	0.2%	21.3	16.6	166.2%
E33	10	<0.1	0.2%	21.3	26.6	266.2%
E34	10	<0.1	<0.1%	16.4	16.6	166.0%
E35	10	<0.1	<0.1%	16.6	16.2	162.0%
E36	10	<0.1	<0.1%	16.5	15.8	158.0%
E37	5	<0.1	0.1%	25.9	16.2	324.1%
E38	5	<0.1	<0.1%	16.6	16.8	336.0%
E39	5	<0.1	<0.1%	16.6	17.6	352.0%
E40	5	<0.1	0.1%	26.6	16.7	334.1%
E41	5	<0.1	0.5%	16.2	17.2	344.5%
E42	5	<0.1	0.4%	16.2	18.2	364.4%
E43	5	<0.1	<0.1%	16.6	16.4	328.0%
E44	5	<0.1	<0.1%	17.5	16.0	320.0%
E45	5	<0.1	<0.1%	17.5	15.7	314.0%
E46	5	<0.1	<0.1%	17.1	15.9	318.0%
E47	5	<0.1	0.1%	17.1	21.3	426.1%

Receptor ID	CL (kg N ha^{-1} yr^{-1})	PC (kg N ha^{-1} yr^{-1})	%PC of CL_{min} (%)	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%PEDR of CL_{min}
E48	5	<0.1	<0.1%	17.1	21.3	426.0%
E49	5	<0.1	<0.1%	17.1	16.4	328.0%
E50	5	<0.1	<0.1%	17.1	16.6	332.0%
E51	5	<0.1	<0.1%	17.1	16.5	330.0%
E52	5	<0.1	<0.1%	16.1	25.9	518.0%
E53	5	<0.1	<0.1%	16.4	16.6	332.0%
E54	10	<0.1	<0.1%	16.0	15.8	158.0%
E55	10	<0.1	<0.1%	15.7	15.8	158.0%
E56	10	<0.1	<0.1%	16.7	17.1	171.0%
E57	5	<0.1	0.6%	16.4	17.5	350.6%
E58	5	0.2	**3.1%**	16.7	17.9	357.1%
E59	5	<0.1	0.6%	16.8	16.6	332.6%
E60	5	<0.1	0.4%	16.8	16.7	334.4%
E61	5	<0.1	<0.1%	17.6	16.2	324.0%
E62	5	<0.1	<0.1%	17.6	16.2	324.0%
E63	5	<0.1	<0.1%	14.1	16.2	324.0%
E64	5	<0.1	<0.1%	14.1	16.6	332.0%
E65	10	<0.1	<0.1%	16.4	17.1	171.0%
Scenario 2						
E1	5	<0.1	0.6%	16.8	17.2	344.6%
E2	5	0.1	**1.1%**	17.2	17.1	341.1%
E3	5	<0.1	0.3%	17.2	17.6	352.3%
E4	10	<0.1	<0.1%	17.2	17.5	175.0%
E5	10	<0.1	<0.1%	17.5	17.5	175.0%
E6	10	<0.1	<0.1%	17.7	17.1	171.0%
E7	10	<0.1	<0.1%	17.2	17.1	171.0%
E8	10	<0.1	<0.1%	17.0	17.1	171.0%
E9	5	<0.1	<0.1%	16.6	16.1	322.0%
E10	5	<0.1	0.1%	17.9	16.7	334.1%
E11	5	<0.1	0.1%	17.9	16.4	328.1%
E12	5	<0.1	0.1%	18.2	16.7	334.1%
E13	5	<0.1	0.1%	18.2	16.8	336.1%
E14	10	<0.1	<0.1%	17.0	16.6	166.0%
E15	5	<0.1	<0.1%	16.7	17.1	342.0%
E16	6	<0.1	0.1%	17.4	17.9	298.5%
E17	6	<0.1	0.2%	17.6	18.2	303.5%
E18	10	0.1	**1.1%**	16.1	16.9	169.1%
E19	10	0.2	**1.6%**	16.4	17.4	173.6%
E20	10	0.2	**2.2%**	16.6	17.4	174.2%
E21	10	<0.1	0.2%	16.7	16.6	166.2%
E22	10	<0.1	0.4%	16.7	17.9	179.4%
E23	10	<0.1	0.3%	16.2	17.0	170.3%
E24	10	<0.1	0.4%	16.2	16.7	167.4%

Receptor ID	CL (kg N ha^{-1} yr^{-1})	PC (kg N ha^{-1} yr^{-1})	%PC of CL_{min} (%)	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%PEDR of CL_{min}
E25	10	0.1	**1.4%**	16.6	17.5	175.4%
E26	10	0.1	**1.2%**	16.6	17.7	177.2%
E27	10	0.0	0.4%	16.2	16.1	161.4%
E28	10	0.1	1.0%	15.8	16.5	165.0%
E29	10	<0.1	0.2%	15.8	14.1	141.2%
E30	10	0.1	0.9%	15.8	14.2	141.9%
E31	10	<0.1	0.3%	15.9	16.4	164.3%
E32	10	<0.1	0.3%	21.3	16.6	166.3%
E33	10	<0.1	0.4%	21.3	26.6	266.4%
E34	10	<0.1	0.1%	16.4	16.6	166.1%
E35	10	<0.1	<0.1%	16.6	16.2	162.0%
E36	10	<0.1	<0.1%	16.5	15.8	158.0%
E37	5	<0.1	0.3%	25.9	16.2	324.3%
E38	5	<0.1	<0.1%	16.6	16.8	336.0%
E39	5	<0.1	0.1%	16.6	17.6	352.1%
E40	5	<0.1	0.3%	26.6	16.7	334.3%
E41	5	<0.1	0.9%	16.2	17.2	344.9%
E42	5	<0.1	0.8%	16.2	18.2	364.8%
E43	5	<0.1	<0.1%	16.6	16.4	328.0%
E44	5	<0.1	0.1%	17.5	16.0	320.1%
E45	5	<0.1	0.1%	17.5	15.7	314.1%
E46	5	<0.1	0.1%	17.1	15.9	318.1%
E47	5	<0.1	0.1%	17.1	21.3	426.1%
E48	5	<0.1	0.1%	17.1	21.3	426.1%
E49	5	<0.1	0.1%	17.1	16.4	328.1%
E50	5	<0.1	0.1%	17.1	16.6	332.1%
E51	5	<0.1	0.1%	17.1	16.5	330.1%
E52	5	<0.1	0.1%	16.1	25.9	518.1%
E53	5	<0.1	0.1%	16.4	16.6	332.1%
E54	10	<0.1	<0.1%	16.0	15.8	158.0%
E55	10	<0.1	<0.1%	15.7	15.8	158.0%
E56	10	<0.1	<0.1%	16.7	17.1	171.0%
E57	5	0.1	**1.2%**	16.4	17.6	351.2%
E58	5	0.3	**6.1%**	16.7	18.0	360.1%
E59	5	0.1	**1.3%**	16.8	16.7	333.3%
E60	5	<0.1	0.8%	16.8	16.7	334.8%
E61	5	<0.1	<0.1%	17.6	16.2	324.0%
E62	5	<0.1	<0.1%	17.6	16.2	324.0%
E63	5	<0.1	0.2%	14.1	16.2	324.2%
E64	5	<0.1	0.2%	14.1	16.6	332.2%
E65	10	<0.1	0.1%	16.4	17.1	171.1%

Receptor ID	CL (kg N ha^{-1} yr^{-1})	PC (kg N ha^{-1} yr^{-1})	%PC of CL_{min} (%)	Background Deposition rate (kg N ha^{-1} yr^{-1})	PEDR (kg N ha^{-1} yr^{-1})	%PEDR of CL_{min}
CL = Critical load – *the CL selected for each designated site relates to its most N-sensitive habitat (or a similar surrogate) listed on the site citation for which data on Critical Loads are available and is also based on a precautionary approach using professional judgement.* PC = Process contribution PEDR = Predicted environmental deposition rate (PC + background)						

Table 5.3 – Acid Deposition Rates at Ecological Receptors

Receptor ID	S PC	N PC	Background	PEC	PC (% of CL function)	Background (% of CL function)	PEC (% of CL function)	Impact
Scenario 1								
E1	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.7	Not significant
E2	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.7	Not significant
E3	<0.1	<0.1	No exceedance	No exceedance	<0.1	50.8	50.8	Not significant
E4	<0.1	<0.1	No exceedance	No exceedance	<0.1	37.5	37.5	Not significant
E5	<0.1	<0.1	No exceedance	No exceedance	<0.1	37.5	37.5	Not significant
E6	<0.1	<0.1	No exceedance	No exceedance	<0.1	26.8	26.8	Not significant
E7	<0.1	<0.1	No exceedance	No exceedance	<0.1	26.8	26.8	Not significant
E8	<0.1	<0.1	No exceedance	No exceedance	<0.1	26.8	26.8	Not significant
E9	<0.1	<0.1	No exceedance	No exceedance	<0.1	36.0	36.0	Not significant
E10	<0.1	<0.1	No exceedance	No exceedance	<0.1	66.8	66.8	Not significant
E11	<0.1	<0.1	No exceedance	No exceedance	<0.1	43.7	43.7	Not significant
E12	<0.1	<0.1	No exceedance	No exceedance	<0.1	43.7	43.7	Not significant
E13	<0.1	<0.1	No exceedance	No exceedance	<0.1	43.7	43.7	Not significant
E14	<0.1	<0.1	No exceedance	No exceedance	<0.1	85.9	85.9	Not significant
E15	<0.1	<0.1	No exceedance	No exceedance	<0.1	26.8	26.8	Not significant
E16	<0.1	<0.1	No exceedance	No exceedance	<0.1	91.3	91.3	Not significant
E17	<0.1	<0.1	No exceedance	No exceedance	<0.1	91.3	91.3	Not significant
E18	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.7	Not significant
E19	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.7	Not significant
E20	<0.1	<0.1	No exceedance	No exceedance	0.2	32.6	32.8	Not significant
E21	<0.1	<0.1	No exceedance	No exceedance	<0.1	30.4	30.4	Not significant
E22	<0.1	<0.1	No exceedance	No exceedance	<0.1	33.4	33.4	Not significant
E23	<0.1	<0.1	No exceedance	No exceedance	<0.1	47.7	47.7	Not significant
E24	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.4	31.4	Not significant

Receptor ID	S PC	N PC	Background	PEC	PC (% of CL function)	Background (% of CL function)	PEC (% of CL function)	Impact
E25	<0.1	<0.1	No exceedance	No exceedance	0.1	33.2	33.3	Not significant
E26	<0.1	<0.1	No exceedance	No exceedance	0.1	33.2	33.3	Not significant
E27	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.6	Not significant
E28	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.6	Not significant
E29	<0.1	<0.1	No exceedance	No exceedance	<0.1	15.5	15.5	Not significant
E30	<0.1	<0.1	No exceedance	No exceedance	0.1	15.5	15.6	Not significant
E31	<0.1	<0.1	No exceedance	No exceedance	<0.1	30.6	30.6	Not significant
E32	<0.1	<0.1	No exceedance	No exceedance	<0.1	35.8	35.8	Not significant
E33	<0.1	<0.1	No exceedance	No exceedance	<0.1	35.3	35.3	Not significant
E34	<0.1	<0.1	No exceedance	No exceedance	<0.1	93.9	93.9	Not significant
E35	<0.1	<0.1	No exceedance	No exceedance	<0.1	93.9	93.9	Not significant
E36	<0.1	<0.1	No exceedance	No exceedance	<0.1	93.9	93.9	Not significant
E37	<0.1	<0.1	0.3	0.3	<0.1	126.8	126.8	Not significant
E38	<0.1	<0.1	No exceedance	No exceedance	<0.1	5.0	5.0	Not significant
E39	<0.1	<0.1	No exceedance	No exceedance	<0.1	49.7	49.7	Not significant
E40	<0.1	<0.1	0.3	0.3	<0.1	121.0	121.0	Not significant
E41	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.9	32.0	Not significant
E42	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.7	32.8	Not significant
E43	<0.1	<0.1	No exceedance	No exceedance	<0.1	36.0	36.0	Not significant
E44	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.0	31.0	Not significant
E45	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.0	31.0	Not significant
E46	<0.1	<0.1	No exceedance	No exceedance	<0.1	33.6	33.6	Not significant
E47	<0.1	<0.1	No exceedance	No exceedance	<0.1	18.7	18.7	Not significant
E48	<0.1	<0.1	No exceedance	No exceedance	<0.1	18.7	18.7	Not significant
E49	<0.1	<0.1	No exceedance	No exceedance	<0.1	20.7	20.7	Not significant
E50	<0.1	<0.1	No exceedance	No exceedance	<0.1	20.7	20.7	Not significant

Receptor ID	S PC	N PC	Background	PEC	PC (% of CL function)	Background (% of CL function)	PEC (% of CL function)	Impact
E51	<0.1	<0.1	No exceedance	No exceedance	<0.1	20.7	20.7	Not significant
E52	<0.1	<0.1	0.1	0.1	<0.1	104.8	104.8	Not significant
E53	<0.1	<0.1	0.1	0.1	<0.1	108.6	108.6	Not significant
E54	<0.1	<0.1	No exceedance	No exceedance	<0.1	33.6	33.6	Not significant
E55	<0.1	<0.1	No exceedance	No exceedance	<0.1	33.6	33.6	Not significant
E56	<0.1	<0.1	No exceedance	No exceedance	<0.1	26.8	26.8	Not significant
E57	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.9	32.0	Not significant
E58	<0.1	<0.1	No exceedance	No exceedance	0.2	31.9	32.2	Not significant
E59	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.9	32.0	Not significant
E60	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.9	32.0	Not significant
E61	<0.1	<0.1	0.9	0.9	<0.1	242.8	242.8	Not significant
E62	<0.1	<0.1	0.9	0.9	<0.1	242.8	242.8	Not significant
E63	<0.1	<0.1	0.3	0.3	<0.1	121.6	121.6	Not significant
E64	<0.1	<0.1	0.3	0.3	<0.1	121.6	121.6	Not significant
E65	<0.1	<0.1	No exceedance	No exceedance	<0.1	23.9	23.9	Not significant
Scenario 2								
E1	<0.1	<0.1	No exceedance	No exceedance	<0.1	32.6	32.7	Not significant
E2	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.7	Not significant
E3	<0.1	<0.1	No exceedance	No exceedance	<0.1	50.8	50.8	Not significant
E4	<0.1	<0.1	No exceedance	No exceedance	<0.1	37.5	37.5	Not significant
E5	<0.1	<0.1	No exceedance	No exceedance	<0.1	37.5	37.5	Not significant
E6	<0.1	<0.1	No exceedance	No exceedance	<0.1	26.8	26.8	Not significant
E7	<0.1	<0.1	No exceedance	No exceedance	<0.1	26.8	26.8	Not significant
E8	<0.1	<0.1	No exceedance	No exceedance	<0.1	26.8	26.8	Not significant
E9	<0.1	<0.1	No exceedance	No exceedance	<0.1	36.0	36.0	Not significant
E10	<0.1	<0.1	No exceedance	No exceedance	<0.1	66.8	66.8	Not significant

Receptor ID	S PC	N PC	Background	PEC	PC (% of CL function)	Background (% of CL function)	PEC (% of CL function)	Impact
E11	<0.1	<0.1	No exceedance	No exceedance	<0.1	43.7	43.7	Not significant
E12	<0.1	<0.1	No exceedance	No exceedance	<0.1	43.7	43.7	Not significant
E13	<0.1	<0.1	No exceedance	No exceedance	<0.1	43.7	43.7	Not significant
E14	<0.1	<0.1	No exceedance	No exceedance	<0.1	85.9	85.9	Not significant
E15	<0.1	<0.1	No exceedance	No exceedance	<0.1	26.8	26.8	Not significant
E16	<0.1	<0.1	No exceedance	No exceedance	<0.1	91.3	91.3	Not significant
E17	<0.1	<0.1	No exceedance	No exceedance	<0.1	91.3	91.3	Not significant
E18	<0.1	<0.1	No exceedance	No exceedance	0.2	32.6	32.7	Not significant
E19	<0.1	<0.1	No exceedance	No exceedance	0.2	32.6	32.8	Not significant
E20	<0.1	<0.1	No exceedance	No exceedance	0.3	32.6	32.9	Not significant
E21	<0.1	<0.1	No exceedance	No exceedance	<0.1	30.4	30.4	Not significant
E22	<0.1	<0.1	No exceedance	No exceedance	0.1	33.4	33.4	Not significant
E23	<0.1	<0.1	No exceedance	No exceedance	<0.1	47.7	47.7	Not significant
E24	<0.1	<0.1	No exceedance	No exceedance	0.1	31.4	31.4	Not significant
E25	<0.1	<0.1	No exceedance	No exceedance	0.2	33.2	33.4	Not significant
E26	<0.1	<0.1	No exceedance	No exceedance	0.2	33.2	33.4	Not significant
E27	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.6	Not significant
E28	<0.1	<0.1	No exceedance	No exceedance	0.1	32.6	32.7	Not significant
E29	<0.1	<0.1	No exceedance	No exceedance	<0.1	15.5	15.5	Not significant
E30	<0.1	<0.1	No exceedance	No exceedance	0.1	15.5	15.6	Not significant
E31	<0.1	<0.1	No exceedance	No exceedance	<0.1	30.6	30.6	Not significant
E32	<0.1	<0.1	No exceedance	No exceedance	0.1	35.8	35.8	Not significant
E33	<0.1	<0.1	No exceedance	No exceedance	0.1	35.3	35.3	Not significant
E34	<0.1	<0.1	No exceedance	No exceedance	<0.1	93.9	93.9	Not significant
E35	<0.1	<0.1	No exceedance	No exceedance	<0.1	93.9	93.9	Not significant
E36	<0.1	<0.1	No exceedance	No exceedance	<0.1	93.9	93.9	Not significant

Receptor ID	S PC	N PC	Background	PEC	PC (% of CL function)	Background (% of CL function)	PEC (% of CL function)	Impact
E37	<0.1	<0.1	0.3	0.3	0.1	126.8	126.8	Not significant
E38	<0.1	<0.1	No exceedance	No exceedance	0.0	5.0	5.0	Not significant
E39	<0.1	<0.1	No exceedance	No exceedance	<0.1	49.7	49.7	Not significant
E40	<0.1	<0.1	0.3	0.3	0.1	121.0	121.1	Not significant
E41	<0.1	<0.1	No exceedance	No exceedance	0.1	31.9	32.0	Not significant
E42	<0.1	<0.1	No exceedance	No exceedance	0.1	32.7	32.8	Not significant
E43	<0.1	<0.1	No exceedance	No exceedance	<0.1	36.0	36.0	Not significant
E44	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.0	31.0	Not significant
E45	<0.1	<0.1	No exceedance	No exceedance	<0.1	31.0	31.0	Not significant
E46	<0.1	<0.1	No exceedance	No exceedance	<0.1	33.6	33.6	Not significant
E47	<0.1	<0.1	No exceedance	No exceedance	<0.1	18.7	18.7	Not significant
E48	<0.1	<0.1	No exceedance	No exceedance	<0.1	18.7	18.7	Not significant
E49	<0.1	<0.1	No exceedance	No exceedance	<0.1	20.7	20.7	Not significant
E50	<0.1	<0.1	No exceedance	No exceedance	<0.1	20.7	20.7	Not significant
E51	<0.1	<0.1	No exceedance	No exceedance	<0.1	20.7	20.7	Not significant
E52	<0.1	<0.1	0.1	0.1	<0.1	104.8	104.8	Not significant
E53	<0.1	<0.1	0.1	0.1	<0.1	108.6	108.6	Not significant
E54	<0.1	<0.1	No exceedance	No exceedance	<0.1	33.6	33.6	Not significant
E55	<0.1	<0.1	No exceedance	No exceedance	<0.1	33.6	33.6	Not significant
E56	<0.1	<0.1	No exceedance	No exceedance	<0.1	26.8	26.8	Not significant
E57	<0.1	<0.1	No exceedance	No exceedance	0.1	31.9	32.0	Not significant
E58	<0.1	<0.1	No exceedance	No exceedance	0.4	31.9	32.4	Not significant
E59	<0.1	<0.1	No exceedance	No exceedance	0.1	31.9	32.0	Not significant
E60	<0.1	<0.1	No exceedance	No exceedance	0.1	31.9	32.0	Not significant
E61	<0.1	<0.1	0.9	0.9	<0.1	242.8	242.8	Not significant
E62	<0.1	<0.1	0.9	0.9	<0.1	242.8	242.8	Not significant

Receptor ID	S PC	N PC	Background	PEC	PC (% of CL function)	Background (% of CL function)	PEC (% of CL function)	Impact
E63	<0.1	<0.1	0.3	0.3	0.1	121.6	121.7	Not significant
E64	<0.1	<0.1	0.3	0.3	0.1	121.6	121.7	Not significant
E65	<0.1	<0.1	No exceedance	No exceedance	<0.1	23.9	23.9	Not significant
CL = Critical load PEC = Predicted environmental concentration (PC + background) No exceedance as per the output of the critical load function tool available on APIS								

5.2 Short-term Model Results

Table 5.4 details the results of the short-term impact assessment results. The summary table provides the maximum result at any receptor for each pollutant and averaging period under operating conditions. The maximum CO (8-hour rolling and hourly means) were observed at H17 and H24 respectively. The full results are contained within Appendix B.

Table 5.4 indicates that the results of the short-term assessment metrics for both human and ecological receptors are below the relevant AQAL during operation of the plant for both Scenario 1 and 2.

Table 5.4 – Short-term Results at Human and Ecological Receptors

Parameter	Short-term Mean				
	AQAL µg/m^3	PC µg/m^3	PEC µg/m^3	% PC of AQAL	% PEC of AQAL
Scenario 1					
Human Receptors					
99.79 percentile 1-hour mean NO_2 (H3)	200	7.1	19.0	3.5%	9.5%
CO 8-hour (H24)	10,000	17.1	1061.1	0.2%	10.6%
CO 1-hour (H17)	30,000	37.5	1141.5	0.1%	3.8%
Ecological Receptors					
24-hour mean NO_x (Dee 1)	75	9.8	27.1	13.1%	36.1%
Scenario 2					
Human Receptors					
99.79 percentile 1-hour mean NO_2 (H3)	200	14.2	26.1	7.1%	13.1%
CO 8-hour (H24)	10,000	34.1	1078.1	0.3%	10.8%
CO 1-hour (H17)	30,000	74.5	1178.5	0.2%	3.9%
Ecological Receptors					
24-hour mean NO_x (Dee 1)	75	19.8	37.1	26.5%	49.5%

6 CONCLUSIONS

Bureau Veritas has been commissioned by Caulmert for support with Environmental Permitting requirements for the proposed Peaking Power Plant at the former Deeside Power Plant. This document provides supporting technical information for the application of an Environmental Permit in accordance with the Industrial Emissions Directive (IED) to operate the site. The permit variation application covers the installation of 11 natural gas generators to the existing permit EPR/XP3131VK.

The generators are operated using natural gas as the fuel; hence, the following pollutants were included in the assessment: nitrogen oxides (NO_x) and carbon monoxide (CO) where applicable. Release rates for NO_x and CO were derived using information provided by the generator manufacturers and emission limits legislation.

The assessment has resulted in the following conclusions:

- Considering annual mean results, all results at both human and ecological receptors were below the relevant assessment metrics.

- The results for nitrogen deposition show exceedances at nine ecological receptors. Where the contribution from the plant is less than 1% of the PEC, this can be considered not significant. However, it is observed that three SSSIs contain exceedances within their contributing over 1% PC of critical load respectively, the eastern area within the Dee Estuary has five exceedances (E18, E19, E20, E25 and E26). The Shotton Lagoons and Reedbeds contains three exceedances at receptors (E57, E58, E59), and the Afon Dyfrdwy (River Dee) has one exceedance directly south of the site (E2). The 1% screening criterion is not a threshold of harm and exceeding this threshold does not, of itself, imply damage to a habitat.

- An ecological report was conducted by Rachel Hacking Ecology[10] to further investigate the exceedance of the 1% screening threshold, which for all designation exceedances states that any additional atmospheric nitrogen deposition has the potential for an adverse impact, but the additional process contribution is unlikely to be significant given the existing background levels causing the exceedance.

- The contour plots in Appendix A show that there are areas of Dee Estuary SSSI as well as the eastern part of Shotton Lagoons SSSI and small areas of the Afon Dyfrdwy (River Dee) SSSI, are located within the 1% exceedance zone of the minimum critical load for nitrogen deposition of 10 and 5 kg N ha^{-1} y^{-1}, respectively. The ecological report states the exceedance of the 1% threshold in these designations is unlikely to be significant given the existing background.

- As the modelled results of the acid deposition PC are less than 1% of the PEC at all considered ecological receptors, these can be described as not significant.

- Considering short-term results, all results at human and ecological receptors were below the relevant assessment metrics.

Due to conservative conditions being employed throughout the assessment, the modelled predictions are expected to represent the upper limit of concentrations.

[10] Ecological Assessment Peaking Plant Nitrogen Exceedance Assessment

Appendix A: Pollutant Concentration Isopleths

Figure A.1 – Nitrogen Deposition Exceedance Zone Maps (1% of minimum critical load of 10 kg N ha-1 y-1) (Scenario 2)

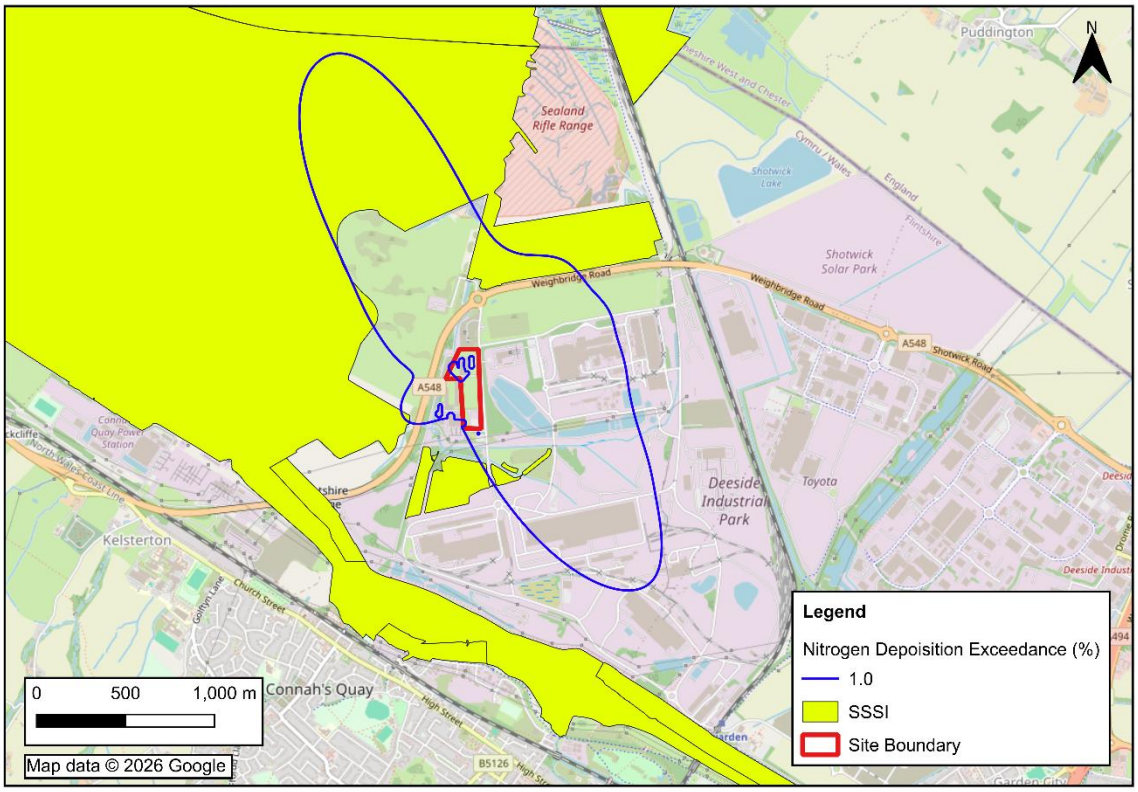


Figure A.2 – Nitrogen Deposition Exceedance Zone Maps (1% of minimum critical load of 5 kg N ha-1 y-1) (Scenario 2)

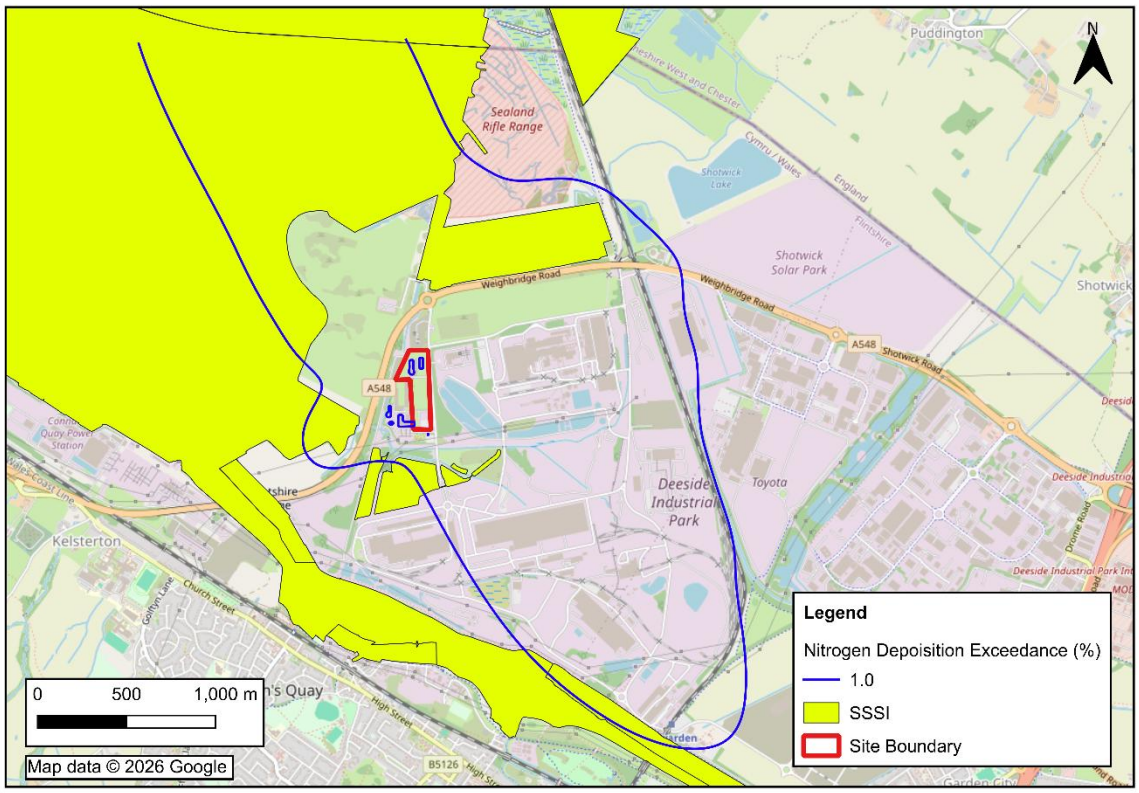
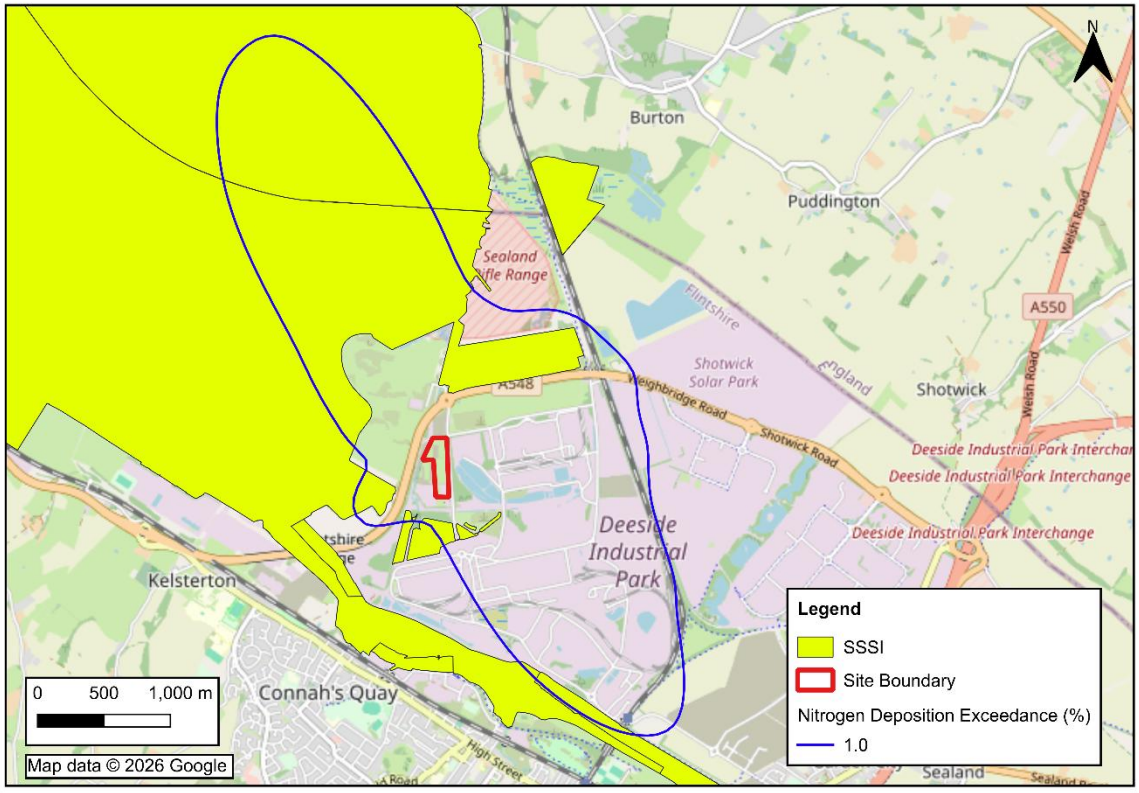


Figure A.3 – Nitrogen Deposition Exceedance Zone Maps (1% of minimum critical load of 5 kg N ha-1 y-1) - 7km (Scenario 2)



Appendix B: Full Results Tables

ATTACHED AS SEPARATE FILE

Appendix C: Model Files

ATTACHED AS SEPARATE FILE

Appendix D: Cumulative Impact Assessment

ATTACHED AS SEPARATE FILE

Appendix E: Ecological Assessment Peaking Plant Nitrogen Exceedance Assessment

ATTACHED AS SEPARATE FILE

APPENDIX 3

Ecological Assessment Peaking Plant Nitrogen Exceedance Assessment

Deeside Power Station Peaking Plant

Atmospheric Nitrogen Deposition Assessment

2026

Rev. A

Client	Caulmert Ltd
Project Title	Deeside Power Station Peaking Plant
Project Reference	RHE.4326
Project Leader	Dr Rachel Hacking
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	Name	Position	Date
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1. Introduction

1.1 Project Brief

1.1.1 Caulmert Ltd are reviewing an Environmental permit variation application which will be required to operate a proposed Gas-powered (hydrogen ready) Peaking Plant within the existing operational area of Deeside Power Station. Rachel Hacking Ecology Limited was commissioned in 2026 by Caulmert Ltd to assess of the ecological impacts of the Peaking Plant exceeding Atmospheric Nitrogen deposition loads on sensitive habitats of the Dee Estuary, Shotton Lagoons and Afon Dyfrdwy/River Dee Sites of Special Scientific Interest (SSSIs).

1.1.2 Appendix 1 shows the location of each SSSI relative to the 1% Nitrogen exceedance zone. The model suggests that a small area of Dee Estuary SSSI, the eastern part of Shotton Lagoons SSSI and a very small linear strip of the River Dee SSSI are located within the 1% exceedance zone for Atmospheric Nitrogen. If habitats that are sensitive to Nitrogen deposition are located within the exceedance zone there is a risk of harm to the qualifying features of each SSSI. The relevant qualifying features for the SSSIs are described in Appendix 2.

1.1.3 During a previous assessment for a Gas-powered Peaking Plant at a different part of Deeside Power Station, Natural Resources Wales (NRW) requested that the assessment included Atmospheric Nitrogen deposition loads on sensitive habitats within The River Dee, Shotton Steelworks and Top-y-Fron Dingle and Kelserton Brook Local Wildlife Sites (LWS). This report includes an assessment of The River Dee and Shotton Steelworks LWS's as well as the SSSI's. Top-y-Fron Dingle and Kelserton Brook LWS lies outside of the 1% Nitrogen exceedance zone and has been excluded. If habitats that are sensitive to Nitrogen deposition are located within the exceedance zones there is a risk of harm to the qualifying features of each LWS. Locations of each LWS are detailed in Appendix 3.

1.2 Scope of Work

1.2.1 The Client commissioned Rachel Hacking Ecology to carry out the following works:

- Desk-based study to obtain details of designated sites and to review previous survey work on relevant areas of the designated sites.
- Classify the vegetation on those areas of the SSSIs and LWSs within the 1% exceedance zone.
- Identify Atmospheric Nitrogen tolerances and critical loads for the vegetation types within the exceedance zone.

- Determine the impacts of additional Atmospheric Nitrogen on the vegetation types within the exceedance zone.

1.3 Site Visit Information

Surveyor Details

1.3.1 Dr Rachel Hacking and Andy Harmer (Principal Ecologists) undertook the botanical assessment of the relevant parts of the sites. The main site visit took place on 29th August 2024. Rachel has over 20 years of experience in habitat surveys, has a PhD in botany and specialises in classifying plant communities. Andy has over 20 years of experience in habitat and protected species assessments and is a highly experienced drone user. Andy's knowledge of the habitats along the relevant parts of the banks of the River Dee SSSI also formed part of the data gathering.

Weather

1.3.2 The weather on the day of the survey was calm, dry and bright, with an average temperature of 16ºC.

2. Methods

2.1 Desk Study

2.1.1 Citations for the SSSIs were obtained from Natural Resources Wales website[1] and extracts are appended (see Appendix 2). Further information about the SSSIs was obtained from Enfys Ecology 2022[2] who carried out vegetation surveys of land within the two SSSIs that are owned by Tata Steel. This included most of the land within the Atmospheric Nitrogen exceedance zone.

2.1.2 The APIS website[3] was interrogated to obtain Atmospheric Nitrogen deposition rates for each broad habitat type within the 1% Atmospheric Nitrogen exceedance zone. In addition the minimum critical load for Atmospheric Nitrogen for each habitat that is a qualifying feature of the SSSIs was obtained.

2.1.3 COFNOD[4] was contacted to provide details of non-statutory designated sites within a 2km radius of the site. Citation details for habitats present within LWSs were provided in JNCC Phase 1 format.

2.2 Field Survey

Botanical Survey

2.2.1 The field data was gathered using a combination of drone footage and visual searches. Andy used a DJI Mini 3 Drone and a Mavic Enterprise 3T drone to gather detailed information of the habitats and species, as well as assessing saltmarsh vegetation from the nearest viewpoints, considering the significant constraints that existed (see Paragraph 3.1.2). Rachel assessed the habitats and species.

2.2.2 Once gathered, species lists were assembled and categorised into plant communities. The published communities within the National Vegetation Classification (NVC)[5] were interrogated and the habitats on site assigned to an NVC community.

2.2.3 Botanical surveys of the LWSs were not carried out because NRW asked for the assessment after the original assessment and survey of statutory designated sites had been submitted.

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[1] https://naturalresources.wales/guidance-and-advice/environmental-topics/wildlife-and-biodiversity/protected-areas-of-land-and-seas/find-protected-areas-of-land-and-sea/

[2] Enfys Ecology (2022). *Tata Steel, Shotton Site, Deeside, Flintshire: Biodiversity Assessment And Management Strategy*. Unpublished Report for Tata Steel

[3] https://www.apis.ac.uk/srcl

[4] https://www.cofnod.org.uk/Home

[5] Rodwell, J.S. (ed.) 1991-2000. *British Plant Communities, Volumes I-V*. Cambridge University Press.

2.3 Data Analysis

2.3.1 Identification of the constant and most abundant plant species enabled classification of the UK Habitat type and enabled assignment of each habitat with the exceedance zone to the categories on the APIS website. Mark Woods (Principal Ecologist) undertook the analysis.

Ellenberg Indicator Values

2.3.1 The impact on the habitats within the 1% Atmospheric Nitrogen deposition exceedance zone will depend on the tolerance of individual species to increased Nitrogen loads. Ellenberg Indicator Values[6] can provide useful information about the ecological conditions on a site. The Ellenberg Indicator Values for Nitrogen (N) for constant species within a particular assemblage can determine whether that assemblage is tolerant or intolerant of high Nitrogen levels. If the assemblage is tolerant then there is less likely to be an impact. Identification of the constant species associated with each habitat located within the exceedance zones and determination of individual N values and average N values for the constant species will infer the extent of tolerance.

[6] Hill, M.O., Mountford, J.O., Roy, D.B. & Bunce, R.G.H. 1999. *Ellenberg's indicator values for British plants: ECOFACT Volume 2 Technical Annex*. Institute of Terrestrial Ecology.

3. Results

3.1 Survey Constraints

3.1.1 It was not feasible to walk over the areas of the Dee Estuary SSSI that are within the exceedance zone because the area is part of an active shooting range. It was, however, feasible to make use of a low-flying drone to photograph the habitats from adjacent areas to the shooting range. The quality of the photographs was sufficient to determine the species and classify the habitat type.

3.1.2 Access to Shotton Lagoons SSSI was restricted by the landowners and it was deemed difficult to effectively walk the site due to the impenetrable vegetation and types of habitats in places. Therefore, a low-flying drone was used to gather information as well as interrogating a previous ecology report. This was deemed robust enough to enable a characterisation of the vegetation.

3.1.3 Access to the LWSs was not considered at the time of survey but would in any case be largely impractical due to similar conditions to both SSSI's. As such, designation citations, as well as inferences made from immediately adjacent habitat within the SSSIs were deemed sufficient to suitably assess the habitats present.

3.2 Desk Study: Site Descriptions

Dee Estuary SSSI

3.2.1 Most of the habitat within the exceedance zone is upper saltmarsh, which is a qualifying feature of the SSSI.

3.2.2 The Enfys Ecology report (2022) mapped the land within part of the exceedance zone as a mix of neutral grassland (g3), coastal saltmarsh (t2a) and intertidal mudflats (t2d). Two very small areas of broadleaved woodland that are within the Dee Estuary SSSI occur close to Weighbridge Road. To the north, the woodland stand is outside of the Enfys Ecology survey area. To the south the woodland stand is located in the survey area and is mapped as Other Woodland: Broadleaved (w1g). Enfys Ecology mapped the saltmarsh but did not survey the vegetation. It was assumed that the upper saltmarsh was "dominated by common cord grass *Spartina anglica* with sea purslane *Atriplex portulacoides*, higher up more diverse grasses begin to appear." The report also suggested that intertidal creeks that formed a network across the upper saltmarsh were sparsely vegetated with glassworts *Salicornia* spp.

3.2.3 The 1% exceedance zone extends further north-west than the extent of the Enfys Ecology survey but when viewing aerial imagery and the drone images, the habitats appear similar to those described.

Shotton Lagoons and Reedbeds SSSI

3.2.4 The habitats within the exceedance zone are a mosaic of lowland mixed deciduous (w1f), reedbeds (f2e), open water (r1) and other neutral grassland (g3c). The reedbeds are a qualifying feature for the SSSI.

3.2.5 The woodland is a mix of semi-mature silver birch *Betula pendula* and willow *Salix* spp., with a dense, uniform canopy and a sparse, heavily shaded field layer of species such as climbing ivy *Hedera helix* and herb-robert *Geranium robertianum*. The grasslands are a mix of coarse grasses with ruderal herbs. Yorkshire fog *Holcus lanatus* and cock's-foot *Dactylis glomerata* are constant species along with a wide variety of common grassland forbs. The reedbeds are a mix of dense stands of common reed *Phragmites australis* that have covered areas of open water or mixed marginal vegetation fringing open water lagoons that contain common reed and greater reedmace *Typha latifolia*. The shorelines of some of the lagoons were more species-rich typically supporting species such as horsetails *Equisetum* spp. and hemp agrimony *Eupatorium cannabinum*.

Afon Dyfrdwy/River Dee SSSI

3.2.6 The Enfys Ecology report (2022) mapped the river bank habitats within the exceedance zone as a mosaic of lowland mixed deciduous woodland (w1f), modified grassland (g4), neutral grassland (g3) and dense scrub (h3), as well as scattered trees, scattered scrub and tall, ruderal herb patches. None of these habitats are qualifying habitats for the Afon Dyfrdwy/River Dee SSSI. Intertidal mudflats (t2d) and the river channel itself also lie within the exceedance zone.

3.2.7 The woodland is a mix of semi-mature silver birch and willow with some sycamore *Acer pseudoplatanus.* The grasslands are species-poor. The mixed scrub comprises hawthorn *Crataegus monogyna*, gorse *Ulex europaeus*, bramble *Rubus fruticosus* agg., elder *Sambucus nigra*, dog rose *Rosa canina* agg. and in some places, saplings of birch.

River Dee LWS

3.2.8 All of the habitats are assumed to be in the 1% exceedance zone, which includes a mix of scattered scrub (2.573 ha), semi-improved neutral grassland (41.76 ha), improved grassland (8.188 ha), poor semi-improved grassland (3.557 ha), tall ruderal vegetation (2.96 ha), swamp (0.32 ha), standing water (80.019 ha), intertidal mud/sand (7.873 ha), dense/continuous plants saltmarsh (17.467 ha). The site is designated for its coastal and floodplain grazing marsh, coastal saltmarsh and mudflat habitats, as well as for ornithological reasons.

3.2.9 According to the citation, the site is for the most part, on a narrow band (about 10-20m wide) of bare mud at low tide. At the high-water mark is a thin strip of saltmarsh vegetation, dominated by sea purslane *Atriplex pedunculata* with sea beet *Beta vulgaris*, grass-leaved orache *Atriplex littoralis*, sea blight *Suaeda maritima* and sea club rush *Bolboschoenus maritimus*. The poor semi-improved pastures alongside the river include patches of saltmarsh vegetation dominated by red fescue *Festuca*

rubra, creeping bent-grass *Agrostis stolonifera*, saltmarsh grass *Puccinellia maritima*, and common couch *Elymus repens* with occasional sea milkwort *Lysimachia maritima*, thrift *Armeria maritima*, sea plantain *Plantago maritima*, lesser sea-spurrey *Spergularia marina*, buck's-horn plantain *Plantago coronopus* and common cord-grass *Spartina anglica*. At the west end of the site closest to the power station, areas of willow and hawthorn scrub exist, along with several man-made lagoons which contain common nettle, creeping thistle *Cirsium arvense* and a marsh of greater reedmace and common reed. On Wepre Tip there is a coarse grassland with scattered willow and birch *Betula* spp. where spiny restharrow *Ononis spinosa* occurs. The embankments comprise semi-improved grassland, including false oat-grass *Arrhenatherum elatius*, common knapweed *Centaurea nigra*, common ragwort *Jacobaea vulgaris,* yellow oat-grass *Trisetum flavescens*, quaking grass *Briza media* and common centaury *Centaurium erythraea*.

Shotton Steelworks LWS

3.2.10 All of the habitats are assumed to be in the 1% exceedance zone, which includes semi-improved neutral grassland (14.918 ha), marsh/marshy grassland (1.096 ha), standing water (0.942 ha), bare ground (1.312 ha). The site is designated for its reedbed, standing open water and pasture/meadow and scrub, as well as for ornithological reasons.

3.2.11 According to the citation, the site is an ex-industrial site in the Dee Estuary, adjacent to the Dee Estuary SSSI. There are a range of habitats present, including rough neutral grassland, marshy grassland, bare ground, tall ruderal herb, reedbed and man-made lagoons. Species present, including viper's bugloss *Echium vulgare*, wild parsnip *Pastinaca sativa*, marsh orchid *Dactylorhiza* spp. and variegated horsetail *Equisetum variegatum*.

3.3 Desk Study: APIS

Dee Estuary SSSI

3.3.1 There are a range of salt-marsh community types that are included on the Critical Loads table[7], which could occur within the exceedance zone. All of the salt-marsh community types have a minimum critical load for Nitrogen of 10kg/N/ha/yr. The average Nitrogen deposition for moorland (soft vegetation) is 14.81kg/N/ha/yr. The average Nitrogen deposition for forest (woodland and scrub) is 26.498kg/N/ha/yr but there is no critical load provided for woodland community types on this SSSI. At the present time the average Nitrogen deposition for moorland is exceeding the critical load by an average of 4.81kg/N/ha/yr (32.5%).

[7] 2024-10-04-17-26-28.687773_APIS_report

Shotton Lagoons SSSI

3.3.2 There are two relevant vegetation types on the Critical loads table[8] including calcareous grassland and swamp (*Phragmites australis* reedbed). Both communities have a minimum critical load for Nitrogen of 10kg/N/ha/yr. The average Nitrogen deposition for moorland (soft vegetation) is 16.741kg/N/ha/yr. The average Nitrogen deposition for forest (woodland and scrub) is 29.932kg/N/ha/yr but there is no critical load for woodland community types on this SSSI. At the present time the average Nitrogen deposition for moorland is exceeding the critical load by an average of 6.741kg/N/ha/yr (40.3%).

Afon Dyfrdwy/River Dee SSSI

3.3.3 The relevant vegetation types on the Critical loads table including a range of communities of running water and a range of communities of salt-marsh, as well as *Luronium natans*. The running water communities have a minimum critical load for Nitrogen of 2kg/N/ha/yr. All of the salt-marsh community types have a minimum critical load for Nitrogen of 10kg/N/ha/yr.

River Dee LWS

3.3.4 There are a range of community types that are included which could occur within the exceedance zone of River Dee LWS. Woodland communities are not present within the LWS and are not considered. All of the relevant open community types present have a minimum critical load for Nitrogen of 10kg/N/ha/yr. The average Nitrogen deposition for moorland (soft vegetation) is 17.94kg/N/ha/yr. At the present time the average Nitrogen deposition for moorland is exceeding the critical load by an average of 7.94kg/N/ha/yr (79.4%)[9].

Shotton Steelworks LWS

3.3.5 There are a range of community types that are included which could occur within the exceedance zone of Shotton Steelworks LWS. Woodland communities are not present within the LWS and are not considered. All of the relevant open community types within the LWS have a minimum critical load for Nitrogen of 10kg/N/ha/yr. The average Nitrogen deposition for moorland (soft vegetation) is 17.04kg/N/ha/yr. At the present time the average Nitrogen deposition for moorland is exceeding the critical load by an average of 7.04kg/N/ha/yr (70.4%)[10].

[8] 2024-10-04-17-10-00.596892_APIS_report

[9] 2025-04-15-16-54-07.562286_APIS_report (3)

[10] 2025-04-15-15-10-16.646743_APIS_report

3.4 Field Survey

Dee Estuary SSSI

3.4.1 The study site within the Dee Estuary SSSI exceedance zone mostly comprises saltmarsh grassland, dominated by sea couch *Elymus atherica* at the upper tidal reach and common cord-grass *Spartina anglica* at the lower tidal areas. Creeks flow through the area, with common saltmarsh-grass *Puccinellia maritima* occurring on the immediate banks. A grassed embankment occurs at the southern edge of the study site and this supports sea couch *Elymus atherica* and common couch-grass *Elymus repens*. Photograph 1 shows the saltmarsh zone.



Photograph 1 showing the Dee Estuary SSSI saltmarsh within exceedance zone

3.4.2 Also lying within the exceedance zone of the Dee Estuary SSSI are two parcels of woodland and scrub. These support white willow *Salix alba*, alder and silver birch *Betula pendula*, with dense bramble, European gorse *Ulex europaeus*, hemp-agrimony *Eupatorium cannabinum* and common nettle *Urtica dioica*. Common reed *Phragmites australis* occurs in pockets within the northern parcel. Photographs 2 and 3 show these woodland and scrub habitats.



Photograph 2 showing the northern parcel of woodland and scrub



Photograph 3 showing the southern parcel of woodland and scrub

3.4.3 The habitats within the Dee Estuary SSSI exceedance zone correlate to the following NVC communities (see Figures 1 and 2):

- SM6 *Spartina anglica* salt-marsh community
- SM8 Annual *Salicornia* salt-marsh community
- SM13 *Puccinellia maritima* salt-marsh community
- W6 *Alnus glutinosa - Urtica dioica* woodland
- W24 *Rubus fruticosus – Holcus lanatus* underscrub
- S26 *Phragmites australis – Urtica dioica* tall-herb fen.

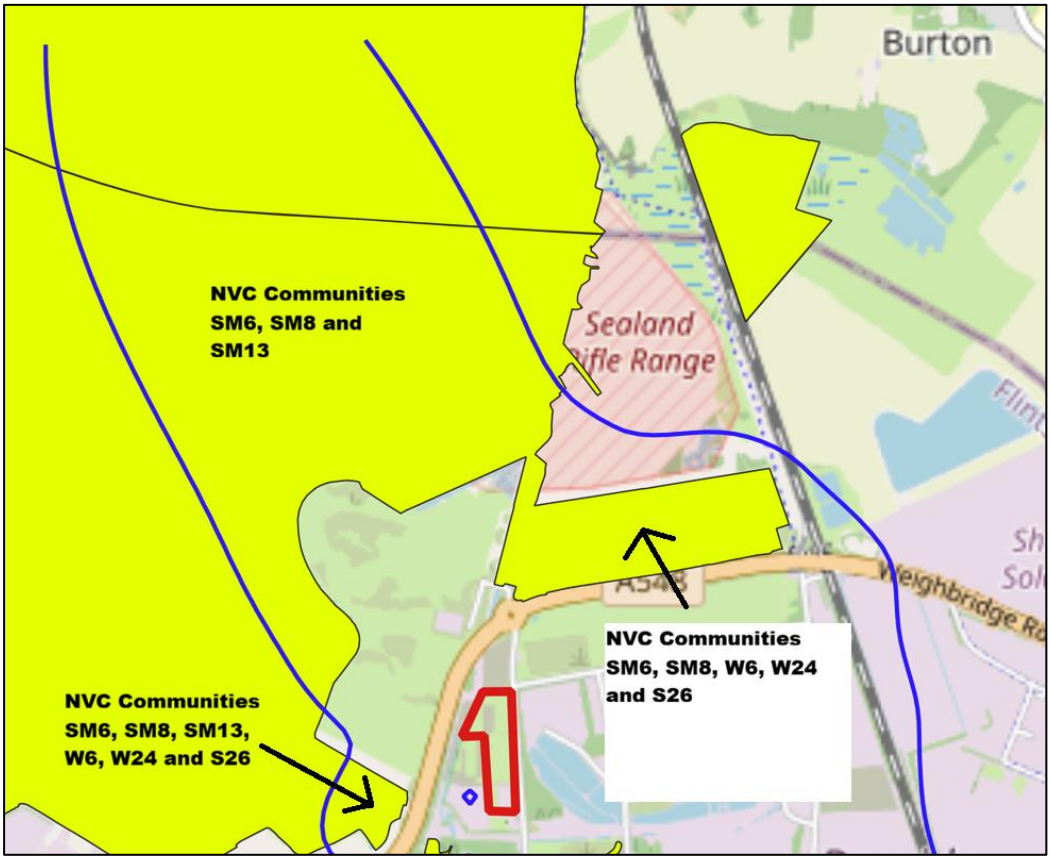


Figure 1. NVC communities within the northern Dee Estuary SSSI exceedance zone



Figure 2. NVC communities within the southern Dee Estuary SSSI exceedance zone

3.4.4 All habitats described during the survey at the Dee Estuary correlate to the Enfys Ecology report (2022).

Shotton Lagoons SSSI

3.4.5 The study site within Shotton Lagoons SSSI exceedance zone comprises a mosaic of woodland (mostly plantation), reedbed, open waterand grassland. The woodland supports white willow *Salix alba*, silver birch *Betula pendula*, grey willow *Salix cinerea* with scattered Hawthorn *Crataegus monogyna.* The reedbed supports mostly Common reed *Phragmites australis* with stands of hemp agrimony *Eupatorium cannabinum* and to a lesser extent, great willowherb *Epilobium hirsutum* and rosebay willowherb *Chamaenerion angustifolium.* The grasslands comprise false oat-grass, Yorkshire fog *Holcus lanatus* and cock's-foot *Dactylis glomerata*, with damper areas supporting soft-rush *Juncus effusus.* Photographs 4 and 5 show these habitats.



Photograph 4 showing the mosaic of habitats within Shotton Lagoons SSSI exceedance zone (south-western areas)



Photograph 5 showing the mosaic of habitats within Shotton Lagoons SSSI exceedance zone (linear strip to north-east)



Photograph 6 showing the mosaic of habitats within Shotton Lagoons SSSI exceedance zone (reedbed and open water looking west)

3.4.6 The habitats within Shotton Lagoons SSSI exceedance zone correlate to the following NVC communities (see Figure 3):

- W1 *Salix cinerea – Galium palustre* woodland, grading to W2 *Salix cinerea – Betula pubescens – Phragmites australis* woodland.
- S26 *Phragmites australis – Urtica dioica* tall-herb fen.
- MG1 *Arrhenatherum elatius* grassland

- MG9 *Holcus lanatus – Deschampsia cespitosa* grassland/MG10 *Holcus lanatus – Juncus effusus* rush-pasture.

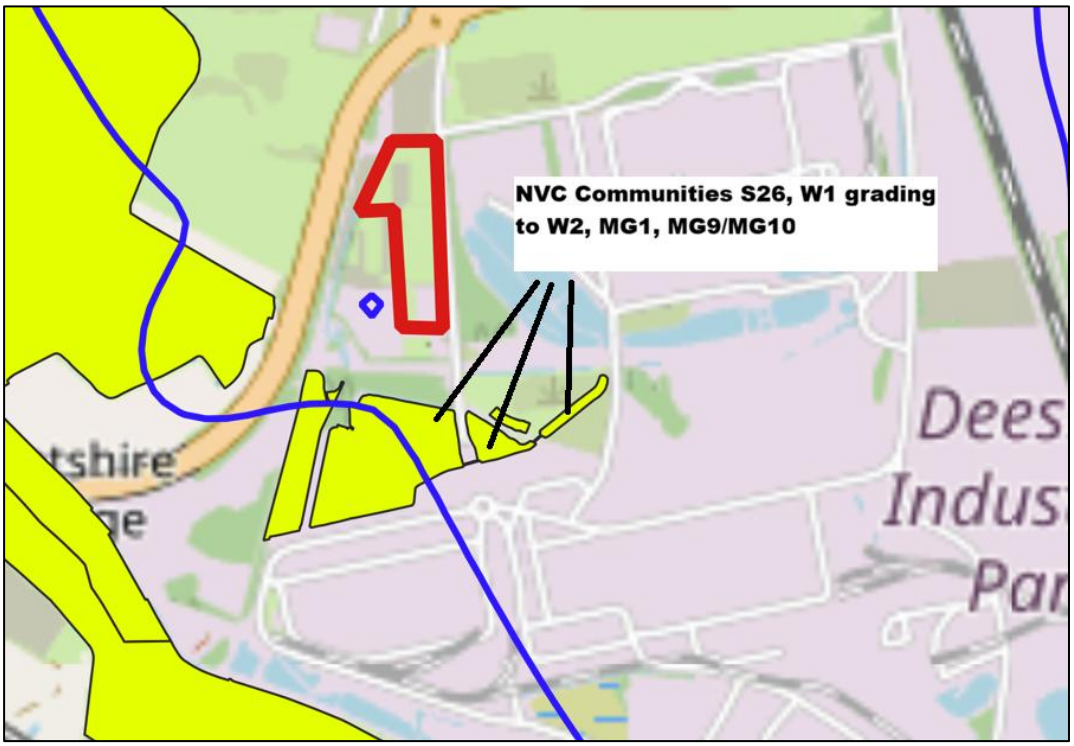


Figure 3. NVC communities within the Shotton Lagoons SSSI exceedance zone

3.4.7 All habitats described during the survey of Shotton Lagoons correlate to the Enfys Ecology report (2022).

Afon Dyfrdwy/River Dee SSSI

3.4.8 The study site within the Afon Dyfrdwy/River Dee Estuary SSSI exceedance zone comprises lowland mixed deciduous woodland, modified grassland, neutral grassland, dense scrub, intertidal mudflats with common cord-grass and the river channel.

3.4.9 The habitats within the Dee Estuary SSSI exceedance zone correlate to the following NVC communities (see Figure 4):

- SM6 *Spartina anglica* salt-marsh community
- W6 *Alnus glutinosa - Urtica dioica* woodland
- W23 *Ulex europaeus - Rubus fruticosus* scrub
- MG6 *Lolio – Cynosuretum cristati* grassland.



Figure 4. NVC communities within the northern River Dee SSSI exceedance zone

3.4.10 All habitats described during the survey at the River Dee correlate to the Enfys Ecology report (2022).

4. Assessment

4.1 Deeside Estuary SSSI

APIS Assessment

4.1.1 Modelling by Caulmert Ltd has identified that Atmospheric N deposition from the proposed Peaking Plant will exceed 1% of minimum critical loads on a small proportion of the Dee Estuary SSSI. Exceedance of the minimum critical load has the potential for an adverse impact on the vegetation that is a qualifying feature of the SSSI. To quantify the magnitude of the impact of a 1% exceedance is not feasible because the average deposition rate already exceeds the minimum critical load by 4.81kg/N/ha/yr (32.5%) from the sources shown on Figure 4. Any additional Atmospheric N deposition has the potential for an adverse impact, but the additional process contribution is unlikely to be significant given the background exceedance levels.

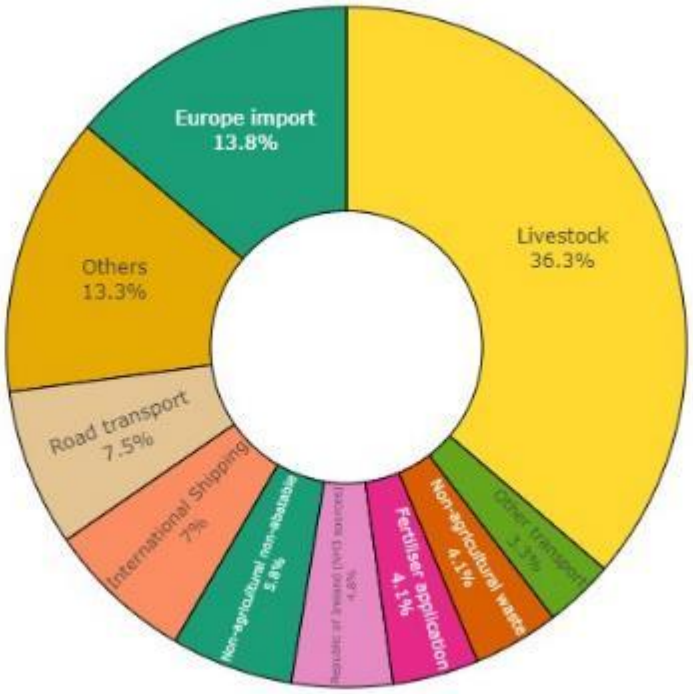


Figure 4. Sources of Atmospheric Nitrogen Deposition on the Dee Estuary

Ellenberg Indicator Values

4.1.2 The vegetation in the intertidal creeks is sparse in the exceedance zone, but the typical species are glassworts Salicornia spp., the most common being *Salicornia europaea*, which has an N value of 6.

4.1.3 Most of the saltmarsh within the exceedance zone is dominated by a mosaic of common saltmarsh-grass *Puccinellia maritima* or common cord-grass *Spartina anglica*, which form mono-cultural patches with common cord-grass being more abundant close to the creeks. Both species have N values of 6.

4.1.4 The upper saltmarsh beyond the normal tidal reach is also species-poor and dominated by coarse grasses including sea couch *Elymus atherica* and common couch-grass *Elymus repens*, which have N values of 6 and 7 respectively.

4.1.5 In summary the saltmarsh communities have an average N value just above 6, which is indicative of fertile soils.

4.1.6 The small area of woodland next to an access track off Weighbridge Road contains white willow Salix alba, grey willow *Salix cinerea*, hawthorn *Crataegus monogyna* and bramble *Rubus fruticosus* agg.. The respective N values for these species are 8, 5, 6, and 6, which is an average N value of 6.25.

4.1.7 The small patch of woodland at the south end of the SSSI, located on the west side of Weighbridge Road is a mix of white willow, ash, Scots pine *Pinus sylvestris*, grey willow and bramble. The respective N values for these species are 8, 6, 2, 5 and 6, which is an average of 5.4. This woodland is in the 0.5% exceedance zone.

4.1.8 In summary the woodland communities have an average N value of 5.8, which is indicative of fertile soils.

4.1.9 The exceedance of Atmospheric Nitrogen deposition on the Dee Estuary is already significant and a further 1% is unlikely to have much of an effect on the vegetation. Much of the vegetation in the 1% exceedance area is tolerant of fertile soils and fertility will be maintained by the input of suspended sediments in tidal flows as well as from atmospheric deposition. Other factors such as soil salinity, inundation and grazing will have as much influence as Atmospheric Nitrogen deposition on the composition of the vegetation. Even if Atmospheric Nitrogen levels were reduced below critical thresholds change in the composition of the vegetation may not occur without changes to other factors.

4.1.10 The grassland of the upper saltmarsh is species-poor and also tolerant of high soil Nitrogen levels. As above, any reduction in Atmospheric Nitrogen deposition is unlikely to promote a change to a more species-rich sward because of the vigour and dense cover of couch-grasses. Occasional inundation with Nitrogen-rich sediments will also maintain high soil fertility.

4.1.11 The woodland stands are tolerant of fertile soils and are located in areas that occasionally will be inundated by high tides which will increase soil Nitrogen levels. A field layer of bramble and ruderal herbs will also be sustained by high Nitrogen levels.

4.2 Shotton Lagoons SSSI

APIS Assessment

4.2.1 Modelling by Caulmert Ltd has identified that Atmospheric N deposition from the proposed Peaking Plant will exceed 1% of minimum critical loads on part of the Shotton Lagoons SSSI. Exceedance of the minimum critical load has the potential for an adverse impact on the vegetation that is a qualifying feature of the SSSI. To quantify the magnitude of the impact of a 1% exceedance is not feasible because the average deposition rate already exceeds the minimum critical load by 6.741kg/N/ha/yr (40.3%) from the sources shown on Figure 5. Any additional Atmospheric N deposition has the potential for an adverse impact, but the additional process contribution is unlikely to be significant given the background exceedance levels.

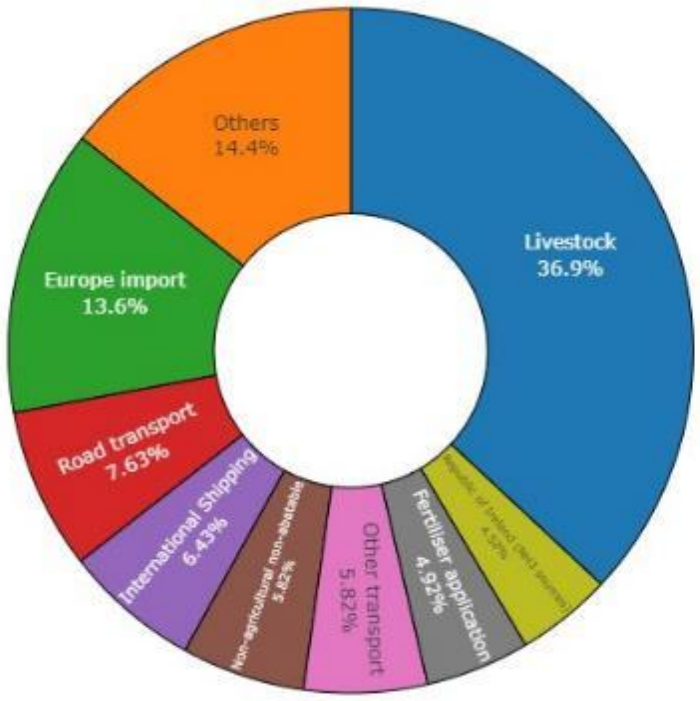


Figure 5. Sources of Atmospheric Nitrogen Deposition on Shotton Lagoons

Ellenberg Indicator Values

4.2.2 The reedbeds are dominated by common reed with occasional greater reedmace. Ellenberg N values are 6 and 7 respectively.

4.2.3 The constant species of the grassland were Yorkshire fog, cock's-foot, false oat-grass *Arrhenatherum elatius*, rough meadow-grass, soft brome *Bromus hordeaceus* and common bent-grass *Agrostis capillaris*. N values for these species were 5, 6, 7, 6, 4 and 4 with an average value of 5.33. The

composition of forbs was variable and localised, lacking constancy so N values for these species have not been considered.

4.2.4 The woodland stands were characterised by the presence of silver birch, grey willow, white willow and hawthorn with respective N values of 4, 5, 8 and 6 and an average N value of 5.75.

4.2.5 The average N values are 6.5 for reedbeds, 5.33 for grassland and 5.75 for woodland. As with the Dee Estuary the communities that are located in 1% exceedance are adapted to fertile soils and an additional 1% above critical thresholds is unlikely to be of any significant effect given that there is already an exceedance above 40%.

4.2.6 Natural succession from open water to reedbed and then to scrub and woodland will occur regardless of the Atmospheric Nitrogen levels unless there is management intervention. Similarly grassland will be replaced by scrub and woodland without management.

4.2.7 There is, however, the potential for an adverse impact because of critical loads above the minimum threshold. There are areas of species-rich swamp and grassland which will be out-competed if soil fertility increases further. The margins of the swamps support a range of species such as hemp agrimony, brooklime *Veronica beccabunga* and the nationally scarce variegated horsetail, which will be replaced by more vigorous species. Similarly, grasslands on less fertile soils support a range of forbs including ox-eye daisy *Leucanthemum vulgare*, common bird's-foot trefoil *Lotus corniculatus*, common valerian *Valeriana officinalis* and crosswort *Cruciata laevipes*, which could also be out-competed by more vigorous species. It is, however, important to recognise that change can also occur in the absence of management.

4.2.8 The comments regarding woodlands on the Dee Estuary also apply to Shotton Lagoons, but there is no tidal inundation so Atmospheric Nitrogen is likely to have a more significant impact.

4.3 Afon Dyfrdwy/River Dee SSSI

APIS Assessment

4.3.1 Modelling by Caulmert Ltd has identified that Atmospheric N deposition from the proposed Peaking Plant will exceed 1% of minimum critical loads on a small proportion of the Afon Dyfrdwy/River Dee SSSI. Exceedance of the minimum critical load has the potential for an adverse impact on the vegetation that is a qualifying feature of the SSSI. To quantify the magnitude of the impact of a 1% exceedance is not feasible because the average deposition rate already exceeds the minimum critical load by 4.81kg/N/ha/yr (32.5%) from the sources shown on Figure 6. Any additional Atmospheric N deposition has the potential for an adverse impact, but the additional process contribution is unlikely to be significant given the background exceedance levels.

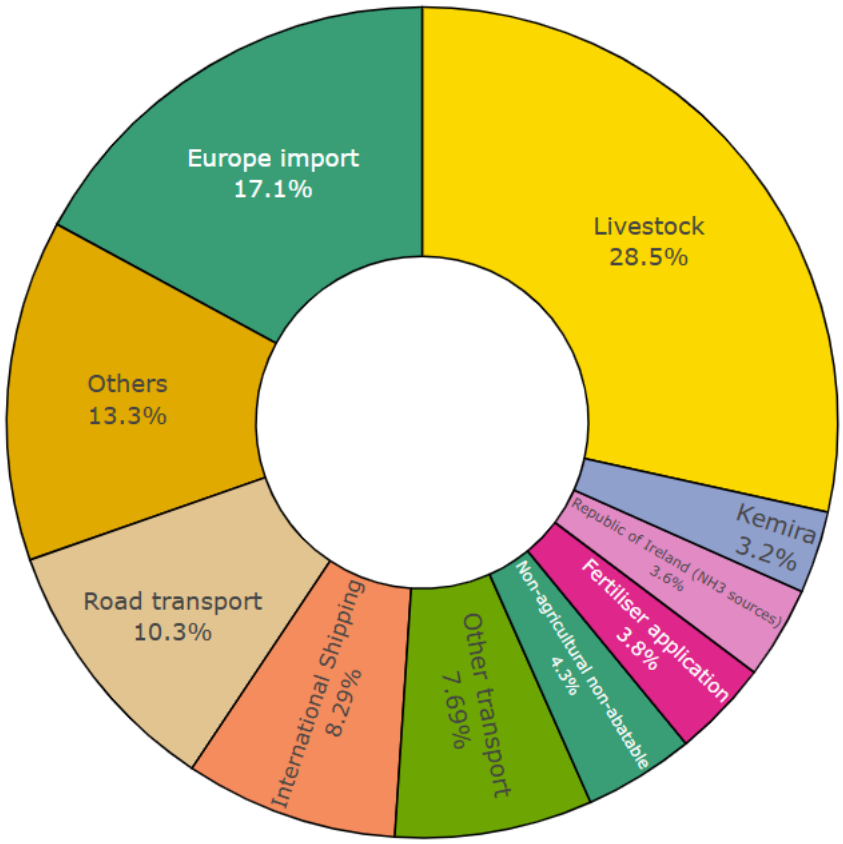


Figure 6. Sources of Atmospheric Nitrogen Deposition on the Dee Estuary

Ellenberg Indicator Values

4.3.2 The vegetation on the mudflat banks includes common saltmarsh-grass or common cord-grass. Both species have N values of 6. In summary the saltmarsh communities have an average N value 6, which is indicative of fertile soils.

4.3.3 The woodland comprises silver birch, grey willow and some sycamore. The respective N values for these species are 4, 5 and 6, which is an average value of 5, which is indicative of fertile soils.

4.3.4 The mixed scrub comprises hawthorn, gorse, bramble, elder, dog rose and saplings of silver birch. The respective N values for these species are 6, 3, 6, 7, 6 and 4, which is an average N value of 5.3, which is indicative of fertile soils.

4.3.5 The exceedance of Atmospheric Nitrogen deposition on the Afon Dyfrdwy/River Dee SSSI is already significant and a further 1% is unlikely to have much of an effect on the vegetation. Much of the vegetation in the 1% exceedance area is tolerant of fertile soils and fertility will be maintained by the input of suspended sediments in tidal flows as well as from atmospheric deposition. Other factors such as soil salinity and inundation will have as much influence as Atmospheric Nitrogen deposition on the composition of the vegetation. Even if Atmospheric Nitrogen levels were reduced below critical thresholds change in the composition of the vegetation may not occur without changes to other factors.

4.3.6 The woodland and scrub areas are tolerant of fertile soils and are located in areas that occasionally will be inundated by high tides which will increase soil Nitrogen levels. A field layer of bramble and ruderal herbs will also be sustained by high Nitrogen levels.

4.4 River Dee LWS

APIS Assessment

4.4.1 Modelling by Caulmert Ltd did not fully cover the area in which the River Dee LWS exists, and as such it has been assumed that the Atmospheric N deposition from the proposed Peaking Plant will exceed 1% of minimum critical loads on the part of the River Dee LWS. Exceedance of the minimum critical load has the potential for an adverse impact on the vegetation that is a qualifying feature of the LWS. To quantify the magnitude of the impact of a 1% exceedance is not feasible because the average deposition rate already exceeds the minimum critical load by 7.94kg/N/ha/yr (79.4%) from the sources shown on Figure 7. Any additional Atmospheric N deposition has the potential for an adverse impact, but the additional process contribution is unlikely to be significant given the background exceedance levels.

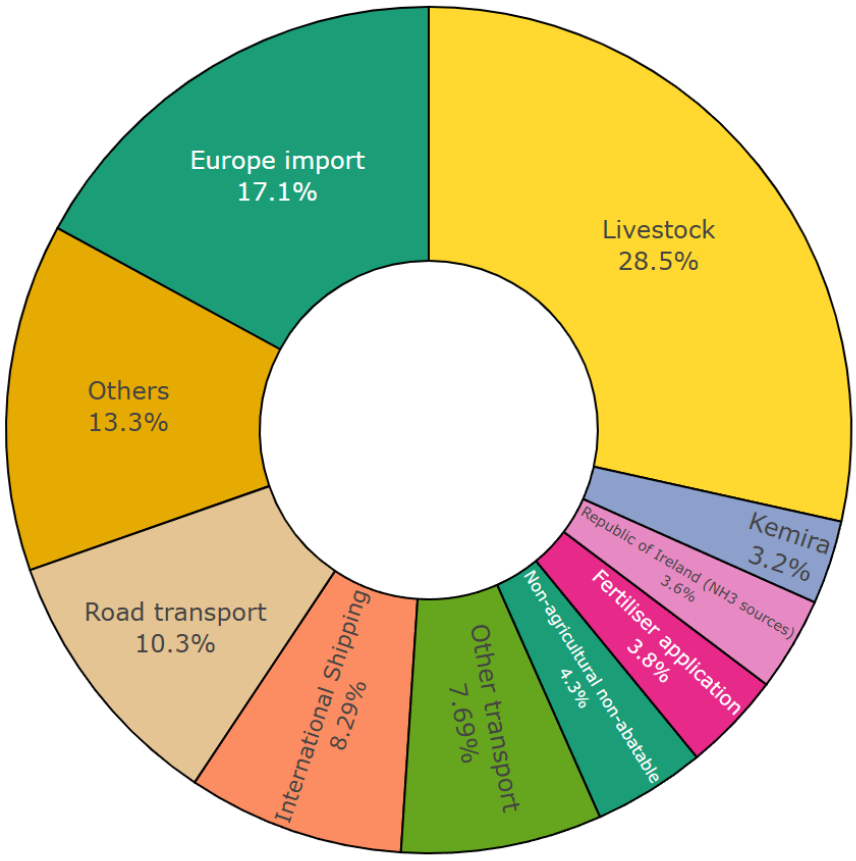


Figure 7. Sources of Atmospheric Nitrogen Deposition on River Dee LWS

Ellenberg Indicator Values

4.4.2 The continuous salt marsh vegetation at the high-water mark are characterised by Sea Purslane, Sea Beet, Grass-leaved Orache, Sea Blite and Sea Club Rush, which have Ellenburg N values of 8, 8, 6, 6 and 7 respectively.

4.4.3 The semi-improved pastures with patches of saltmarsh vegetation including red fescue, creeping bent, saltmarsh grass, couch, sea milkwort, thrift, sea plantain, lesser sea-spurrey, buck's-horn plantain, common cord-grass and sea purslane have Ellenburg N values of 5, 6, 6, 7, 5, 4, 6, 4, 5 and 8 respectively.

4.4.4 The areas of scrub are dominated by Willow, and whilst not identified within the citation down to species level, an assumption of native Willow species can be made, which have an average Ellenburg N value of 6.

4.4.5 In the lagoons, the nettle and creeping thistle have Ellenburg N values of 8 and 6 respectively.

4.4.6 The coarse grassland is likely to be dominated by Perennial Rye-grass *Lolium perenne*, with Willow and Birch scrub, as well as Spiny Restharrow, which have Ellenburg N values of 6, 6, 4 and 3 respectively.

4.4.7 The semi-improved grassland and ruderal dominated embankments comprise false oat-grass, black knapweed, common ragwort, creeping thistle, yellow oat-grass, quaking grass and common centaury. These species have Ellenburg N values of 7, 5, 4, 6, 4, 3, and 3 respectively.

4.4.8 The average N values are 7 for saltmarsh, 5.6 for intermittent saltmarsh pasture, 6 for scrub, 7 for lagoons, 4.75 for coarse grassland and 4.57 for the grassland and ruderal embankments. As with the Dee Estuary SSSI, the communities present within the assumed 1% exceedance zone are adapted to fertile soils and an additional 1% above critical thresholds is unlikely to be of any significant effect given that there is already an exceedance above 70%. Furthermore, the fertility is likely to be maintained by the input of suspended sediments in tidal flows as well as from atmospheric deposition. Other factors such as soil salinity, inundation and grazing are likely to have as much influence as Atmospheric Nitrogen deposition on the vegetative community. Even if Atmospheric Nitrogen levels could be reduced below critical thresholds a change in the composition of the vegetation may not occur without changes to these other influencing factors.

4.4.9 In summary, the saltmarsh and lagoon communities are generally of high-tolerance to high soil Nitrogen levels and are unlikely to be affected by a comparatively small increase in Nitrogen levels. Whilst the grassland, ruderal and scrub communities are generally of lower tolerance, the species diversity is relatively low and characterised by a number of vigorous species, which are unlikely to change regardless of a small change in Nitrogen input, as the occasional inundation of surrounding land is likely to maintain the high soil fertility that favours these species.

4.5 Shotton Steelworks LWS

APIS Assessment

4.5.1 Modelling by Caulmert Ltd did not fully cover the area in which the Shotton Steelworks LWS exists, and as such it has been assumed that the Atmospheric N deposition from the proposed Peaking Plant will exceed 1% of minimum critical loads on the part of the Shotton Steelworks LWS. Exceedance of the minimum critical load has the potential for an adverse impact on the vegetation that is a qualifying feature of the LWS. To quantify the magnitude of the impact of a 1% exceedance is not feasible because the average deposition rate already exceeds the minimum critical load by 7.04kg/N/ha/yr (70.4%) from the sources shown on Figure 8. Any additional Atmospheric N deposition has the potential for an adverse impact, but the additional process contribution is unlikely to be significant given the background exceedance levels.

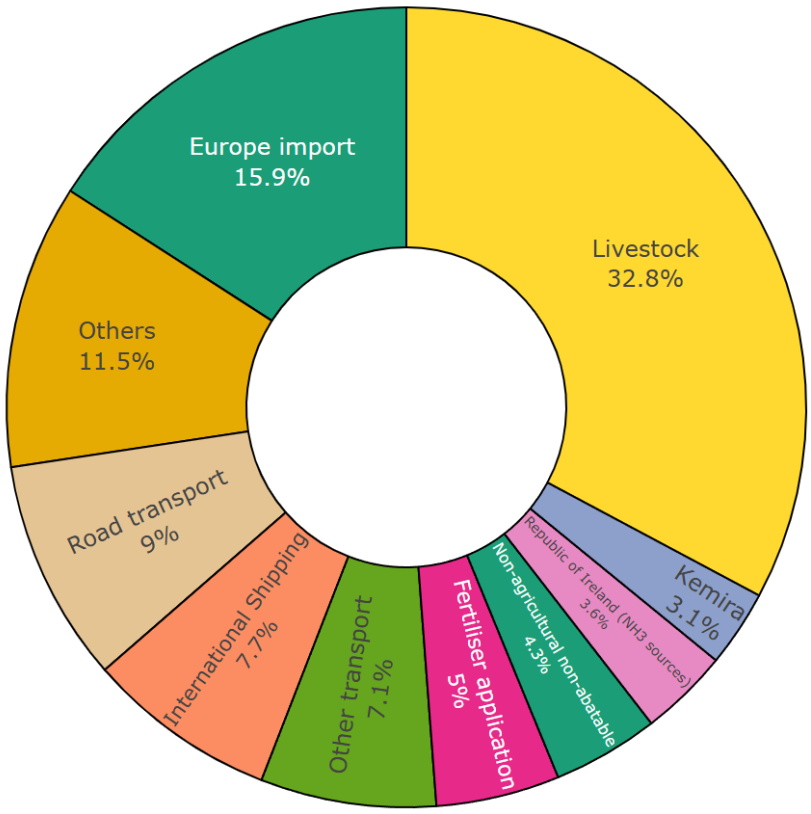


Figure 8. Sources of Atmospheric Nitrogen Deposition on Shotton Steelworks LWS

Ellenberg Indicator Values

4.5.2 The habitats present within the Shotton Steelworks LWS are considered equivalent to those detailed within the Shotton Lagoons SSSI, although they are slightly less species diverse. As such, the above

comments made on Ellenburg indicator values for Shotton Lagoons SSSI remain true for Shotton Steelworks LWS.

4.5.3 The communities that are assumed to be located in 1% exceedance are adapted to fertile soils and an additional 1% above critical thresholds is unlikely to be of any significant effect given that there is already an exceedance above 79%.

4.5.4 Natural succession from open water to reedbed and then to scrub and woodland will occur regardless of the Atmospheric Nitrogen levels unless there is management intervention. Similarly grassland will be replaced by scrub and woodland without management.

4.5.5 There is, however, some potential for an adverse impact because of critical loads above the minimum threshold. There are areas of floristically interesting marsh and grassland, which include species such as viper's bugloss, wild parsnip, marsh orchids and variegated horsetail. These species have Ellenburg N values of 4, 5, 2. 3, and 1 (taken as an average from genus *Dactylorhiza*), and 3, with an average of 3.58. This value represents a relatively low tolerance; these species are likely to be out-competed by more vigorous species if soil fertility increases further. It is, however, important to again recognise that similar change can also occur in the absence of management.

5. Conclusions

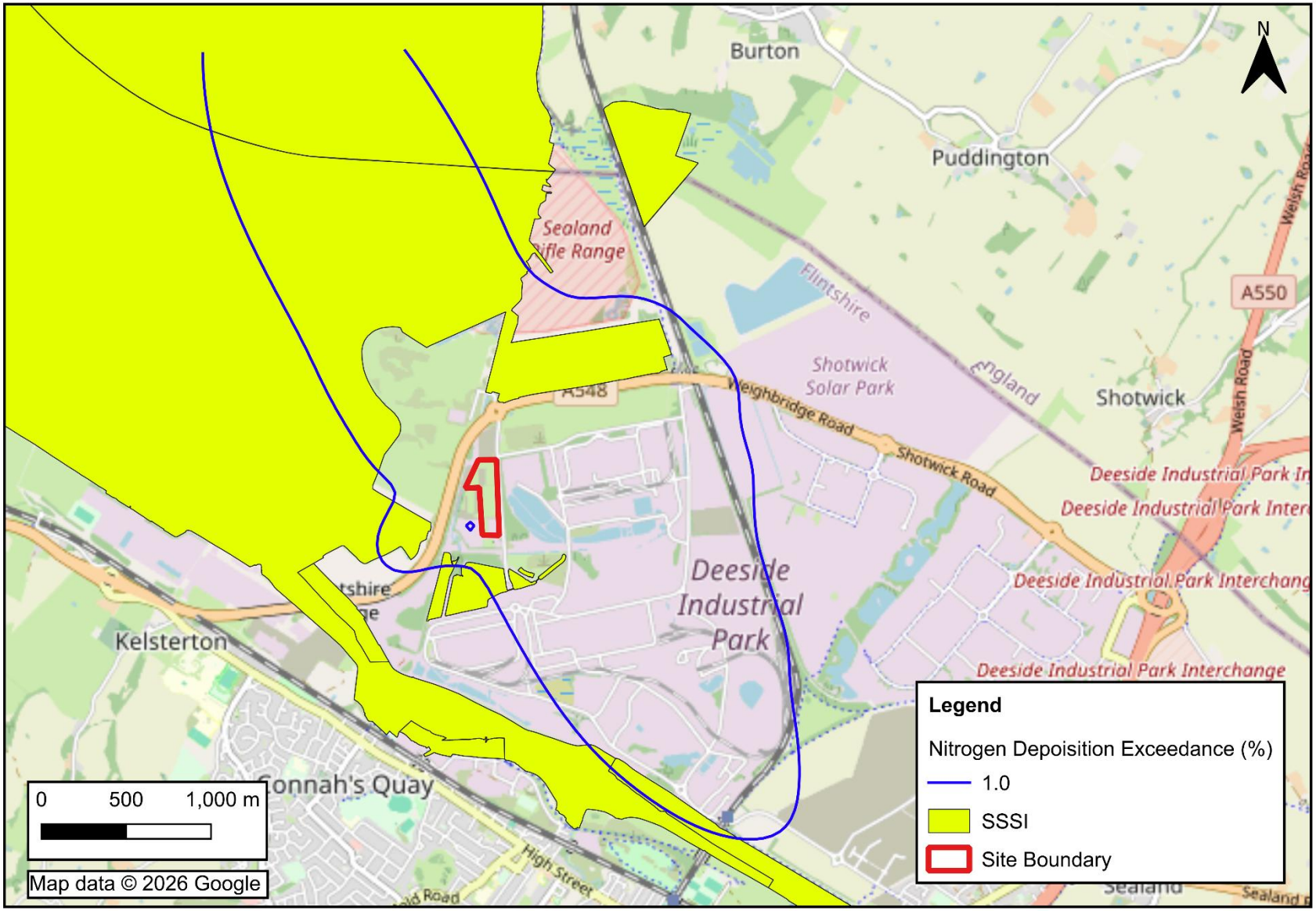
5.1.1 Any increase in Atmospheric Nitrogen deposition above the minimum critical threshold has the potential to cause changes to the composition of vegetation communities, often favouring more vigorous species and leading to less diverse assemblages.

5.1.2 As such an exceedance of the critical threshold for Atmospheric Nitrogen is a cause for concern. However, an exceedance of a very low % on the Dee Estuary SSSI, Shotton Lagoons SSSI and the Afon Dyfrdwy/River Dee SSSI has to be considered in the context of the significant exceedance that is already occurring. The addition of 1% to exceedance levels of 32.5 and 40.3% respectively is very unlikely to significantly exacerbate the problems caused by high Atmospheric Nitrogen deposition.

5.1.3 Assumed exceedance of 1% on both the River Dee LWS and Shotton Steelworks LWS should also be judged by the same context. The addition of 1% to exceedance levels of 79.4 and 70.4% respectively is very unlikely to significantly exacerbate the problems caused by high Atmospheric Nitrogen deposition.

5.1.4 In the short term, targeted habitat management is likely to be the most effective method of offsetting the impacts of Nitrogen deposition. The control of vigorous species by removal of biomass through mowing and cutting of grassland and reedbed and coppicing of woodland and scrub should be sufficient to offset the impacts of 1% exceedance level.

Appendix 1: Atmospheric Nitrogen Exceedance Zone Map


N
Burton
Puddington
Sealand Rifle Range
Flintshire
England
A550
Welsh Road
Shotwick Solar Park
A548
Neighbridge Road
Shotwick Road
Shotwick
Deeside Industrial Park
Kelsterton
Connah's Quay
High Street
Sealand
0
500
1,000 m
Map data © 2026 Google
Legend
Nitrogen Depoisition Exceedance (%)
1.0
SSSI
Site Boundary

Appendix 2: SSSI Citations

The following is an extract from the Dee Estuary SSSI citation

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

DEE ESTUARY/ABER AFON DYFRDWY

Date of Notification: 1954, 1971, 1979, 1983, 1984, 1998

National Grid Reference: SJ 220 800

Site Area: 13,679.7 ha Area in Wales: 8,442.6 ha

Description:

"The Dee Estuary/Aber Afon Dyfrdwy is of special interest for its total populations of internationally important wintering waterfowl; its populations of individual waterfowl and tern species whose numbers reach national and in some cases, internationally important levels; its intertidal mud and sandflats, saltmarsh and transitional habitats; the hard rocky sandstone cliffs of Hilbre Island and Middle Eye with their cliff vegetation and maritime heathland and grassland; its assemblage of nationally scarce plants; and its populations of sandhill rustic moth *Luperina nickerlii gueneei*, a Red Data Book species……

The Dee Estuary/Aber Afon Dyfrdwy supports extensive areas of saltmarsh vegetation and exhibits a complete succession from early pioneer vegetation colonising intertidal flats through lower, middle and upper saltmarsh types to brackish and freshwater transitions at the top of the shore. Although land reclamation has led to a loss of many of these natural transitions, there are still a number of areas, particularly on the English shoreline, around Neston and Parkgate, where transitions to swamp vegetation still occur. These are dominated usually by common reed *Phragmites australis* and sea club-rush *Bolboschoenus maritimus*. On the Welsh shoreline this habitat feature is limited to areas around Connah's Quay and to the southeast of Flint. In NorthEast Wales, swamp vegetation is scarce generally and the more extensive areas adjacent to the estuary, including those at Shotton, are therefore important.

The saltmarshes themselves support a variety of vegetation communities characteristic of estuaries in northern and western Britain. The Dee Estuary/Aber Afon Dyfrdwy supports a large area of marsh dominated by common cord grass *Spartina anglica*. Its current extent reflects the fact that the estuary continues to accrete following historical land claim. Species such as glasswort *Salicornia* sp. and annual seablite *Suaeda maritima* are also present. Much of the saltmarsh remains ungrazed and this has allowed extensive stands of species intolerant of grazing to develop, such as sea purslane *Atriplex portulacoides*. Where grazing intensity has declined in locations at the top of the shore, rank strandline vegetation dominated by common couch *Elytrigia repens* and sea couch *Elytrigia atherica* has developed."

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

FLINTSHIRE SHOTTON LAGOONS AND REEDBEDS

Date of Notification 1999

National Grid Reference: SJ298709

Site Area: 11.9 ha

Description:

Shotton Lagoons and Reedbeds are of special interest for their breeding population of common tern, *Sterna hirundo* and their reedswamp vegetation characterised by common reed *Phragmites australis*.

Shotton Lagoons and Reedbeds are situated on former intertidal land at the head of the Dee Estuary 1 km northeast of Connah's Quay. Following reclamation of the land for industrial purposes, the area has been used for storage and treatment of water prior to its discharge into the estuary.

The lagoons, with their extensive areas of open water and fringing reed swamp vegetation, provide habitat for a number of breeding bird species. Of these, the common tern population is of European importance. These birds, which originally nested on Burton Marshes where they were frequently inundated by spring tides, were encouraged to use the lagoons by the provision of artificial nesting habitat in 1969. The first terns nested in 1970. As the nesting habitat has been extended and developed, the number of tern pairs nesting has continued to increase such that in 1998, 471 pairs were present rearing nearly 600 young. This common tern colony is the largest in Wales and it forms well over 50 % of the Welsh breeding population.

The lagoons are in parts fringed by or are infilled by emergent swamp vegetation characterised by *Phragmites australis* and to a lesser extent, sea club rush, *Bolboschoenus maritimus* and reedmace *Typha latifolia*. At the western end, a large *Phragmites australis* reedbed occurs. This reedbed varies in composition from stands almost totally dominated by *Phragmites australis* to others containing a range of tall herb vegetation such as angelica, *Angelica sylvestris*, great willow herb *Epilobium hirsutum* and gipsywort, *Lycopus europaeus*. Reedbeds are uncommon in North Wales and this area represents one of the largest in Northeast Wales. Associated with the reedbeds are breeding birds, such as reed warblers *Acrocephalus scirpaceus*, scarce in North Wales and others of more local interest such as sedge warbler, *Acrocephalus schoenobaenus* and reed bunting *Emberiza schoeniclus*.

Two nationally scarce plants occur. Variegated horsetail *Equisetum variegatum* occurs in its only known coastal site in Northeast Wales, whilst white mullein *Verbascum lychnitis* grows on basic slag waste around some of the wetland features. A wide range of locally uncommon plant species also occur including wild parsnip *Pastinacia sativa* and various orchids such as northern marsh orchid, *Dactylorhiza purpurella*.

SITE OF SPECIAL SCIENTIFIC INTEREST CITATION

AFON DYFRDWY (RIVER DEE)

Date of Notification 1995, 2002

National Grid Reference: SH 930351 – SJ 311695

Site Area: 1489.5 ha

Description:

Afon Dyfrdwy (River Dee) is of special interest for its fluvial geomorphology, Carboniferous geology, range of river habitat types, saltmarsh transition habitats, populations of floating water plantain *Luronium natans*, slender hare's-ear *Bupleurum tenuissimum*, sea barley *Hordeum marinum*, hard-grass *Parapholis strigosa*, otter *Lutra lutra*, salmon *Salmo salar*, bullhead *Cottus gobio*, brook lamprey *Lampetra planeri*, river lamprey *Lampetra fluviatilis*, sea lamprey *Petromyzon marinus*, club-tailed dragonfly *Gomphus vulgatissimus* and other aquatic invertebrates.

The main channel of the River Dee lies within both Wales and England, and is notified as two separate SSSIs – the Afon Dyfrdwy (River Dee) SSSI in Wales and the River Dee (England) SSSI in England. The features for which the SSSIs are notified, in particular migratory fish, depend upon the whole river ecosystem. Salmon, otter, club-tailed dragonfly, and fluvial geomorphology are of special interest in both Wales and England.

The site extends from the outflow of Llyn Tegid SSSI downstream to where it flows into the Dee Estuary SSSI. In its swifter upper reaches it flows through the broad valley near Corwen, and the spectacular Vale of Llangollen before entering the Cheshire plain at Erbistock and meandering northwards through the Cheshire plain to its tidal limit at Farndon. In its slower, more mature reaches the river is characteristic of a floodplain river with meanders, oxbows and other river-formed landscape features. The River Dee is heavily regulated, with its flow controlled by the reservoirs of Tegid, Celyn and Brenig. The site includes the Ceiriog, Meloch, Tryweryn, and Mynach tributaries.

The source of the River Dee lies within the Snowdonia National Park and its catchment contains a wide spectrum of landscapes from high mountains around Bala, rugged peaks near Llangollen, steep-sided wooded valleys, and the plains of Cheshire and north Shropshire through to the vast mudflats of the estuary. There is a tidal influence as far upstream as Farndon and high tides regularly exceed the Chester weir crest level.

Appendix 3: LWS Citations

Site:

River Dee LWS

Designation reason:

Coastal and floodplain grazing marsh, Coastal saltmarsh, Mudflats, Ornithological

Habitats:

Scattered scrub (2.573 ha), Semi-improved neutral grassland (41.76 ha), Improved grassland (8.188 ha), Poor semi-improved grassland (3.557 ha), Tall ruderal vegetation (2.96 ha), Swamp (0.32 ha), Standing water (80.019 ha), Intertidal mud/sand (7.873 ha), Dense/continuous plants saltmarsh (17.467 ha).

Description:

Elongated and narrow site comprising both banks of the River Dee between the county boundary at Saltney and the Dee Estuary SSSI boundary at Connah's Quay Power Station. The site, for most of its 9.3 km length is a narrow band (about 10-20m wide) of bare mud at low tide. At the high water mark this is a thin strip of saltmarsh vegetation is dominated by sea purslane with sea beet, grass-leaved orache, sea blight and sea club rush. The poor semi-improved pastures along side the river include patches of saltmarsh vegetation dominated by red fescue, creeping bent, saltmarsh grass, and couch with occasional sea milkwort, thrift, sea plantain, lesser sea-spurrey, buck's-horn plantain, common cord-grass and sea purslane. At the west end of the site, near the power station, are areas of willow and hawthorn scrub, several man-made lagoons with nettle, creeping thistle and a marsh of greater reedmace and common reed. On Wepre Tip there is a coarse grassland with scattered willow and birch bushes where spiny restharrow occurs. The embankments comprise semi-improved grassland with false oat-grass, black knapweed, ragwort and creeping thistle. Also present are yellow oat-grass, quaking grass and common centaury. An important site for birds, used by waders, kingfishers, lapwings and gulls.

Site:

Shotton Steelworks

Designation reason:

Pasture/meadow and scrub, Ornithological, Reedbed, Standing open water.

Habitats:

Semi-improved neutral grassland (14.918 ha), Marsh/marshy grassland (1.096 ha), Standing water (0.942 ha), Bare ground (1.312 ha).

Description:

Ex-industrial site in the Dee Estuary, adjacent to the Dee Estuary SSSI. There are many habitats present, including rough neutral grassland, marshy grassland, bare ground, tall herb, reedbed and man-made lagoons. There are many interesting floral species found in the area, including viper's bugloss, wild parsnip, marsh orchids and variegated horsetail. The site is also important for breeding and wintering birds, there being an important tern colony along with many wetland species.

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