Appendix E – Air Quality Impact Assessment

Kimberly-Clark

Kimberly-Clark Northfleet Paper Mill

Air Quality Assessment

Report No.: 446562-02 (02)

APRIL 2026

RSK GENERAL NOTES

Report No.: 446561-02 (02)

Title: Kimberly-Clark Northfleet Paper Mill

Client: Kimberly-Clark

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Abbreviations

AER	Air Emissions Risk
AQO	Air Quality Objective
AQS	Air Quality Standard
AQMA	Air Quality Management Area
BAT	Best Available Technique
CLe	Critical Level
CLo	Critical Load
CO	Carbon monoxide
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EAL	Environment Assessment Level
EC	European Commission
EIP	Environmental Improvement Plan
ELV	Emission Limit Value
EPR	Environmental Permitting Regulations
EPUK	Environmental Protection United Kingdom
EU	European Union
GBC	Gravesham Borough Council
IAQM	Institute of Air Quality Management
KC	Kimberly-Clark
LAQM	Local Air Quality Management
LWS	Local Wildlife Site
MCPD	Medium Combustion Plant Directive
NNR	National Nature Reserve
NO_2	Nitrogen dioxide
NOx	Oxides of nitrogen
PC	Process Contribution
PEC	Predicted Environmental Concentration
SAC	Special Areas of Conservation
SSSI	Sites of Special Scientific Interest
SPA	Special Protection Area

Contents

1 INTRODUCTION

RSK Environment Ltd (RSK) has been commissioned to undertake an air quality assessment to support the permit variation application for two new dual-fuelled boilers (natural gas and hydrogen) at Kimberly-Clark's (KC) paper mill in Northfleet, Gravesend. The operator, KC, currently releases emissions to air from a number of combustion and process emission sources associated with various activities contained within their Environmental Permit (EPR/BJ7379IZ), issued under the Environmental Permitting (England and Wales) Regulations 2016, as amended (EPR).

The facility produces tissue products and operates a single tissue machine, with a total capacity of 35,000 air dry tonnes (ADT) per year. The facility's current heat and steam requirements are met by two of three onsite currently operational natural gas-fuelled boilers, configured in a duty/duty/standby setup. The variation proposes that the three natural gas-fuelled boilers and associated stacks are replaced with two new dual-fuelled boilers and two new stacks, configured in a duty/standby setup.

The following report presents the findings of an assessment of the impacts of emissions of nitrogen dioxide (NO_2) and carbon monoxide (CO) on nearby human receptors, as well as the impacts of oxides of nitrogen (NOx), and subsequent impacts of nutrient nitrogen and acid deposition on nearby sensitive ecological receptors. As referenced within the Environment Agency's hydrogen combustion guidance[1], only emissions of NOx (or NO_2) and CO need to be considered from hydrogen gas-fuelled plant. This assessment has considered both the long- and short-term air quality impacts of the proposed boilers by considering the existing and proposed situations.

The site, as presented in **Figure 1.1**, lies within the jurisdiction of Gravesham Borough Council (GBC), which contains three Air Quality Management Areas (AQMAs). The site is not located within any of the declared AQMAs.

[1] https://www.gov.uk/guidance/hydrogen-combustion-comply-with-emission-limit-values

Figure 1.1: Site boundary of the Kimberly-Clark Northfleet Paper Mill

2 SITE DESCRIPTION

2.1 Existing Operations

The KC facility is a commercial producer of tissue products, and is permitted to operate under Schedule 1, Section 6.1 Part A (1) (b)[2], Section 6.1 Part A (1) (b)[3] and Section 1.1 Part A (1) (a)[4] of EPR. The site also has a number of directly associated activities, including the treatment of water.

The tissue products are made from a combination of virgin and recycled fibre, processed by a single tissue machine at the site, which has a total annual capacity of 35,000 ADT. The tissue machine dryers' heat and steam requirements and other site requirements are met by two of three on-site 12 MWth natural gas-fired boilers, configured in a duty/duty/standby setup. A fourth boiler is also currently on-site; however, this was decommissioned in 2021.

The above activities result in a number of emissions to air points, including emissions from the three natural gas-fired boilers, exhausted via a single 61 m stack. As already stated, these operate in a duty/duty/standby setup, with the site's steam requirements (typically around 7 tonnes per hour (tph)) far below the output of all three boilers (19.5 tph). Emission limit values (ELVs) have been set for the main boilers fired on natural gas.

Other combustion sources on-site include a 4.1 MWth natural gas burner for the dryer (see emission point A6 within the environmental permit); two additional natural gas burners (emission points A2 and A4) associated with unused dryers have already been decommissioned.

Other on-site sources of emissions relate to emissions of particulate matter from process operations; however, due to the proposed variation being a change from natural gas to dual-fuelled boilers, no significant changes to the emissions of particulate matter are anticipated, and they have not been considered further.

2.2 Proposed Operations

The proposed variation involves decommissioning the existing natural gas-fired boilers (emission point A1) and replacing them with two new dual-fuelled boilers (fuelled on either hydrogen or natural gas), each with a capacity of 7.6 MWth. These boilers can each produce 12 tph of steam, resulting in a total capacity of 24 tph from the two boilers. Again, this capacity significantly exceeds the site's requirements, which, as already stated, is typically around 7 tph.

[2] Producing, in an industrial plant, paper and board where the plant has a production capacity of more than 20 tonnes per day.

[3] Disposal of non-hazardous waste with a capacity exceeding 50 tonnes per day involving biological treatment.

[4] Burning any fuel in an appliance with a rated thermal input of 50 megawatts or more.

As with current operations, the two boilers are proposed to function in a duty/ standby configuration, usually operating at 50% to 75% load, reflecting a typical steam requirement of 7 tph. The new boilers will be located in a new boiler house to the northwest of the main process building, with their emissions being exhausted through two separate 20-meter stacks.

During the first year of operation, the new boilers will require commissioning, which will be undertaken one boiler at a time using natural gas. Commissioning of each boiler is not anticipated to take longer than 2 months, with the load of the existing boilers reduced to prevent the requirement to dump surplus steam.

All other combustion operations are proposed to stay as the current operation.

3 LEGISLATION & GUIDANCE

3.1 Key Legislation and Policy

3.1.1 Air Quality Regulations

The air quality standards (AQSs) and air quality objectives (AQOs) in the United Kingdom are derived from EC directives and are adopted into English law via the Air Quality (England) Regulations 2000 and Air Quality (England) Amendment Regulations 2002. Directive 2008/50/EC set limits values, and was translated into UK law in 2010 via the Air Quality Standards Regulations 2010. The European Union (Withdrawal) Act retains existing EU environmental provisions in the UK.

3.1.2 Environmental Permitting Regulations (EPR)

Certain industrial processes are regulated under the Environmental Permitting Regulations (EPR), which require specific industrial and waste management operations to obtain an environmental permit before they can operate. The Environment Agency (EA), which is the regulatory authority in England, enforces these regulations to protect the environment.

Regarding emissions to air, operators must minimise their emissions and adhere to permit conditions that set limits on these emissions. They are also required to conduct monitoring and follow best available techniques (BAT) to ensure compliance.

The latest UK Environmental Permitting (England and Wales) Regulations 2018 bring the Medium Combustion Plant Directive (MCPD) (2015/2193/EC) into force in England and Wales.

Furthermore, as part of their regulatory position, the EA have produced environmental assessment levels (EALs) to regulate hazardous pollutants produced by industry that are not captured within the Air Quality Regulations. These are non-statutory guideline values and are contained within their Air Emissions Risk (AER) guidance[5]. Typically, a site will not need to go beyond Best Available Technique (BAT) to achieve these EALs.

3.2 Guidance

3.2.1 Air emissions risk assessment for your environmental permit guidance

This guidance[2], which was adopted in 2016 (and updated in 2025) by the Department for Environment, Food and Rural Affairs (Defra) and the EA, outlines a procedure which can be used to determine when detailed dispersion modelling is required and provides a list of air quality standards applicable to industrial installations.

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

3.2.2 Local Air Quality Management Review and Assessment Technical Guidance

The Department for Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their air quality review and assessment work. This 2022 guidance referred to in this document as LAQM.TG (22), has been used to identify locations where exposure can be considered 'relevant'.

3.2.3 AQTAG06: Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air

The 2014 AQTAG06 guidance provides technical guidance on how to approach detailed modelling of emissions to air when considering impacts on ecological receptors. It includes a method which can be used to assess the potential impacts of nitrogen and acid deposition on local ecosystems.

3.2.4 Hydrogen combustion: comply with emission limit values

Current legislation (Industrial Emissions Directive (IED) or MCPD) does not include ELVs for hydrogen combustion. Therefore, UK regulators have issued interim expectations[6] for operators of hydrogen-fired combustion plant. The guidance contains interim ELVs and a method for calculating bespoke NOx and CO ELVs for mixed blends until formal BAT-AELs are set.

[6] https://www.gov.uk/guidance/hydrogen-combustion-comply-with-emission-limit-values

4 ASSESSMENT CRITERIA

Based on the current regulations, the air quality standards for the pollutants proposed for assessment are presented in **Table 4.1**. This includes the Environment Agency's and Defra's environmental assessment levels (EALs), as referenced in **Section 3.1.2**

Table 4.1: Air Quality Standards Relevant to the Assessment

Pollutant	Averaging period	Exceedances allowed per year	Ground level concentration limit (μg/m^3)	Designation
Nitrogen dioxide (NO_2)	1-hour mean	18	200	AQO[1]
	calendar year mean	-	40	AQO[1]
CO	1-hour mean	-	30,000	EAL
	8-hour mean	-	10,000	AQO[1]

Note 1 The limit value is the same as the Air Quality Objective.

In addition, the United Nations Economic Commission for Europe (UNECE) has set environmental criteria known as critical levels (CLe) for the protection of vegetation from direct effects and critical loads (CLo) to protect against the indirect effects of the deposition of pollutants. The applicable critical levels, derived from EC directive 2008/50/EC and translated into UK law via the Air Quality Standards Regulations 2010, are provided in **Table 4.2.** Critical loads for the protection of vegetation are site-specific, and as such, they have been detailed further in **Table 5.4**.

Table 4.2: Critical Levels Relevant to the Assessment

Pollutant	Averaging period	Exceedances allowed per year	Ground level concentration limit (μg/m^3)	Designation
NOx	24-hour mean	-	75 or 200[1]	CLe[2]
	calendar year mean	-	30	AQO[3]/CLe

Note 1 The critical level is generally considered to be 75 μg/m^3, but this only applies where ozone is below the AOT40 critical level, and sulphur dioxide is below the lower critical level of 10 μg/m^3.

Note 2 Defined by the World Health Organisation and is not an Air Quality Objective.

Note 3 Only the critical level applies at locations within 20 km from agglomerations (250,000 people) or within 5 km away from other built-up areas, industrial installations (PART A) or motorways or major roads with traffic counts of more than 50,000 vehicles per day.

5 ASSESSMENT METHODOLOGY

5.1 Assessment Scope

The scope of the impact assessment is based on the requirements of the Environment Agency, as detailed within their various guidance documents (see **Section 5.2**) and the changes proposed as part of the variation (see **Section 2).**

Based on the above, dispersion modelling of emissions will be conducted to predict the local impacts of the site's operations, both as they currently operate and as they will operate under their proposed variation (in this case, the change to new hydrogen and natural gas dual-fuelled boilers). This assessment will determine the site's total future impacts and allow for a comparison with the existing baseline.

While the boilers are dual-fuelled, it is proposed to be fuelled primarily on gaseous hydrogen, produced by the nearby Hydro green hydrogen project, located on land owned by Kimberly-Clark's Northfleet paper mill. Therefore, the remainder of the assessment considers the new boilers fuelled on hydrogen only. However, as there may be times when hydrogen supply is restricted, and the boilers may be fuelled by natural gas, sensitivity to this scenario has also been undertaken (see **Section 5.4).** While it is possible the new boilers can operate on a hydrogen or natural gas blend, this is understood not to be a preferred option, and this assessment has only considered the boilers fuelled on either hydrogen or natural gas.

As discussed in **Section 2**, as with current operations, the two boilers are proposed to function in a duty/standby configuration. Therefore, the emissions from a single proposed boiler have been considered in the assessment.

Impacts will be compared against the annual and 1-hour mean NO_2 AQO, the 1-hour and 8-hour CO AQO/EAL for human receptors, and the annual mean and 24-hour NOx critical levels and nitrogen and acid deposition critical loads in relation to ecological receptors. These are pollutants of most concern related to the change of boiler fuel from natural gas to hydrogen.

5.2 Dispersion Modelling Methodology

The approach taken for assessing the potential air quality impacts of the permit variation may be summarised as follows:

- Determination of emission rates and modelling parameters;
- Identification of sensitive receptors (both human and ecological);
- Baseline characterisation;
- Dispersion modelling to predict both short-term and long-term concentrations to air;
- Calculation of nutrient nitrogen and acid deposition fluxes; and

- Comparison of results against relevant AQO and critical levels and loads.

The dispersion modelling for this assessment has been undertaken in line with the following EA guidance documents:

- Hydrogen combustion: comply with emission limit values (2024)[8];
- Medium combustion plant: apply for an environmental permit (2026)[9];
- Air emissions risk assessment for your environmental permit (2025)[10]; and
- Environmental permitting: air dispersion modelling reports (2024)[11].

5.2.1 Modelling Software

The model used in this study is the Lakes AERMOD (V13) dispersion model, running the US EPA executable 24142. AERMOD is a steady-state Gaussian plume atmospheric dispersion model; it characterises the atmospheric boundary layer properties using the friction velocity and Monin-Obukhov length rather than the Pasquill-Gifford stability classes.

The AERMOD model can include the treatment of both surface and elevated sources, terrain, buildings and chemistry effects. The model calculates downwind pollutant concentrations in the surrounding area for each hour of the day and night. Statistics on the frequency and concentration of pollutants at the receptor sites are based on hourly calculations.

Along with the ADMS dispersion model, AERMOD is commonly used within the UK for regulatory purposes and is judged fit for purpose for this assessment.

5.2.2 Modelling Scenarios

Based on the site's proposed operations (**Section 2)** and aims of the assessment, detailed in **Section 5.1**, the following modelling scenarios have been considered:

- **Existing -** Modelling of the site's existing operations, including two natural gas-fired steam boilers and a single tissue dryer machine drying hood (PM3); and
- **Proposed -** Modelling of the site's proposed operations, including one hydrogen-fuelled steam boiler and a single tissue dryer machine drying hood (PM3).

If the hydrogen supply is restricted, the new boilers are capable of running on natural gas; therefore, the results of modelling sensitivity to the new boilers running on natural gas have been provided in **Appendix A**. This is discussed further in **Section 5.4.**

[8] https://www.gov.uk/guidance/hydrogen-combustion-comply-with-emission-limit-values

[9] https://www.gov.uk/guidance/medium-combustion-plant-apply-for-an-environmental-permit

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

[11] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

Furthermore, during the new boiler commissioning period, they will operate (one commissioned at a time), with the load of the existing boilers reduced to prevent the requirement to dump surplus steam. However, the exact operation during commissioning has not been confirmed; therefore, sensitivity to the following commissioning scenario (see **Section 5.4**) has been undertaken, with results presented in **Appendix A**:

- **Commissioning -** Modelling of the site's existing operations (including two natural gas-fuelled steam boilers and one tissue dryer machine drying hood (PM3), plus one new natural gas-fuelled steam boiler.

All other emissions to air sources on-site are mothballed and planned for removal (existing fourth boiler, etc.) or do not emit NOx or CO and have not been included within the assessment.

5.2.3 Emission Sources

All physical stack parameters (stack heights and diameters, etc.) have been provided by the Kimberly-Clark Northfleet site team. All efflux parameters for the existing operations have been taken from available stack monitoring data (from between 2022 – 2025) and emission limit values (ELVs) contained within the site's environmental permit (EPR/BJ7379IZ). All efflux parameters for the proposed boilers have been calculated based on design data provided by the stack designers Cannon and ELVs contained within the EA's hydrogen combustion guidance[12]. As design data specific to hydrogen and natural gas combustion has been provided, exhaust flows have not been modified based on the ETN Position Paper[13].

The emissions from the single new hydrogen-fuelled boiler have been modelled assuming they are running at 60% maximum continuous rating (MCR). This equates to 7.2 tph of steam, which is similar to the site's typical steam requirements (7 tph).

All emission rates and stack parameters entered into the model have been presented in **Table 4.1**.

[12] https://www.gov.uk/guidance/hydrogen-combustion-comply-with-emission-limit-values

[13] https://etn.global/wp-content/uploads/2023/03/ETN-Proposed-NOx-emissions-reporting-for-hydrogen-containing-fuels-Position-paper-March2023.pdf

Table 5.1: Stack Parameters Used Within the Dispersion Model

Parameter	Existing Boiler 1	Existing Boiler 2	Proposed Boiler[1]	TM3 Burner
Stack Location (X, Y)	562747, 174613		562585, 174367	562552, 174233
Stack Height (m)	61		20	21
Stack Diameter (m)	1.67		0.6	1.4
Exhaust Temperature (°C)	174[4]	152[4]	96/85	207
Exit Velocity (m/s)	4.64[4]		5.97/7.30	6.8[2]
Oxygen, dry exhaust (%)	n/a[5]	n/a[5]	3.82/3.81	n/a[5]
Moisture Content (%)	n/a[5]	n/a[5]	31.34/17.18	n/a[5]
Actual Flow (m^3/s)	5.71[4]	4.40[4]	1.69/2.06	10.47
Normalised flow (Nm^3/s)	2.49[3]	2.24	0.819[3]/1.244[3]	1.86[3]
NOx Concentration (mg/Nm^3)	200[3]	200[3]	137[3]/100[3]	250[3]
CO Concentration (mg/Nm^3)	50[3]	50[3]	68.5[3,6]/50[3,6]	339[3]
NOx Emission Rate (g/s)	0.497[4]	0.449[4]	0.112/0.124	0.464
CO Emission Rate (g/s)	0.12[4]	0.11[4]	0.056/0.062	0.63

Note 1 Hydrogen/Natural gas-fired
Note 2 Square capped stack – velocity entered, with the capped stack module used in AERMOD.
Note 3 Reference Conditions (REF) are: 273K, 101.3kPa, dry gas, 3% oxygen.
Note 4 Stack monitoring was taken from separate boiler ducts feeding into a single exhaust stack. Therefore, combined parameters (average for temperature and summed emission rates and flow rates have been inputted into the mode or used for velocity calculationsl).
Note 5 n/a - Flow rates used within the model and calculations are the maximum values from within the site's 2022, 2024 and 2025 stack monitoring reports and have not been calculated based on specific oxygen and moisture contents. Average data has been used for temperature.
Note 6 n/a -Based on manufacturer specifications and uplifted by 37% based on EA guidance.

5.2.4 Meteorological Data

Hourly sequential meteorological data from the London City Airport meteorological station for 2021 - 2023 have been used within the model. London City Airport is the nearest suitable meteorological station to the site; both the meteorological station and the proposed development are located near the Thames Estuary, and the meteorological station is 20.7 km northwest of the KC Northfleet site. Furthermore, the data capture is above 85%.

Each year has been modelled separately, with the worst-case prediction presented at each receptor. The wind rose diagram for the entire modelled period (2021 – 2023) is presented in **Figure 5.1**.

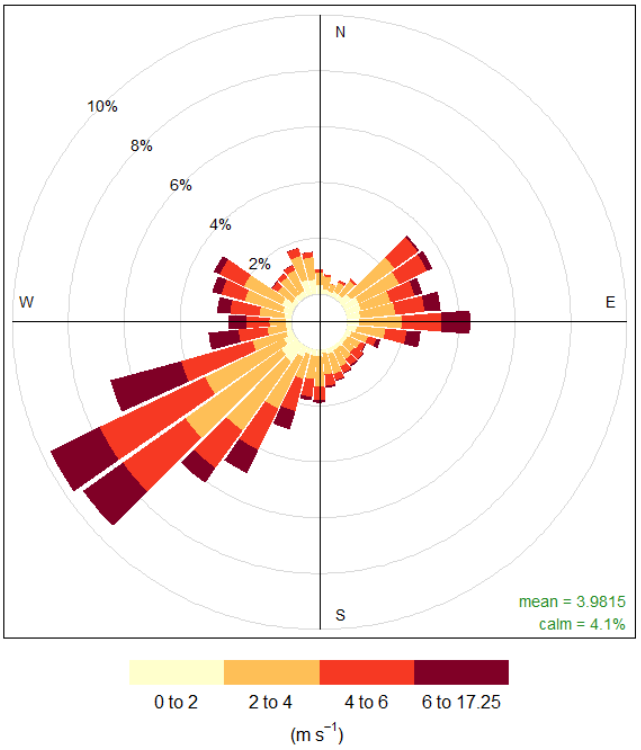

Figure 5.1: Wind Rose for the London City Airport Meteorological Station (2021 – 2023)

5.2.5 Terrain and Land Use

The topographical features surrounding the site will have an influence on the dispersion of pollution within the area. Terrain effects have been accounted for using 50 m resolution OS terrain data. Due to the complex terrain surrounding the site, sensitivity has been undertaken to running the model using alternative terrain heights (taken from Google Earth) for the receptor and stack locations.

The above Met data were obtained in ADMS format and processed for use in AERMOD using AERMET, considering the land use parameters contained in **Table 5.2**.

Table 5.2: Land use parameters used within AERMET

Sector	Albedo	Bowen Ratio	Surface Roughness (m)
280 - 100	0.2	1.0	0.1
100 - 280	0.2	1.0	0.6

5.2.6 Buildings

Buildings have the potential to disrupt atmospheric flow. In the case of emissions from a stack, they can entrain pollutants into the leeward side of the building (known as a cavity region). This cavity region is highly turbulent, often bringing pollutants rapidly towards ground level, increasing their concentrations. These concentrations will then reduce with diminishing turbulent wake. AERMOD has the capability to model the impacts of stack pollutants being entrained into the cavity region through its BPIPPRM module. To capture the potential influence of buildings/structures on the dispersion profile of emissions (e.g. building 'downwash' effects), six nearby onsite buildings have been included. The parameters of the modelled buildings and structures are summarised in **Table 5.3** and illustrated in **Figure 5.2.**

Table 5.3: Buildings Included in the Model

Building ID	X (m)	Y (m)	Height (m)	Width (m)	Length (m)
BLD_1	562438	174323	29	51	140
BLD_3[1]	562798	174441	36	178	55
BLD_4[1]	562534	174297	19	155	84
BLD_5[1]	562517	174210	9	213	112
BLD_6[1]	562636	174455	8	60	45
BLD_9[2]	562609	174431	43	-	-

Note [1] Entered in the model as a polygon building

Note [2] Entered in the model as a circular building with a diameter of 14 m.

Figure 5.2: Buildings and Emission Points included in the Model

Contains Imagery @2026 Airbus, Infoterra Ltd & Bluesky, Landsat / Copernicus, Maxar Technologies, Map data @2026

5.2.7 Model Output Grid

A nested Cartesian receptor grid covering 20 km × 20 km, centred on the emission sources, was used to resolve concentration fields. The grid employed progressively finer resolution near the stack:

- 20 m spacing within 200 m;
- 50 m spacing within 500 m;
- 100 m spacing within 1,000 m;
- 200 m spacing within 2,000 m;
- 500 m spacing within 5,000 m; and
- 1000 m spacing within 10,000 m.

All receptors were assigned a height of 1.5 m above ground level to represent typical human breathing height.

5.2.8 Human Receptors

The modelled discrete human receptors were chosen based on 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 3.2.2** (LAQM

TG22). **Figure 5.3** details the discrete human receptors included within the model, with the full list contained in **Table B1** in **Appendix B**.

5.2.9 Ecological Receptors

The modelled ecological receptors have been determined using distance-based screening criteria from the nature and heritage conservation screening report for the site provided by the Environment Agency (See **Appendix D**). All ecological sites within this distance have been considered for assessment.

The ecological sites included within this assessment and their associated critical loads (taken from APIS[14]) are presented in **Table 5.4**, with the full list contained in **Table B1** in **Appendix B** and shown in **Figure 5.4**

Table 5.4: Ecological Sites Considered in the Model

Receptor Description	Nutrient Nitrogen Dep Critical Load (kgN/ha/yr)	Acid Dep Critical Load (Keq/ha/yr)[1]	Modelled Receptors
North Downs Woodlands SAC	10	1.983	E7
Thames Estuary & Marshes SPA	5	1.019	E2, E8
Thames Estuary & Marshes Ramsar	5[2]	1.019[2]	E1 – E2, E8
Swanscombe Peninsula SSSI	5[2]	1.019[2]	E3 – E6
Local Wildlife Sites (including Ebbsfleet Marshes and Northfleet Botany Marshes)	5[2]	1.019[2]	E6, E9, E14 – E15
Protected Species migratory route (including Atlantic Salmon, Allis Shad, European Eel, River Lamprey, Sea Lamprey, Smelt, and Twaite Shad)	5[2]	1.019[2]	E10 – E13

Note 1 Represents the MinCLMaxN

Note 2 No data is available, so the corresponding value from the SAC/SPA/SSSI covering the same area has been used.

[14] https://www.apis.ac.uk/

Figure 5.3: Location of Modelled Human Receptors

Contains Imagery @2026 Airbus, Infoterra Ltd & Bluesky, Landsat / Copernicus, Maxar Technologies, Map data @2026

Figure 5.4: Location of Modelled Ecological Receptors[1]

Contains Imagery @2026 Airbus, Infoterra Ltd & Bluesky, Landsat / Copernicus, Maxar Technologies, Map data @2026

Note [1] Receptor E7 is not presented due to their distance from the site.

5.2.10 Baseline Air Quality

Local Authority Data

According to the latest 2025 Air Quality Annual Status Report (ASR) released by GBC, there was one automatic monitoring station operating within the district. However, 65 diffusion tubes were monitoring NO_2 in 2024. Seven of these diffusion tubes were located in the vicinity of the proposed KC Northfleet site. The monitoring data from these seven diffusion tube sites are presented in **Table 5.5**. The data from these tubes show that there were no exceedances of annual average NO_2 concentrations between the years 2020 - 2024. This was also the case at all seven diffusion tubes where data were reported. The locations of the seven diffusion tubes in relation to the KC Northfleet site are presented in **Figure 5.5**.

The highest monitoring result from 2024 (in bold in **Table 5.5)** has been assumed to be representative of all receptors and has been used as the background concentration within **Section 6.**

Table 5.5: Annual Mean NO_2 Selected Local Monitoring (2020-2024)

Site ID	Location	Site type	Distance from Site (km)	Annual Mean NO_2 Concentrations ($\mu g/m^3$)				
				2020	2021	2022	2023	2024
GR191	Lawn Primary School, Highstreet	Roadside	0.4	20.6	20.9	18.9	15.5	13.9
GR52	32 The Hill (Lampost)	Roadside	0.2	27.5	30.1	27.8	22.4	22.8
GR721	Northfleet Cemetery (Post)	Roadside	1.2	20.8	21.4	19.8	17.1	15.6
GR98	The Leather Bottle PH	Urban Background	0.3	28.5	30.3	25.8	23.8	22.3
GR112	50 Stonebridge Road (Façade)	Urban Background	1.1	30.1	31.1	30.5	23.1	19.1
GR124	Stonebridge Road Telegraph Post Opposite No.67	Roadside	1.4	29.0	27.6	27.7	23	18.8

Site ID	Location	Site type	Distance from Site (km)	Annual Mean NO_2 Concentrations ($\mu g/m^3$)				
				2020	2021	2022	2023	2024
GR139	Rosherville Way, Lampost near Compass Court	Roadside	0.7	31.5	30.7	29.6	23.8	**24.7**
Air Quality Objective				**40**				

Note 1: Triplicate site

Defra Background Maps

In addition to the local monitoring data, estimated background air quality data is available from the Local Air Quality Management (LAQM) website operated by Defra. This website provides estimated annual average background concentrations of NO_2 and CO on a 1 km_2 grid basis. **Table 5.6** presents the highest estimated annual average background concentrations for the grid square containing any modelled receptor for the year 2026.

Table 5.6: Estimated Background Annual Average NO_2 and CO Concentrations at the Proposed Development Site (from the 2021 base maps)

Assessment Year	Annual Average NO_2 ($\mu g/m^3$)	Annual Average CO ($\mu g/m^3$)
2026	21.7	375[2]
Air Quality Objective	**40**	-

Note 1: Presented concentrations for the 1 km^2 grid centred on 562500,174500.

Ecological Background

Background NOx concentrations and nitrogen and acid deposition fluxes have been taken from the APIS website, which provides three-year average background concentrations and fluxes on a 1 km^2 grid basis. The latest three-year average available is for 2021 (2020 - 2022). The background values in **Table 5.7** represent the worst-case predicted concentration across any of the habitat sites assessed.

Table 5.7: Estimated Background Annual Average NOx Concentrations and Nitrogen and Acid Deposition Fluxes in the Area Surrounding the KC Northfleet Site

	Annual Average NO_x ($\mu g/m^3$)	Nitrogen Deposition (kgN/hayr)	Acid Deposition (keq/ha/yr)
2021	31.3	12.3/25.7[1]	1.1/2.0[1]

	Annual Average NO_x (µg/m^3)	Nitrogen Deposition (kgN/hayr)	Acid Deposition (keq/ha/yr)
Air Quality Objective	**30**	**-**	**-**

Note 1: Grassland/Forest Deposition

Cumulative Schemes

A search of Defra's Pollutant Transfer Register[15] demonstrates that there are no installations that release emissions to air in close proximity to the KC site; therefore, suitably accounted for within the background concentrations used within this assessment (the nearest installation being the Botany Road non-ferrous metals site (EPR/BM4945IW), 2.3 km south of the site), 4.5 km south of the site). The nearby Hydro green hydrogen project is not proposing any significant emissions to air.

Furthermore, a search of GBC's planning portal has not found any nearby proposed developments that will emit pollutants at a magnitude (large-scale industrial sites, etc.) or location likely to combine with the emissions from the KC that will have a significant impact that will likely affect the conclusions of this report.

[15] https://prtr.defra.gov.uk/map-search

Figure 5.5: Location of nearby diffusion tubes

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5.2.11 Conversion of NO to NO_2 and Results Processing

NOx emitted to the atmosphere as a result of combustion will consist largely of nitric oxide (NO). Once released into the atmosphere, NO is oxidised to NO_2, which is of concern with respect to health and other impacts. The proportion of NO converted to NO_2 depends on a number of factors, including wind speed, distance from the source, solar irradiation and the availability of oxidants, such as ozone (O_3). The dispersion modelling exercise predicts concentrations of NOx, which subsequently require conversion to NO_2 for comparison with objectives for human health.

Based on Environment Agency recommendations[15], NOx Process Contributions (PCs) have been converted to the respective NO_2 concentrations using 70% for long-term emissions and 35% for short-term emissions based on 'worst case' conversion criteria.

5.2.12 Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA AQTAG06[16]. Dry deposition flux was calculated using the following equation:

Dry deposition flux (µg/m^2/s) = ground level concentration (µg/m^3) x deposition velocity (m/s)

Wet deposition occurs via the incorporation of the pollutant into water droplets, which are then removed in rain or snow and NO_2 wet deposition is not considered significant over short distances compared with dry deposition. Therefore, for the purposes of this assessment (in accordance with AQTAG06), wet deposition has not been considered.

The applied deposition velocities for the relevant chemical species are shown in **Table 5.8.**

Table 5.8: Applied Deposition Velocities

Pollutant	Deposition Velocity (m s^{-1})
	Grassland/Forest
NOx	0.0015/0.003

For the purposes of this assessment, dry deposition rates of nitrogen and acidic equivalents at the identified ecological receptors have been calculated by applying the appropriate grassland or forest deposition velocities to the modelled annual mean concentrations of NO_2.

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

[15] https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment

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

deposition flux by the standard conversion factor of 95.9.

The acid critical loads are provided in units of equivalents (keq/ha/year), which is a measure of how acidifying the chemical species can be. The deposition PC is converted from $\mu g/m^2/s$ to units of keq/ha/year by a standard conversion factor for N of 6.84.

5.2.13 Results Processing

The site operates year-round, except during scheduled maintenance periods. The model, however, assumes that the site runs continuously for 8,760 hours each year. As a result, no post-processing of the results has been performed, except for the conversions of NOx to NO_2 and the calculations of deposition mentioned earlier.

5.2.14 Interpretation of Modelled Results

Human Receptors

EA guidance[17] states that where impacts are below the following criteria, they can be classed as insignificant:

- if the short-term PC is less than 10% of the short-term environmental standard, then a PC can be considered insignificant; and
- if the long-term PC is less than 1% of the long-term environmental standard, then a PC can be considered insignificant.

However, at the detailed modelling stage, there is no EA criterion to decide whether PCs are significant. Therefore, a judgement on significance has been made based on the magnitude of the PCs (including whether they are insignificant or not) in the context of the predicted environmental concentration (PEC), the existing baseline, modelling uncertainty and site-specific circumstances, such as compliance with Best Available Techniques (BAT).

Ecological Receptors

Where emissions affect nature sites, the EA have similar insignificance screening criteria for the impacts (PCs) on internationally (SAC, SPA, Ramsar) or nationally (SSSI) designated sites. Where the above screening criteria are not exceeded, the impacts at ecological sites can be classed as insignificant. Impacts on locally designated sites can be considered insignificant where the PCs are less than 100% of the objective (for both long and short-term impacts).

Again, where the insignificance screening criteria are exceeded, significance has been judged based on PCs in the context of the predicted environmental concentration (PEC), the existing information and site-specific circumstances, such as compliance with Best Available Techniques (BAT).

[17] https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports

5.3 Uncertainties and Assumptions

The following uncertainties and assumptions have been made in the air quality assessment:

- There will be uncertainties introduced because the modelling has simplified real-world processes into a series of algorithms. For example, it has been assumed that wind conditions measured at London City Airport meteorological monitoring station for the years 2021 to 2023 were representative of wind conditions at the site; and
- The combustion process emissions modelled in this assessment will vary over time. It is assumed that the data from the 3 years of stack monitoring used for the existing sources and design information used for the proposed boiler sources are representative of actual emissions.
- The area surrounding the stack is subject to steep terrain height that may not be fully resolved by the 50 m terrain data used. As a result, modelling sensitivity to attempt to understand the effect this uncertainty has on results has been undertaken.
- There is an element of uncertainty in all measured and modelled data. All values presented within the report are the best possible estimates.

5.4 Sensitivity

In line with best practice requirements, modelling sensitivity has been undertaken in order to understand the likely uncertainty with the modelling parameters chosen. In addition to running the model for three meteorological years, the following sensitivity tests have been undertaken:

- sensitivity to the model not accounting for building effects;
- sensitivity to the model not accounting for terrain effects;
- sensitivity to the use of natural gas within the proposed hydrogen-fuelled boilers;
- sensitivity to a scenario where the dual-fuelled boilers are being commissioned on natural gas, which will occur one at a time while the existing operations are occurring; and
- sensitivity to alternative terrain heights, based on values taken from Google Earth.

The results of the sensitivity testing are reported in **Appendix A**. The results indicate that realistic changes in modelling parameters or operational changes are not likely to affect the outcome of this modelling assessment.

6 ASSESSMENT OF IMPACTS

This section sets out the results of the dispersion modelling, which was undertaken in line with the methodology described in **Section 5**. The results have been compared against the ambient air quality objectives and critical loads and levels, as well as the EA's insignificance criteria. The results presented in this section represent the worst-case impacts across the three years of meteorological data.

6.1 Impacts on Human Receptors

6.1.1 NO_2 Annual Mean

Table 6.1 shows the comparison of annual mean NO_2 PCs for the Existing and the Proposed scenarios at the assessed receptor locations. Furthermore, the percentage change between the scenarios and the future PEC (background, as described in **Section 5.2.10** + proposed operations) are also presented.

Table 6.1: Predicted Annual Mean NO_2 Impacts at Discrete Receptors

Receptor ID	Existing (µg/m^3)	Proposed (µg/m^3)	% PC of AQO	PC Change % of AQO	Proposed PEC (µg/m^3)[1]	% Proposed PEC of AQO
R1	0.67	0.84	2.1%	0%	25.54	64%
R2	0.74	0.82	2.0%	0%	25.52	64%
R3	0.42	0.49	1.2%	0%	25.19	63%
R4	0.30	0.34	0.8%	0%	25.04	63%
R5	0.45	0.49	1.2%	0%	25.19	63%
R6	0.41	0.49	1.2%	0%	25.19	63%
R7	0.62	0.73	1.8%	0%	25.43	64%
R8	0.31	0.35	0.9%	0%	25.05	63%
R9	0.34	0.36	0.9%	0%	25.06	63%
R10	0.43	0.45	1.1%	0%	25.15	63%
R11	0.39	0.42	1.0%	0%	25.12	63%
R12	0.27	0.31	0.8%	0%	25.01	63%
R13	0.20	0.20	0.5%	0%	24.90	62%
R14	0.21	0.17	0.4%	0%	24.87	62%
R15	0.23	0.19	0.5%	0%	24.89	62%
R16	0.34	0.30	0.7%	0%	25.00	62%
R17	0.27	0.28	0.7%	0%	24.98	62%
R18	0.22	0.21	0.5%	0%	24.91	62%
R19	0.08	0.04	0.1%	0%	24.74	62%
R20	0.13	0.06	0.1%	0%	24.76	62%
R21	0.16	0.07	0.2%	0%	24.77	62%

Receptor ID	Existing (µg/m^3)	Proposed (µg/m^3)	% PC of AQO	PC Change % of AQO	Proposed PEC (µg/m^3)[1]	% Proposed PEC of AQO
R22	0.51	0.55	1.4%	0%	25.25	63%
AQO			**40 µg/m^3**			

Note 1 The highest nearby monitored NO_2 concentration in 2024 has been used for all receptors (see **Section 5.2.10**)

In the case of long-term NO_2, the model predicts that the highest site-wide PC following the variation would be 0.84 µg/m^3 (or 2.1% of the AQO) at receptor R1. This results in a maximum increase of 0.17 µg/m^3, or 0.4% of the AQO. The site-wide impacts, therefore, cannot be considered insignificant with regard to EA guidance; however, this is the case for both the existing and proposed operations.

While there is a proposed increase at some receptor locations as a result of the variation, there is also the potential for reduced impacts at others, as demonstrated in **Table 6.1** and **Figure 6.1**

Furthermore, while there is predicted to be an increase at some locations as a result of the variation, the predicted PECs continue to be well below the annual NO_2 objective. **Figure 6.1** presents the maximum 3-year predicted site-wide PC concentrations under the existing and proposed operations.

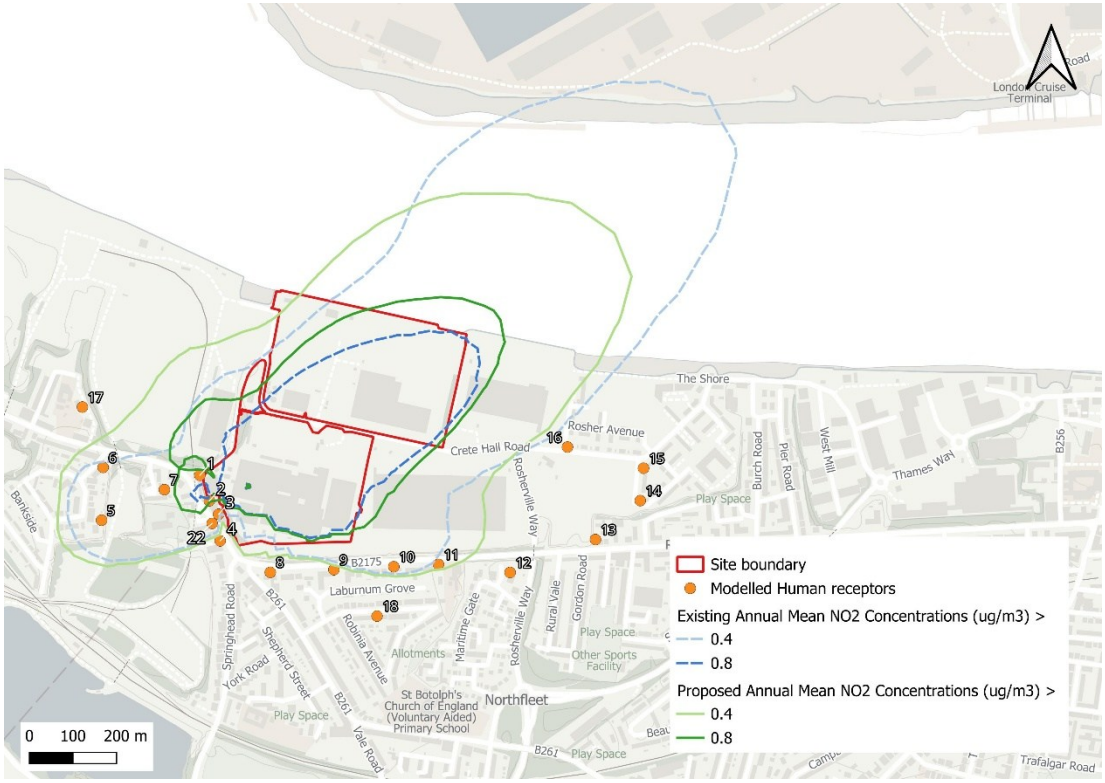

Figure 6.1: Site-wide Existing and Proposed Annual Mean NO_2 PC Contour (maximum of 3 years)

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6.1.2 NO_2 1-hour Mean

Table 6.2 shows the comparison of the 99.79th percentile 1-hour mean NO_2 PCs for the Existing and Proposed scenarios at the assessed receptor locations. Furthermore, the percentage change between the scenarios and the future PEC (background, as described in **Section 5.2.10** + proposed operations) are also presented.

Table 6.2: Predicted 99.79th Hourly Mean NO_2 Impacts at Discrete Receptors

Receptor ID	Existing (µg/m³)	Proposed (µg/m³)	% PC of AQO	PC Change % of AQO	Proposed PEC (µg/m³)[1,2]	% Proposed PEC of AQO
R1	2.82	2.85	1%	0%	52.25	**26%**
R2	3.44	3.71	2%	0%	53.11	**27%**
R3	3.33	4.92	2%	1%	54.32	**27%**
R4	3.32	3.85	2%	0%	53.25	**27%**
R5	3.07	3.28	2%	0%	52.68	**26%**
R6	2.57	2.65	1%	0%	52.05	**26%**
R7	3.24	3.25	2%	0%	52.65	**26%**
R8	2.97	3.44	2%	0%	52.84	**26%**
R9	2.83	2.90	1%	0%	52.30	**26%**
R10	4.43	4.54	2%	0%	53.94	**27%**
R11	3.89	4.36	2%	0%	53.76	**27%**
R12	3.40	3.90	2%	0%	53.30	**27%**
R13	2.07	3.33	2%	1%	52.73	**26%**
R14	1.45	2.52	1%	1%	51.92	**26%**
R15	1.50	2.28	1%	0%	51.68	**26%**
R16	1.94	2.93	1%	0%	52.33	**26%**
R17	1.63	1.80	1%	0%	51.20	**26%**
R18	1.65	2.14	1%	0%	51.54	**26%**
R19	1.13	0.74	0%	0%	50.14	**25%**
R20	1.41	0.87	0%	0%	50.27	**25%**
R21	1.41	0.91	0%	0%	50.31	**25%**
R22	3.28	4.31	2%	1%	53.71	**27%**
AQO		**200 µg/m³**				

Note 1 The highest nearby monitored NO_2 concentration in 2024 has been used for all receptors (see **Section 5.2.10**)

Note 2 2 x the annual mean background inline with EA guidance

In the case of the 1-hour NO_2 objective, the model predicts that the highest site-wide PC following the variation would be 4.92 µg/m³ (or 2% of the AQO) at receptor R3. This results in an increase of 1.59 µg/m³, or 1% of the AQO. The site-wide

impacts, therefore, can be considered insignificant with regard to EA guidance (being below 10% of the objective[18]). This is the case for both the existing and proposed operations.

As a result of the predicted site-wide PCs being insignificant, no contours have been presented. Furthermore, while there is predicted to be an increase at some locations as a result of the variation, the predicted PECs continue to be well below the 1-hour mean NO_2 objective.

6.1.3 CO 8-hour Mean

Table 6.3 shows the comparison of the 100th percentile 8-hour mean CO PCs for the Existing and Proposed scenarios at the assessed receptor locations. Furthermore, the percentage change between the scenarios and the future PEC (background, as described in **Section 5.2.10** + proposed operations) are also presented.

Table 6.3: Predicted 100th 8-hour Mean CO Impacts at Discrete Receptors

Receptor ID	Existing (µg/m³)	Proposed (µg/m³)	% PC of AQO	PC Change % of AQO	Proposed PEC (µg/m³)[1,2]	% Proposed PEC of AQO
R1	10.79	10.81	0%	0%	760.81	**7.6%**
R2	11.16	11.39	0%	0%	761.39	**7.6%**
R3	7.59	8.37	0%	0%	758.37	**7.6%**
R4	7.54	8.74	0%	0%	758.74	**7.6%**
R5	6.85	7.62	0%	0%	757.62	**7.6%**
R6	6.88	6.99	0%	0%	756.99	**7.6%**
R7	8.32	8.60	0%	0%	758.60	**7.6%**
R8	9.72	10.04	0%	0%	760.04	**7.6%**
R9	7.83	8.57	0%	0%	758.57	**7.6%**
R10	12.44	12.59	0%	0%	762.59	**7.6%**
R11	11.08	11.84	0%	0%	761.84	**7.6%**
R12	9.84	11.15	0%	0%	761.15	**7.6%**
R13	5.16	5.56	0%	0%	755.56	**7.6%**
R14	3.62	4.24	0%	0%	754.24	**7.5%**
R15	3.37	3.68	0%	0%	753.68	**7.5%**
R16	5.06	5.61	0%	0%	755.61	**7.6%**
R17	4.61	4.88	0%	0%	754.88	**7.5%**
R18	5.13	5.71	0%	0%	755.71	**7.6%**
R19	1.36	1.31	0%	0%	751.31	**7.5%**
R20	1.37	1.27	0%	0%	751.27	**7.5%**

[18] see Section **5.2.14**

Receptor ID	Existing (µg/m^3)	Proposed (µg/m^3)	% PC of AQO	PC Change % of AQO	Proposed PEC (µg/m^3)[1,2]	% Proposed PEC of AQO
R21	1.58	1.52	0%	0%	751.52	**7.5%**
R22	9.72	9.88	0%	0%	759.88	**7.6%**
AQO		**10,000 µg/m^3**				

Note 1 The 2001 DEFRA Background Concentration has been used for all receptors.

Note 2 2 x the annual mean background inline with EA guidance

In the case of the 8-hour CO objective, the model predicts that the highest site-wide PC following the variation would be 12.59 µg/m^3 (or 0% of the AQO) at receptor R3. The site-wide impacts, therefore, can be considered insignificant with regard to EA guidance (being below 10% of the objective[19]). This is the case for both the existing and proposed operations.

As a result of the predicted site-wide PCs being insignificant, no contours have been presented. Furthermore, while there is predicted to be an increase at some locations as a result of the variation, the predicted PECs continue to be well below the 8-hour mean CO objective.

6.1.4 CO 1-hour Mean

Table 6.4 shows the comparison of the 100th percentile 1-hour mean CO PCs for the Existing and Proposed scenarios at the assessed receptor locations. Furthermore, the percentage change between the scenarios and the future PEC (background, as described in **Section 5.2.10,** + proposed operations) are also presented.

Table 6.4: Predicted 100th 1-hour Mean CO Impacts at Discrete Receptors

Receptor ID	Existing (µg/m^3)	Proposed (µg/m^3)	% PC of EAL	PC Change % of EAL	Proposed PEC (µg/m^3)[1,2]	% Proposed PEC of EAL
R1	13.50	13.57	0%	0%	763.57	**2.5%**
R2	15.13	15.28	0%	0%	765.28	**2.6%**
R3	16.07	16.56	0%	0%	766.56	**2.6%**
R4	14.21	17.84	0%	0%	767.84	**2.6%**
R5	13.94	14.17	0%	0%	764.17	**2.5%**
R6	13.60	13.65	0%	0%	763.65	**2.5%**
R7	13.89	13.91	0%	0%	763.91	**2.5%**
R8	12.93	13.53	0%	0%	763.53	**2.5%**
R9	13.62	13.62	0%	0%	763.62	**2.5%**

[19] see Section **5.2.14**

Receptor ID	Existing (µg/m^3)	Proposed (µg/m^3)	% PC of EAL	PC Change % of EAL	Proposed PEC (µg/m^3)[1,2]	% Proposed PEC of EAL
R10	19.06	19.11	0%	0%	769.11	**2.6%**
R11	18.35	18.43	0%	0%	768.43	**2.6%**
R12	16.09	16.69	0%	0%	766.69	**2.6%**
R13	13.19	14.06	0%	0%	764.06	**2.5%**
R14	12.10	12.53	0%	0%	762.53	**2.5%**
R15	11.85	12.96	0%	0%	762.96	**2.5%**
R16	15.09	15.39	0%	0%	765.39	**2.6%**
R17	13.29	13.38	0%	0%	763.38	**2.5%**
R18	13.16	13.25	0%	0%	763.25	**2.5%**
R19	3.38	3.13	0%	0%	753.13	**2.5%**
R20	3.54	3.31	0%	0%	753.31	**2.5%**
R21	3.49	3.28	0%	0%	753.28	**2.5%**
R22	13.98	15.32	0%	0%	765.32	**2.6%**
EAL		**30,000 µg/m^3**				

Note 1 The DEFRA 2001 Background Concentration has been used for all receptors.

Note 2 2 x the annual mean background inline with EA guidance

In the case of the 1-hour CO EAL, the model predicts that the highest site-wide PC following the variation would be 19.11 µg/m^3 (or 0% of the AQO) at receptor R10. The site-wide impacts, therefore, can be considered insignificant with regard to EA guidance (being below 10% of the objective[20]). This is the case for both the existing and proposed operations.

As a result of the predicted site-wide PCs being insignificant, no contours have been presented. Furthermore, while there is predicted to be an increase at some locations as a result of the variation, the predicted PECs continue to be well below the 1-hour mean CO objective.

6.1.5 Significance of Effects

The assessment has demonstrated that the proposed site-wide impacts against all air quality standards are below the EA's 1% and 10% insignificance thresholds for long- and short-term impacts, respectively. This is the case for both the existing and proposed operations. The exception to the above is for the NO_2 annual mean impacts, where impacts exceed the 1% insignificance threshold. Again, this is the case at both the existing and proposed operations.

While there is a proposed minor increases at some receptor locations as a result of the variation, including at locations where the 1% insignificance threshold is already exceeded, there is also the potential for minor reductions impacts at others. When

[20] see Section **5.2.14**

considering that the majority of impacts are below insignificance thresholds and all proposed PECs (background + proposed operational emissions) following the changes are well below all AQS, the impacts on human health due to the proposed changes are judged to be not significant.

Furthermore, reasonable and foreseeable changes associated with the uncertainties and sensitivities discussed in **Sections 5.3 and 5.4** are not likely to change this conclusion.

6.2 Site-wide Impacts on Ecological Receptors

6.2.1 NOx Impacts

Table C1 and **Table C2** within **Appendix C** detail the results of the NOx assessment at nearby ecology sites, with an assessment against the annual mean (30 µg/m^3) and 100th percentile 24-hour mean CLe (75 µg/m^3) undertaken.

The site-wide impacts following the changes to the new boiler and stack configuration result in a predicted impact less than the 1%[21] or 10% insignificance thresholds for both long and short impacts, respectively, at all modelled receptors.

The results presented demonstrate potential exceedances of the annual and 24-hour mean[22] NOx critical level as a result of the proposed operation's PEC (background + proposed operations impact). However, as the worst-case background concentration, assessment criteria and emission assumptions have been used, the results presented will have overestimated the impacts at some locations.

6.2.2 Critical Loads for Nutrient Nitrogen and Acidity

Table C3 and **Table C4** within **Appendix C** present the results for total nutrient nitrogen and acid deposition fluxes at each ecological receptor. The PCs are assessed against the minimum CLo for each site.

The site-wide impacts following the changes to the new boiler and stack configuration result in predicted nitrogen and acid deposition flux impacts less than the 1%[21] insignificance thresholds at all modelled receptors.

The results presented demonstrate potential exceedances of the annual mean nitrogen deposition and acid critical loads as a result of the proposed operation's PEC (background + proposed operations impact). This is due to the existing background concentrations, of which the site is currently contributing.

The above is the case for both the existing situation and following the proposed variation, with both minor increases and decreases in fluxes predicted due to the

[21] The screening threshold of 100% has been used for non-statutory ecology sites such as local wildlife sites, as per EA guidance, and no exceedances of this threshold have been predicted.

[22] Assuming a critical level of 75 µg/m3 only

proposed variation. A contour plot of the proposed nitrogen deposition impacts is illustrated in **Figure 6.2**.

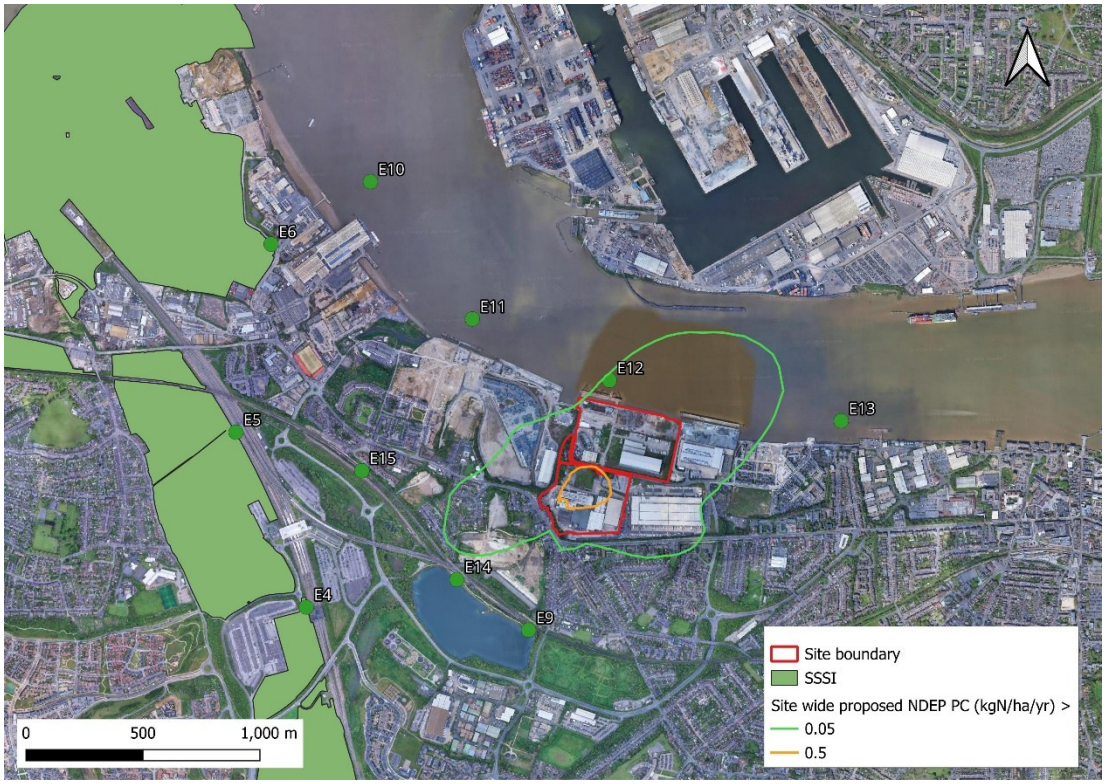


Figure 6.2: Site-wide Proposed Annual Mean Nitrogen Deposition Flux Contour (maximum of 3 years).

Contains Imagery @2026 Airbus, Infoterra Ltd & Bluesky, Landsat / Copernicus, Maxar Technologies, Map data @2026.

6.2.3 Significance of Effects

The proposed site-wide impacts on nearby habitat sites are not expected to exceed the relevant insignificance thresholds against any relevant criteria. While there are predicted exceedances at some locations, primarily due to existing background fluxes and worst-case emission assumptions, as existing and proposed impacts following the proposed variation can be classed as insignificant, the impacts are judged to be not significant.

Furthermore, reasonable and foreseeable changes associated with the uncertainties and sensitivities discussed in **Sections 5.3 and 5.4** are not likely to change this conclusion.

7 CONCLUSIONS

An air quality assessment to support a permit variation application for the replacement of three natural-gas fired boilers with two new dual-fuelled boilers (natural gas and hydrogen) and associated stacks at the Kimberly-Clark Northfleet site has been prepared with reference to existing air quality in the area, relevant air quality legislation, policy and guidance and appropriate conservatisms.

Ground level concentrations of oxides of nitrogen, nitrogen dioxide and carbon monoxide associated with the emissions from the new flues were predicted at nearby relevant human and ecological receptor locations using dispersion modelling. This included consideration of all site-wide combustion sources.

The assessment has demonstrated that the proposed site-wide impacts against all air quality standards are below the EA's 1% and 10% insignificance thresholds for long- and short-term impacts, respectively. The exception to the above is for the NO_2 annual mean impacts, where impacts exceed the 1% insignificance threshold at some locations. This is the case at both the existing and proposed operations. When considering that the majority of impacts are below insignificance thresholds and all proposed total concentrations (background + proposed operational emissions) following the changes are well below all AQS, the impacts on human health due to the proposed changes have been judged to be not significant.

The proposed site-wide impacts on nearby habitat sites are not expected to exceed the relevant insignificance thresholds against any relevant criteria. While there are predicted exceedances at some locations, primarily due to the existing background fluxes and worst-case emissions assumptions, as existing and proposed impacts following the proposed variation can be classed as insignificant, the impacts are judged to be not significant.

Furthermore, reasonable and foreseeable changes associated with the uncertainties and sensitivities discussed in **Sections 5.3 and 5.4** are not likely to change the conclusions of this assessment.

Overall, the air quality effects of the proposed permit variation are judged to be not significant.

APPENDIX A – MODEL SENSITIVITY ANALYSIS

Table A1 presents the results of the model sensitivity testing described in Section 4. The results presented are the PCs for Receptor R1 (the worst-case modelled receptor against the annual mean NO_2 AQO) for the meteorological year 2023. As can be seen from the results, the model is not overly sensitive to changes in the fuel used within the proposed boilers, and the impacts during commissioning are likely to be only slightly greater (at the worst-case receptor). Furthermore, the results presented within the report are near worst case in terms of building and terrain effects but are within normal modelling uncertainty. While manually altering terrain does demonstrates and 1-hour building sensitivity present higher predictions, the differences are not judged to impact the conclusions of the assessment. Based on the impacts predicted in the main body of the report, the sensitivity testing does not impact the conclusions of the assessment.

Table A1: Results of the Sensitivity Testing

Model description	Annual mean NO_2 ($\mu g/m^3$)	99.79th %ile 1-hour Mean NO_2 ($\mu g/m^3$)
Core Model – Assuming proposed boilers are fired on Hydrogen	0.75	2.85
Model 1 – Core Model with no building	0.78	4.64
Model 2 – Core Model with no terrain	0.73	2.67
Model 3 – Core Model assuming proposed new boilers are fired on natural gas	0.77	2.87
Model 4 – Core Model assuming a scenario where one dual-fuelled boilers are being commissioned on natural gas, which will occur while two of the existing natural gas boilers and other site impacts are in operation	0.82	2.90
Model 5 – Sensitivity to manually entered receptor heights	1.03	4.59

APPENDIX B – RECEPTORS

Table B1 presents the discrete human and ecological receptors included in the dispersion model.

Table B1: Discrete Human and Ecological Receptors Included in the Model

Receptor ID	Receptor Type	X (m)	Y (m)	Height (m)
1	Residential	562440	174256	1.5
2	Residential	562462	174198	1.5
3	Residential	562483	174167	1.5
4	Residential	562487	174106	1.5
5	Residential	562215	174153	1.5
6	Residential	562218	174274	1.5
7	Residential	562359	174223	1.5
8	Residential	562602	174033	1.5
9	Residential	562748	174040	1.5
10	Residential	562885	174046	1.5
11	Residential	562987	174052	1.5
12	Residential	563152	174033	1.5
13	Residential	563347	174109	1.5
14	Residential	563450	174198	1.5
15	Residential	563457	174272	1.5
16	Residential	563283	174321	1.5
17	Residential	562171	174413	1.5
18	Residential	562846	173933	1.5
19	Residential	563625	176392	1.5
20	Residential	563900	176181	1.5
21	Residential	564092	176016	1.5
22	Residential	562469	174146	1.5
E1	Ecological	567298	173750	1.5
E2	Ecological	568987	176177	1.5
E3	Ecological	561677	172882	1.5
E4	Ecological	561451	173785	1.5

Receptor ID	Receptor Type	X (m)	Y (m)	Height (m)
E5	Ecological	561150	174533	1.5
E6	Ecological	561300	175338	1.5
E7	Ecological	567598	165780	1.5
E8	Ecological	568067	174485	1.5
E9	Ecological	562401	173687	1.5
E10	Ecological	561725	175605	1.5
E11	Ecological	562161	175017	1.5
E12	Ecological	562747	174756	1.5
E13	Ecological	563738	174582	1.5
E14	Ecological	562095	173903	1.5
E15	Ecological	561689	174368	1.5

APPENDIX C – ECOLOGICAL RECEPTOR RESULTS

Table C1: Predicted Annual Mean NO_x Impacts at Discrete Ecological Receptors

Receptor ID	Existing PC (µg/m³)	Proposed PC (µg/m³)	% PC of CIe	PC Change % of CIe	PEC µg/m³	% PEC of CLe
E1 (Ramsar)	0.03	0.01	<0.1%	0%	31.31	104%
E2 (Ramsar/ SPA)	0.03	0.01	<0.1%	0%	31.31	104%
E3 (SSSI)	0.05	0.04	0.1%	0%	31.34	104%
E4 (SSSI)	0.22	0.18	0.6%	0%	31.48	105%
E5 (SSSI)	0.15	0.09	0.3%	0%	31.39	105%
E6 (SSSI/ LWS)	0.08	0.05	0.2%	0%	31.35	104%
E7 (SAC)	0.01	<0.01	<0.1%	0%	31.30	104%
E8 (Ramsar/ SPA)	0.02	0.01	<0.1%	0%	31.31	104%
E9 (LWS)	0.18	0.17	0.6%	0%	31.47	105%
E10 (SMR[23])	0.08	0.05	0.2%	0%	31.35	105%
E11 (SMR[19])	0.18	0.14	0.5%	0%	31.44	105%
E12 (SMR[19])	0.39	0.56	1.9%	1%	31.86	106%
E13 (SMR[19])	0.34	0.24	0.8%	0%	31.54	105%
E14 (LWS)	0.38	0.37	1.2%	0%	31.67	106%
E15 (LWS)	0.26	0.21	0.7%	0%	31.51	105%
CLe			**30**			

[23] Special Migratory Route

Table C2: Predicted 24-hour Mean NO_x Impacts at Discrete Ecological Receptors

Receptor ID	Existing PC (µg/m³)	Proposed PC (µg/m³)	Proposed% of Objective	Change % of Objective	PEC µg/m³	% PEC of CLe
E1 (Ramsar)	2.26	1.39	1.9%	-1%	63.99	85%
E2 (Ramsar/ SPA)	1.73	0.91	1.2%	-1%	63.51	85%
E3 (SSSI)	6.05	4.45	5.9%	-2%	67.05	89%
E4 (SSSI)	5.02	6.46	8.6%	2%	69.06	92%
E5 (SSSI)	3.80	4.27	5.7%	1%	66.87	89%
E6 (SSSI/ LWS)	5.33	5.00	6.7%	0%	67.60	90%
E7 (SAC)	1.49	0.64	0.8%	-1%	63.24	84%
E8 (Ramsar/ SPA)	2.08	1.19	1.6%	-1%	63.79	85%
E9 (LWS)	10.98	12.71	17.0%	2%	75.31	100%
E10 (SMR[24])	5.12	4.98	6.6%	0%	67.58	90%
E11 (SMR[19])	6.15	8.72	11.6%	3%	71.32	95%
E12 (SMR[19])	10.78	17.57	23.4%	9%	80.17	107%
E13 (SMR[19])	5.92	7.79	10.4%	2%	70.39	94%
E14 (LWS)	8.75	11.02	14.7%	3%	73.62	98%
E15 (LWS)	4.60	6.17	8.2%	2%	68.77	92%
CLe			**75**			

[24] Special Migratory Route

Table C3: Predicted Annual Mean Nutrient Nitrogen Deposition Impacts at Discrete Ecological Receptors

Receptor ID	Existing PC (kgN/ha/yr)	Proposed PC (kgN/ha/yr)	Proposed % of Objective	Change % of Objective	PEC (kgN/ha/yr)	% PEC of CLo	Critical Load (kgN/ha/yr)
E1 (Ramsar)	<0.01	<0.01	<0.1%	0%	12.30	246%	5
E2 (Ramsar/ SPA)	<0.01	<0.01	<0.1%	0%	12.30	246%	5
E3 (SSSI)	0.01	<0.01	0.1%	0%	12.30	246%	5
E4 (SSSI)	0.02	0.02	0.4%	0%	12.32	246%	5
E5 (SSSI)	0.02	0.01	0.2%	0%	12.31	246%	5
E6 (SSSI/ LWS)	0.01	<0.01	0.1%	0%	12.30	246%	5
E7 (SAC)	<0.01[1]	<0.01 [1]	<0.1%	0%	25.71 [1]	257%	10
E8 (Ramsar/ SPA)	<0.01	<0.01	<0.1%	0%	12.30	246%	5
E9 (LWS)	0.02	0.02	0.3%	0%	12.32	246%	5
E10 (SMR[25])	0.01	0.01	0.1%	0%	12.31	246%	5
E11 (SMR[19])	0.02	0.01	0.3%	0%	12.31	246%	5
E12 (SMR[19])	0.04	0.06	1.1%	0%	12.36	247%	5
E13 (SMR[19])	0.03	0.02	0.5%	0%	12.32	246%	5
E14 (LWS)	0.04	0.04	0.8%	0%	12.34	247%	5
E15 (LWS)	0.03	0.02	0.4%	0%	12.32	246%	5

Note 1 – Forest deposition values applied.

[25] Special Migratory Route

Table C4: Predicted Annual Mean Acid Deposition Impacts at Discrete Ecological Receptors

Receptor ID	Existing PC (Keq/ha/yr)	Proposed PC (Keq/ha/yr)	Proposed % of Objective	Change % of Objective	PEC Keq/ha/yr	% PEC of CLo	Critical Load (Keq/ha/yr)
E1 (Ramsar)	<0.001	<0.001	0.01%	0%	1.10	108%	1.019
E2 (Ramsar/ SPA)	<0.001	<0.001	0.01%	0%	1.10	108%	1.019
E3 (SSSI)	<0.001	<0.001	0.03%	0%	1.10	108%	1.019
E4 (SSSI)	0.002	0.001	0.13%	0%	1.10	108%	1.019
E5 (SSSI)	0.001	0.001	0.07%	0%	1.10	108%	1.019
E6 (SSSI/ LWS)	0.001	<0.001	0.03%	0%	1.10	108%	1.019
E7 (SAC)	<0.001 [1]	<0.001 [1]	<0.01%	0%	2.00 [1]	101%	1.983
E8 (Ramsar/ SPA)	<0.001	<0.001	0.01%	0%	1.10	108%	1.019
E9 (LWS)	0.001	0.001	0.12%	0%	1.10	108%	1.019
E10 (SMR[26])	0.001	<0.001	0.04%	0%	1.10	108%	1.019
E11 (SMR[19])	0.001	0.001	0.10%	0%	1.10	108%	1.019
E12 (SMR[19])	0.003	0.004	0.40%	0%	1.10	108%	1.019
E13 (SMR[19])	0.002	0.002	0.17%	0%	1.10	108%	1.019
E14 (LWS)	0.003	0.003	0.26%	0%	1.10	108%	1.019
E15 (LWS)	0.002	0.002	0.15%	0%	1.10	108%	1.019

Note 1 – Forest deposition values applied.

[26] Special Migratory Route

APPENDIX D – PRE-APPLICATION BASIC SCREENING REPORT

Nature and Heritage Conservation

Screening Report: Bespoke installation

Reference	**EPR/BJ7379IZ/P001**
NGR	**TQ 62711 74327**
Buffer (m)	**5**
Date report produced	**24/05/2024**
Number of maps enclosed	**2**

This nature and heritage conservation report

The nature and heritage conservation sites, protected species and habitats, and other features identified in the table below **must be considered in your application**.

In the further information column, there are links which give more information about the site or feature type and indicate where you are able to self-serve to get the most accurate site boundaries or feature locations.

Most designated site boundaries are available on Magic map. Using Magic map allows you to zoom in and see the site boundary or feature location in detail, Magic map also allows you to measure the distance from these sites and features to your proposed boundary. Help videos are available on Magic map to guide you through.

Where information is not publicly available, or is only available to those with GIS access, we have provided a map at the end of this report.

Sites and Features within screening distance	Screening distance (km)	Further Information
Special Areas of Conservation (cSAC or SAC)	10	Joint Nature Conservation Committee and Magic map
North Downs Woodlands		
Special Protection Area (pSPA or SPA)	10	Joint Nature Conservation Committee and Magic map
Thames Estuary & Marshes		

Ramsar **Thames Estuary & Marshes**	10	Joint Nature Conservation Committee and Magic map
Sites of Special Scientific Interest (SSSI) **Swanscombe Peninsula**	2	Natural England and Magic map
Local Wildlife Sites (LWS) **Ebbsfleet Marshes etc, Northfleet Botany Marshes** (see map below)	2	Appropriate Local Record Centre (LRC)

Protected Species within screening distance	Screening distance (km)	Further Information
Atlantic Salmon migratory route **Allis Shad migratory route** **European Eel migratory route** **River Lamprey migratory route** **Sea Lamprey migratory route** **Smelt migratory route** **Twaite Shad migratory route** (see map below)	up to 2	Natural England Environment Agency. Dial 03708 506 506 for your local Fisheries and Biodiversity team

Where protected species are present, a licence may be required from Natural England to handle the species or undertake the proposed works.

The relevant Local Records Centre must be contacted for information on the features within local wildlife sites. A small administration charge may also be incurred for this service.

The following nature and heritage conservation sites, protected species and habitats, and other features have been checked for, where they are relevant for the permit type requested, but have not been found within screening distance of your site unless included in the list above.

Special Areas of Conservation (cSAC or SAC), Special Protection Area (pSPA or SPA), Marine Conservation Zone (MCZ), Ramsar, Sites of Special Scientific Interest (SSSI), National Nature Reserve (NNR), Local Nature Reserve (LNR), Local Wildlife Sites (LWS), Ancient Woodland, relevant species and habitats.

Please note we have screened this application for features for which we have information. It is however your responsibility to comply with all environmental and planning legislation, this information does not imply that no other checks or permissions will be required.

The nature and heritage screening we have conducted as part of this report is subject to change as it is based on data we hold at the time it is generated. We cannot guarantee there will be no changes to our screening data between the date of this report and the submission of the permit application, which could result in the return of an application or requesting further information

Local Wildlife Sites

Environment Agency

Legend

Local Wildlife Sites

1: 25,000

0 625

Metres

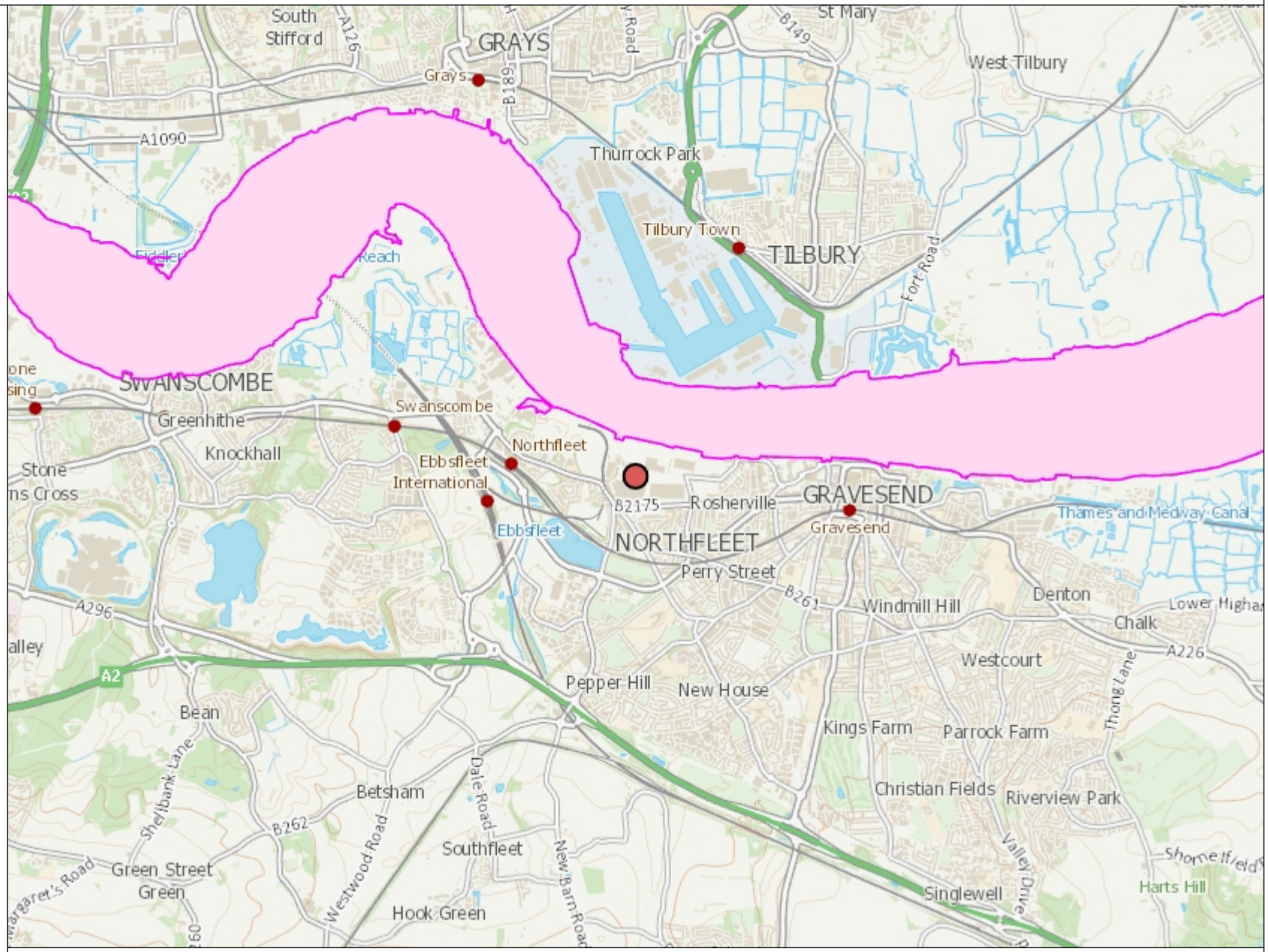
N W E S

Protected Species

Environment Agency

Legend

Fish migratory routes screened for Environmental Permits



1: 50,000

0 1,250

Metres

N W E S