UK Power Reserve Ltd

STOR Generation Project at Docks Way, Newport

Detailed Air Quality Assessment

443371-AQ-08(00)

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RSK GENERAL NOTES

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Author	Annie Trevis Graduate Air Quality Consultant	**Technical reviewer**	Anna McMahon Senior Air Quality Consultant
Signature		Signature	
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Abbreviations

AERMOD	American Meteorological Society/United States Environmental Protection Agency Regulatory Model
APIS	Air Pollution Information System
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQS	Air Quality Standard
BAT	Best available techniques
CO	Carbon Monoxide
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EAL	Environmental Assessment Level
EC	European Commission
EPR	Environmental Permitting Regulations
EU	European Union
IAQM	Institute of Air Quality Management
LNR	Local Nature Reserve
MCPD	Medium Combustion Plant Directive
NAQS	National Air Quality Strategy
NCC	Newport City Council
NNR	National Nature Reserve
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
PC	Process Contribution
PEC	Predicted Environmental Concentration
$PM_{2.5}$	Particulate matter of size fraction approximating to <2.5mm diameter
PM_{10}	Particulate matter of size fraction approximating to <10mm diameter
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STOR	Short Term Operating Reserve

Contents

1 INTRODUCTION

RSK Environment Limited (RSK) has been commissioned by UK Power Reserve Ltd (the client) to undertake an air quality impact assessment of the power generation plant at a site adjacent to Docks Way, Newport (hereafter referred to as 'the site').

The site has an area of less than 0.5 ha, on land located to the south of Docks Way, Newport; the approximate grid reference of the site is 330916,186173. Figure 1.1 shows the location of the site. The site falls within the jurisdiction of Newport City Council (NCC).

The generating plant comprises a series of four 2 MW_e natural gas-fuelled engine generators with a continuous (when operating) electrical output of 8 MW_e. The generators are each contained within a soundproofed engine cell within a portal framed container. Figure 1.2 shows the site layout, identifying the locations of the four exhaust flues. UKPR currently have a contract to operate the generators for 15 years, but their lifespan may exceed 15 years depending on market conditions at that time.

The plant are operational but now require an environmental permit under the Environmental Permitting (England and Wales) (Amendment) Regulations 2018 to transpose the requirements of the Medium Combustion Plant Directive (MCPD) EU/2015/2193 of 25 November 2015.

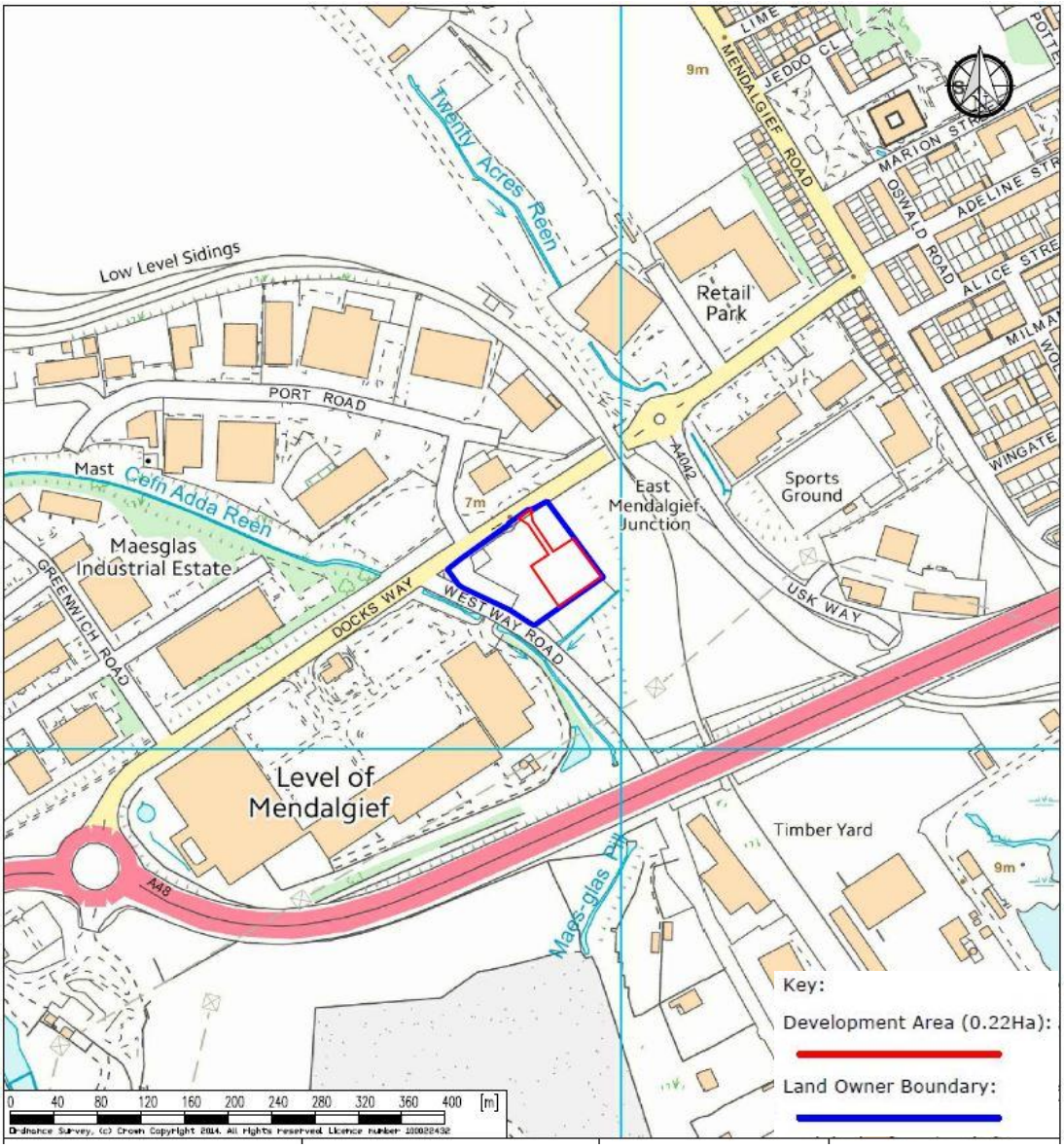
The plant generate electricity to serve the local area and provide power services to the National Grid via the local distribution network. The gas generators provide additional power capacity at times of peak demand. The generating plant participate in the National Grid's Short-Term Operating Reserve (STOR) programme to provide balance to the National Grid during unexpected periods of high demand for electricity or where there are constraints on electricity available in England and Wales.

STOR plant are not designed to operate continuously throughout the year. Over the last five years, the plant (at individual sites) across UKPR's portfolio have not exceeded 1,500 operating hours per annum. However, to enable the plant to operate flexibly whenever the margin of excess capacity between supply and demand becomes sufficiently small, an increased number of operating hours of up to 8,750 per annum have been tested in this report. Any number of the plant can operate at up to 100% power output at any time and this assessment has therefore reported air quality impacts considering maximum operating hours and output for a conservative scenario.

This report has been prepared to support the environmental permit application. It has sought to characterise existing baseline ambient air quality and to assess the air quality impacts of the power station on human and ecological receptors when operating at full capacity.

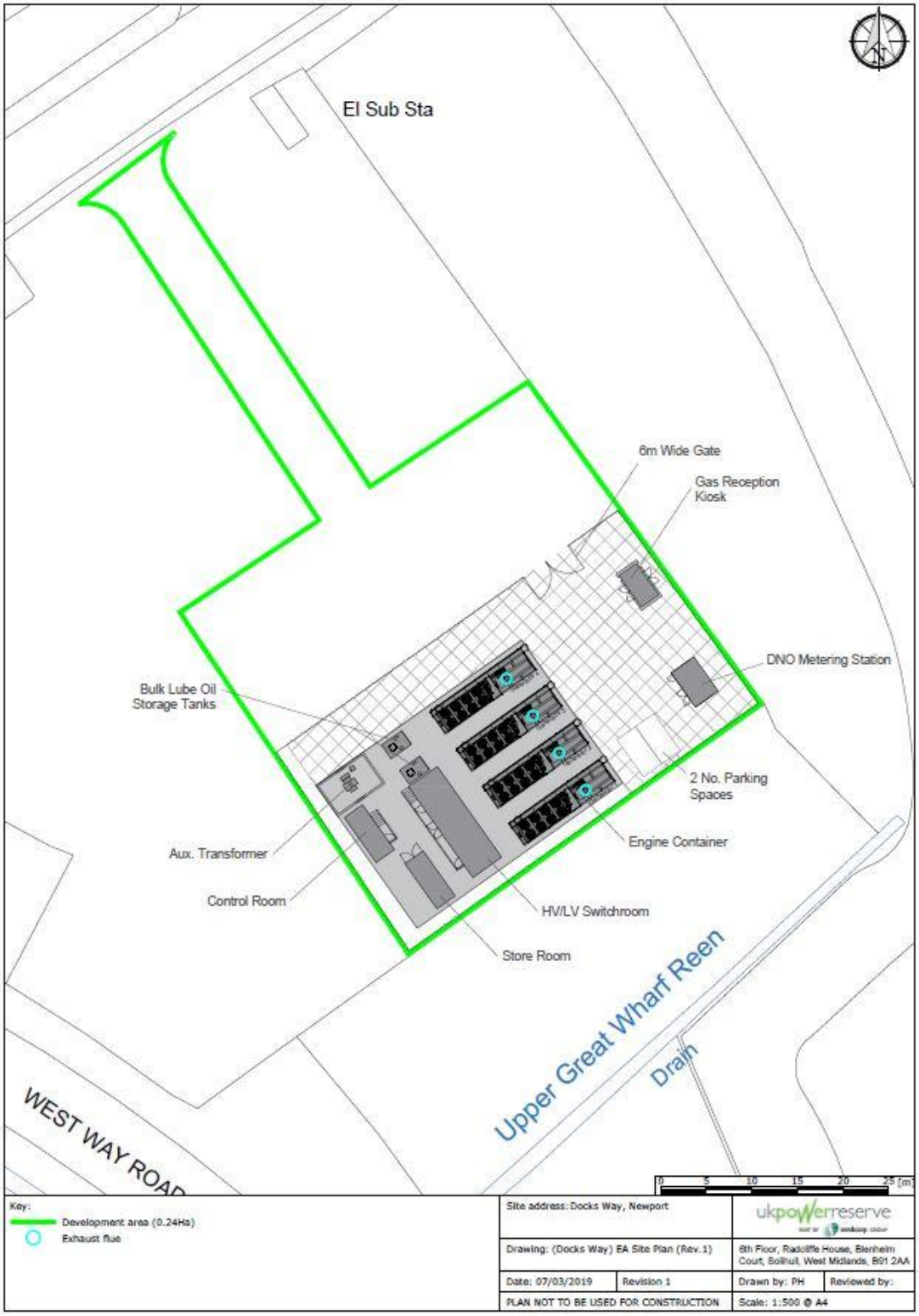
RSK previously produced the air quality assessment for the site to accompany the planning application submitted during 2014, which included cumulative assessment of three committed developments. However, at the time of writing it is understood that these previously considered committed developments have still not been built and are not operational and at the request of the client, a cumulative impact assessment of the development with any committed/consented developments in the Newport Docks area was not undertaken.

Figure 1.1: Location of the Docks Way Site



Source:UK Power Reserve. Drawing: [15023.101] (Docks Way) Location Plan (Rev.3).

Figure 1.2: Site Layout for the Docks Way Power Generation



2 LEGISLATION AND POLICY CONTEXT

2.1 Air Quality Strategy

UK air quality policy is published under the umbrella of the Environment Act 1995, Part IV and specifically Section 80, the National Air Quality Strategy (NAQS). The latest *Air Quality Strategy for England, Scotland, Wales and Northern Ireland – Working Together for Clean Air*, published in July 2007 sets air quality standards and objectives for ten key air pollutants to be achieved between 2003 and 2020.

The EU Air Quality Framework Directive (1996) established a framework under which the EU could set limit or target values for specified pollutants. The directive identified several pollutants for which limit or target values have been, or will be set in subsequent 'daughter directives'. The framework and daughter directives were consolidated by Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe, which retains the existing air quality standards and introduces new objectives for fine particulates ($PM_{2.5}$).

2.1.1 Air Quality Standards (AQSs)

The air quality standards (AQSs) in the United Kingdom are derived from European Commission (EC) directives and are adopted into English law via the Air Quality (England) Regulations 2000 and Air Quality (England) Amendment Regulations 2002. The Air Quality Limit Values Regulations 2003 and subsequent amendments implement the EU Air Quality Framework Directive into English Law. Directive 2008/50/EC was translated into UK law in 2010 via the Air Quality Standards Regulations 2010.

2.1.2 The Environment Act

The set objectives are to be used in the review and assessment of air quality by local authorities under Section 82 of the Environment Act (1995). If exceedances are measured or predicted through the review and assessment process, the local authority must declare an air quality management area (AQMA) under Section 83 of the Act, and produce an air quality action plan (AQAP) to outline how air quality is to be improved to meet the objectives under Section 84 of the Act.

2.1.3 Environmental Permitting Regulations

Many industrial processes have the potential to release pollution to land, air and water, with the potential to pose a health risk to people as well as damaging the environment. To prevent this, many industrial processes are regulated under the Environmental Permitting Regulations (EPR), which either set emissions limit values with which the installation must comply and/or requires best available techniques (BAT) to be used at the installation site.

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

2.2 Guidance

2.2.1 Air emissions risk assessment for your environmental permit (Environment Agency, 2016) ('the Defra and EA guidance')

This guidance, which was adopted in 2016, outlines a procedure which can be used to determine when detailed dispersion modelling is required and the elements which are required as part of detailed dispersion modelling assessment. A subsection of the guidance also outlines features of air quality assessment which should be submitted within the air quality assessment report. This report has been written with reference to this document and has been used in conjunction with the 2018 EA guidance below (however it is understood from online information that the 2018 EA guidance has not yet been finalised).

2.2.2 Emissions from specified generators: guidance on dispersion modelling for oxides of nitrogen assessment from specified generators (Environment Agency, 2018) ('the EA 2018 guidance')

This 'interim final' guidance outlines an approach to undertaking air quality assessments for plants requiring assessment under the EPR following transposition of the MCPD into English law. This assessment has been prepared with reference to the guidance where appropriate, which refers to the processes involved in undertaking an air quality assessment and allows for differences in approach to be adopted based on different screening criteria.

2.2.3 AQTAG06: Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air (Environment Agency, 2014) ('AQTAG.06')

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

2.2.4 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 guidance, referred to in this document as LAQM.TG (16), has been used to identify locations where exposure can be considered 'relevant'. This is important as Directive 2008/50/EC indicates that the AQSs should not be applied at any locations situated within areas where members of the public do not have access and there is no fixed habitation. These definitions provide greater clarity than those specified in the EA 2018 guidance and broadly correlate such that these are considered more robust for use in an air quality assessment. The definitions identified in LAQM TG.16 are summarised in Table 2.1, below.

Table 2.1: Locations where AQSs should and should not be applied, replicated from LAQM TG.16

Averaging period	Locations where AQSs should be applied	Locations where AQSs should not be applied
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24-hour mean and 8-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties*	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and: 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes.	N/A

Notes: Such locations should represent parts of the garden where relevant public exposure to pollutants is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure to pollutants would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.

In all cases, the AQSs should not be applied at locations where health and safety at work provisions exist and where members of the public do not have access.

3 ASSESSMENT SCOPE

3.1 Overall Approach

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

- Baseline characterisation of local air quality;
- Desk study review to confirm the location of nearby existing receptors that may be sensitive to changes in airborne pollutant concentrations as a result of emissions arising from the plant including a review of local mapping data and statutory ecological sites; and,
- Detailed dispersion modelling to predict the impact of emissions to air from the plant on local air quality at nearby sensitive receptors and across a modelled grid over the surrounding area.

3.2 Baseline Characterisation

Existing or baseline air quality refers to the concentrations of relevant substances that are already present in ambient air. These substances are emitted by various sources, including road traffic, industrial, domestic, agricultural and natural sources.

A desk-based study has been undertaken using data obtained from monitoring stations maintained by NCC and from the Local Air Quality Management (LAQM) support website operated by Defra.

3.3 Dispersion Modelling Assessment

Due to the emissions associated with the operation of the plant at the site, a detailed assessment has been undertaken of the emissions to air f and the impact on local air quality at relative sensitive receptors in proximity to the site.

In the view of the unmanned nature of the plant, it is not considered that a significant traffic increase is likely, and this has not been assessed further.

No committed/consented developments have been included in the modelling assessment at the request of the client as the three committed sites considered at the planning application stage are understood to still not have been built and are therefore assumed to not be operational.

3.4 Air Pollutants of Concern

The plant is natural gas fuelled. Natural gas is a clean-burning fuel and emits insignificant quantities of particulate matter, and hence the assessment of impacts has been undertaken in terms of nitrogen oxides (NO_x), nitrogen dioxide (NO_2) and carbon monoxide (CO).

4 BASELINE AIR QUALITY CHARACTERISATION

Existing or baseline air quality refers to the concentrations of relevant substances that are already present in ambient air. These substances are emitted by various sources, including road traffic, industrial, domestic, agricultural and natural sources. Baseline air quality data for the pollutants of concern have been reviewed in the following subsections.

4.1 Presence of Air Quality Management Areas (AQMAs)

NCC have declared 11 AQMAs, all due to exceedances of the annual mean NO_2 concentration objective. The nearest to the site is the George Street AQMA, approximately 1.4km to the north. The development site is therefore not located within an AQMA.

4.2 Baseline Monitoring Data

According to the NCC 2018 Air Quality Annual Status Report, it is understood that NCC undertook diffusion tube monitoring of NO_2 at 80 sites and automatic monitoring at two sites during 2017. The annual mean NO_2 concentrations for 2015-2017 at monitoring sites within ~1km are presented in Table 4.1. No exceedances of the AQS were recorded at any of these sites during the years presented.

Table 4.1: 2015-2017 Annual Average Measured NO_2 Concentrations at the Selected Monitoring Locations within ~1km of the Site

Site ID	Site Name	Site Type	Approximate Distance from the Site (in km)	Annual Mean NO_2 Concentration ($\mu g/m^3$)		
				2015	2016	2017
NCC19C	94 Mendalgief Road	Façade	0.54	-	21.2	21.5
NCC55	116 Alexandra Road	Kerbside	0.60	31.1	29.8	29.4
NCC13B	76 Capel Crescent	Roadside	0.88	-	24.7	23.2
NCC42	Mendalgief Road	Roadside	0.88	27.0	29.7	25.7
NCC59	99 Stow Hill	Roadside	1.09	-	25.8	28.7
Air Quality Standard ($\mu g/m^3$)				**40**		

4.3 LAQM Background Data

In addition to local monitoring data, estimated background air quality data are available from the LAQM Support website operated by Defra. The LAQM Support website provides estimated annual average background concentrations of NO_x, NO_2 and CO on a $1km^2$ grid basis.

The CO concentrations for 2001 were taken from the LAQM Support website. For a conservative estimate, it has been assumed that there has been no reduction in the background concentrations since 2001.

No exceedances of the annual mean NO_2 or NO_x AQSs were identified, and as the estimated annual mean CO concentrations presented are substantially lower than 10,000µg/m^3, exceedances of the 8-hour rolling mean for CO are also unlikely. As background concentrations of NO_2, NO_x and CO are predicted to fall with time, exceedances of these AQSs would not be anticipated in future years.

Table 4.2 presents the annual mean NO_x, NO_2 and CO concentrations from the Defra background maps for the relevant grid square where the development site is located.

Table 4.2: Estimated 2016-2018 Annual Average NO_2, NO_x and CO Concentrations derived from Defra LAQM Background Maps

Grid Square		Year	Annual Average NO_2 (µg/m^3)	Annual Average NO_x (µg/m^3)	Annual Average CO (µg/m^3)*
X	Y				
330500	186500	2016	16.22	22.78	0.3
		2017	15.73	21.97	
		2018	15.11	20.99	

Notes: Presented concentrations for 1 km^2 grid centered on 330500, 186500; approximate centre of development site is 330916,186173.
*For a conservative estimate, concentrations of CO have been taken from the estimated background concentrations for 2001 available on the UK-AIR website and have not been scaled to reflect the baseline year.

5 METHODOLOGY

5.1 Operational Impact Assessment

5.1.1 Modelling Software

The impact assessment of the site was undertaken using BREEZE AERMOD with a Geographical Information System (GIS) capability (Version 9.6.5).

5.1.2 Emission Sources and Operating Profile

STOR plant are not designed to operate continuously throughout the year. Over the last five years, the plant (at individual sites) across UKPR's portfolio have not exceeded 1,500 operating hours per annum. However, to enable the plant to operate flexibly whenever the margin of excess capacity between supply and demand becomes sufficiently small, the assessment of impacts on air quality within this report has assumed the plant to be operating continuously, i.e. 8,760 hours per year. In reality, the gas generators will not run continuously during the year. As such, the modelling undertaken has provided a 'worst case' assessment of emissions generated by the plant and the predicted concentrations are therefore likely to overestimate actual impacts.

Table 5.1 presents the physical and emission characteristics of the generator model, which are based on data sheets or calculations provided by the client. There are four Cummins 2000N5CB generators on site. Each engine has its own vertical individual exhaust stack; the approximate locations of which were determined from the site plan provided (Figure 1.2). The stack height from the ground has been modelled at 9m.

The client has advised that the engines have been retuned to improve efficiency and as such the generators in this report have been modelled as having a maximum emissions rate of 500mgNO_x/Nm^3 at 5% O_2 (186mgNO_x/Nm^3 at 15% O_2). It is understood that all other parameters quoted in the emissions specification (i.e. temperature, volumetric flow rate, etc.) would remain the same as stated in the generator specification. As the effect which retuning the engines can have on CO concentrations is not known at the time of writing, the CO emissions rate has been scaled proportionately to the ratio between the achievable NO_x emissions rate (as stated in the generator specification) and the NO_x emissions rate at which UKPR intend to operate the engines. Consequently, the CO emissions rate is 2,102mg/Nm^3 at 5% O_2 (780mg/Nm^3 at 15% O_2).

Table 5.1: Physical and Emission Characteristics of Engine Sources Included in the Assessment

Description	Engine
Generator model	Cummins 2000N5CB
Operation	Up to 8760 hours per year
Fuel	Natural gas
Stack height above ground level (m)	9 (from ground level)

Stack diameter (m)	0.5 (provided by the client)
Stack exhaust temperature (°C)	457 (provided on specification sheet)
Gas flow (m^3/s)	6.93 (provided on specification sheet)
Oxygen content (%) (when dry)	9
Actual stack exit velocity (m/s)	35.29 (calculated from volumetric flow rate and stack diameter)
NO_x exhaust emissions rate (g/s)	0.97
CO exhaust emissions rate (g/s)	4.078
Stack Locations	330953.6, 186162.0 330956.6, 186158.0 330959.4, 186153.9 330962.2, 186149.9
Number of units	**4**

5.1.3 Buildings

In order to capture the potential influence of buildings/structures on the dispersion profile of combustion emissions (e.g. building 'wake' and downwash effects), buildings surrounding the site and those on the site were considered in the dispersion model. Off-site buildings were assessed in accordance with the EA 2018 guidance, which identified that none met the criteria for inclusion in the model.

The locations and heights of these buildings/structures are listed in Table 5..

Table 5.2: Building Details included in the Air Quality Assessment

ID	Building	Grid Ref, X	Grid Ref, Y	Height, m
Docks Way Site				
B01	Gas Reception Kiosk	330967.9	186175	3.2
B02	DNO Metering Station	330974.1	186164.4	2.35
B03	Store Room	330942.4	186141.8	2.585
B04	Control Room	330935.8	186146.8	4.086
B05	HV/LV Switchroom	330953.1	186142.5	5.0
B06	Oil Storage Tank 1	330939.9	186154.9	1.525
B07	Oil Storage Tank 2	330941.9	186152	1.525
B08	Engine Container 1	330945.3	186158.5	6.0
B09	Engine Container 2	330948.1	186154.4	6.0
B10	Engine Container 3	330950.9	186150.3	6.0
B11	Engine Container 4	330953.8	186146.1	6.0

5.1.4 Meteorological Data

Hourly sequential meteorological data measured between 2016 and 2018 at the Rhoose (Cardiff) weather station, approximately 30km from the site, has been employed in the assessment.

The maximum of the predicted pollutant concentrations from the three years of meteorological data have been reported.

Figures A3-A5 in Appendix A show the wind rose for the 2016, 2017 and 2018 datasets measured at the Rhoose station.

5.1.5 Terrain

Ordnance Survey Panoramic digital terrain data were included in the assessment to account for topographical features of the land covering the model domain.

5.1.6 Background Air Quality Data Used in the Modelling

Human receptors H23, H24 and H25 are located within 20m of the B4237 (Cardiff Road), so the diffusion tube NCC12A on George Street, further east of the B4237 (façade) has been chosen as representative of background NO_2 concentrations for these receptors. H01, H08 and H11 are located adjacent to Mendalgief Road/Docks Way (within 20m) and therefore the diffusion tube NCC19C on Mendalgief Road (façade) has been chosen for background concentrations for these receptors. The Defra estimated annual average background concentrations for the year 2017 have been used to represent NO_2 concentrations for the remaining human receptors (which are >20m from any main roads), and for NO_x background concentrations for all the ecological receptors. Annual mean CO concentrations have been taken from the 2001 LAQM Support/ UK-AIR background maps. For a conservative estimate, the 2001 CO concentrations have not been scaled to the year 2017.

The background concentrations used for the assessment are summarised in Table 5. and 5.4 below.

Table 5.3: Background Pollutant Concentrations for NO_2 and CO used in the Dispersion Modelling Assessment – Human Receptors

Receptor ID	Grid Square		Annual Average NO_2 (µg/m^3)	NO_2 Data Source	Annual Average CO (µg/m^3)
	X	Y			
H15	329500	185500	17.16	Defra	0.31
H24	329500	186500	37.80	Diffusion Tube NCC12A	0.34
H21, H22	330500	183500	10.75	Defra	0.26
H14, H20	330500	184500	13.14	Defra	0.28
H09, H16	330500	185500	15.89	Defra	0.31
H01	330500	186500	21.50	Diffusion Tube NCC19C	0.33
H02, H03, H04, H12, H13	330500	186500	15.73	Defra	0.33
H23	330500	186500	37.80	Diffusion Tube NCC12A	0.33
H05	331500	185500	12.95	Defra	0.29
H06, H07, H10, H17, H18	331500	186500	16.84	Defra	0.33
H08, H11	331500	186500	21.50	Diffusion Tube NCC19C	0.33

Receptor ID	Grid Square		Annual Average NO_2 ($\mu g/m^3$)	NO_2 Data Source	Annual Average CO ($\mu g/m^3$)
	X	Y			
H25	331500	187500	37.80	Diffusion Tube NCC12A	0.35
H19	332500	186500	16.24	Defra	0.32

Table 5.4: Background Pollutant Concentrations for NO_x used in the Dispersion Modelling Assessment – Ecological Receptors

Receptor ID	Grid Coordinates		Annual Average NO_x ($\mu g/m^3$)
	X	Y	
E01	330690	184747	17.99
E02	332053	183761	13.17
E03	331214	184073	16.48
E04	331766	183957	14.48
E06	331100	184129	16.48
E08	330411	185166	22.27
E09	331926	185653	17.73
E10	330869	184667	17.99
E11	331672	186230	17.99
E12	331965	187451	16.48
E13	331609	187853	14.48
E14	332337	187057	16.48

Background nitrogen and acid deposition rates obtained from APIS for ecological receptors, used in this assessment, are presented in Table 5.5 and 5.6.

Table 5.5: Background Nitrogen Deposition Rates use in the Assessment

Receptor ID	Ecological Site	Existing Background Deposition Rate (kgN/ha/yr)
E01	Gwent Levels - St. Brides	12.74
E02	Severn Estuary	12.74
E03	Severn Estuary	12.74
E04	River Usk	12.74
E06	Gwent Levels - St Brides	12.74
E08	Gwent Levels - St Brides	17.64
E09	River Usk	17.64
E10	Gwent Levels	12.74
E11	River Usk	17.64
E12	River Usk	17.64
E13	River Usk	17.64
E14	River Usk	17.64

Table 5.6: Background Acid Deposition Rates use in the Assessment

Receptor ID	Ecological Site	Existing Background Acid Deposition Rate (keq/ha/yr)	
		N	S
E08	Gwent Levels - St Brides	1.26	0.32

5.1.7 Receptor Locations and Model Domain

Pollutant concentrations were predicted at a number of receptors around the site, as shown in Figures A1 and A2 in Appendix A. Each discrete human receptor was assumed to be 1.5m above ground level (i.e. close to 'breathing height'), whilst ecological receptors were assumed to be 0m above ground level.

For the purposes of producing isopleths of ground level concentration contours, hypothetical grid receptors spaced at 50m covering approximately 4km x 4km and 250m spacing covering approximately 20km x 20km, approximately centred over the site location have been included.

Details of all specific receptors included in the modelling study (and hence the air quality impacts assessed) are summarised in Table 5.7.

Table 5.7: Receptors Included in the Dispersion Modelling Assessment

Receptor ID	Receptor Location	Grid reference	
		X	Y
Human Receptors			
H01	*Car Showroom Docks Way*	*330887.3*	*186243.8*
H02	*Retail Park Docks Way/West Way Road*	*330867.3*	*186100.1*
H03	Residential Property Bideford Road	330236	186179
H04	*Commercial Greenwich Road*	*330559*	*186152*
H05	*Commercial West Way Road*	*331069*	*185933*
H06	*Retail Park Docks Way/Usk Way*	*331082.6*	*186279.2*
H07	Residential Property - Mendalgief Road	331394	186194
H08	Residential Property - junction of Lime Close and Mendalgief Road	331122.2	186626.8
H09	Residential Property - Maesglas Crescent	330261	185861
H10	Residential Property - Church Street	331729	186746
H11	Residential Property - junction of Mendalgief Road and Docks Way	331211	186409
H12	Residential Development - Twenty Acre Reen	330673	186485
H13	Residential Development - Twenty Acre Reen	330666	186722
H14	Duffryn High School	330037	184853
H15	Residential Property - Edney Way	329973	185261
H16	Residential Property - Maesglas Crescent	330113	185752
H17	Residential Property - Wolseley St	331425	186235
H18	Residential Property - St Michael St	331843	186770

Receptor ID	Receptor Location	Grid reference	
		X	Y
H19	Residential Property - Stephenson Street	332046	186113
H20	Duffryn School	330004	184981
H21	Residential Property - New Dairy Farm	330635	183906
H22	Residential Property - Lighthouse Road	330048	183533
H23	Residential Property - Cardiff Road	330275	186830
H24	Residential Property - Cardiff Road/Park Drive	329742	186197
H25	Residential Property - Cardiff Road	331127	187239
Ecological Receptors (24-hour NO_x and Annual NO_x AQS apply)			
E01	Gwent Levels - St. Brides	330690	184747
E02	Severn Estuary	332053	183761
E03	Severn Estuary	331214	184073
E04	River Usk	331766	183957
E06	Gwent Levels - St Brides	331100	184129
E08	Gwent Levels - St Brides	330411	185166
E09	River Usk	331926	185653
E10	Gwent Levels	330869	184667
E11	River Usk	331672	186230
E12	River Usk	331965	187451
E13	River Usk	331609	187853
E14	River Usk	332337	187057
Italicised text indicates receptor is not at a location of relevant exposure for the annual mean NO_2 or 8-hour CO AQSs, and therefore only the 1-hour NO_2 AQS is applicable at these locations.			

As per advice the client has received from the EA, impacts of air quality at discrete ecological receptor locations have been considered within Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites within 5km of the site, and at Sites of Special Scientific Interest (SSSIs) within 2km of the site.

RSK referred to the Multi-Agency Geographic Information for the Countryside (MAGIC) website to determine the presence of these sites within the identified distances from the development site. Identified within 5km were the River Usk (SAC) and the Severn Estuary (SPA, SAC, Ramsar) and within 2km were three SSSI's; the lower River Usk, the Gwent Levels – St. Brides, and the Severn Estuary.

5.1.8 Processing of Results

NO_x 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 human 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 O_3. The dispersion modelling exercise predicts concentrations of NO_x which subsequently require conversion to NO_2 for comparison with the objectives for human health. The long- and short-term predicted NO_x concentrations 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 referenced by the Environment Agency[1]. For comparison with the NO_x objectives for ecological health, the results do not need to be converted as above.

The total pollutant concentrations (Predicted Environmental Concentrations (PECs)) are calculated from the Process Contribution (PC) as follows:

- Annual mean pollutant standards: PEC = PC + Background Concentration
- Other (short term) standards: $PEC_{short\ term} = PC_{short\ term} + (2 \times Background_{long\ term})$.

The results of the dispersion modelling assessment are discussed in Section 6.

Isopleths, or pollution concentration contours, for annual average and hourly NO_2 and annual average and 24-hourly NO_x, are presented in Appendix B.

5.1.9 Nitrogen and Acid Deposition Calculations

Total annual mean NO_x concentrations, and acid and nitrogen deposition rates, were calculated at the identified discrete ecological receptor locations (E01-E14). The contribution of NO_2 emitted by the existing and proposed plant to nitrogen and acid deposition on sensitive ecological receptors has been determined by following the methodology set out in AQTAG06 (EA, 2014).

The broad habitat types identifiable at each ecological site were determined based on publicly available online data. Where more than one habitat type was identified within each ecological site, it has been assumed that the habitat most sensitive to the development is represented at the modelled discrete receptor location, for a conservative assessment. Receptor E08 was identified as neutral grassland, and the remaining ecological receptors were identified as coastal saltmarsh.

The critical nitrogen deposition loading capacities, the acid deposition loading capacities, and background nitrogen and acid deposition rates, were obtained from the Air Pollution Information System (APIS) website.

The total NO_x concentrations have been compared to the annual mean Air Quality Strategy objective. The nitrogen deposition process contributions (PCs) were compared to the applicable minimum deposition critical loads. The acid deposition process contributions (PCs) were compared to the critical load functions, using the 'Critical Load Function tool' on the APIS website.

5.2 Assessment Objectives and Limits

The relevant[2] objectives for England and Wales to protect human health and vegetation and ecosystems from the Air Quality Strategy are summarised below in Table 5.8. The

[1] Environment Agency, (n.d.). CONVERSION RATIOS FOR NOX AND NO_2.

[2] Relevance, in this case, is defined by the scope of the assessment.

24-hour mean NO_x Environmental Assessment Level (EAL) from the 2016 Defra and EA guidance has also been included, however it should be noted that this is referred to a 'target for protected conservation areas' within this guidance.

Table 5.8: Relevant Air Quality Objectives

Substance	Averaging period	AQS / EAL (µg/m^3)
For the Protection of Human Health		
Nitrogen dioxide (NO_2)	Annual Mean	40
	99.79th Percentile of Hourly Means	200 (18 exceedances allowed per year)
Carbon monoxide (CO)	Maximum daily 8-hour mean	10,000
For the Protection of Vegetation and Ecosystems		
Nitrogen oxides (NO_x)	Annual Mean	30
	24-hour Mean	75

5.2.1 Nitrogen Deposition

The relevant critical loads for nitrogen deposition, taken from APIS, at the identified ecological receptors are presented in Table 5.9.

Table 5.9: Critical Loads for Nitrogen Deposition

Receptor ID	Habitat	Critical Load (kgN/ha/yr)*
E01, E02, E03, E04, E05, E06, E07, E09, E10, E11, E12, E13, E14	Coastal Saltmarsh	20-30
E08	Neutral Grassland	20-30
*Lower critical load used in assessment for conservative assessment		

5.2.2 Acidification

The acidification critical loads for E08 are presented in Table 5.10. For the remaining 13 discrete ecological receptors, the APIS website advises 'there is no comparable acid critical load class for which the CL function is calculated'.

Table 5.10: Critical Loads for Acidification

Receptor ID	Ecological Site	CLMinN (keqN/ha/yr)	CLMaxN (keqN/ha/yr)	CLMaxS (keqS/ha/yr)
E08	Gwent Levels – St Brides	1.071	5.071	4.00

5.3 Significance Criteria

The significance of the PC arising from the plant has been determined using the criteria outlined in the Defra & EA (2016) guidance. These are intended for use in interpreting the results of an air quality screening assessment to determine whether further detailed

modelling is required, but they provide a useful guide to the significance of an impact in the absence of any agreed criteria relating to the assessment of impacts from dispersion modelling.

However, the PCs have also been viewed in context of the 'headspace' between predicted pollutant concentrations and the applicable AQS, whether they represent 'relevant exposure' and of the number of exceedances of any screening criteria which are exceeded.

Based on the Defra and EA 2016 screening criteria, the PC from the plant can be considered to be insignificant if the following primary criteria are met:

- The short-term PC is less than 10% of the short-term AQS / environmental assessment level (EAL); and
- The long-term PC is less than 1% of the long-term AQS / EAL.

If these criteria are met then the impact can be considered to be insignificant, if the criteria aren't met, then the secondary stage criteria can be used, which are:

- The short-term PC is less than 20% of the short-term AQS / EAL minus twice the long-term background concentration; and
- The long-term PEC is less than 70% of the long-term AQS / EAL.

If both the second stage criteria are met, then the impact can be considered to be insignificant. However, if the criteria are not met, this does not necessarily mean an impact is significant and consideration has been given as to whether the PEC exceeds the relevant standards and consideration of the conservative nature of this assessment.

5.4 Uncertainties and Assumptions

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

- Estimated background data from NCC and the Defra LAQM website was used in the assessment. It is assumed that these background concentrations are likely to be applicable for the lifetime of the development, which is considered to be a conservative assumption;
- 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 the Rhoose weather station for 2016 to 2018 were representative of wind conditions at and around the site. Furthermore, it has been assumed that the subsequent dispersion of emitted pollutants will conform to a Gaussian distribution in order to simplify the real-world dilution and dispersion conditions; and,
- For assessing both long- and short-term impacts, these emission sources were assumed to be operating continuously throughout the year to capture the worst-case meteorological conditions that result in the maximum impact at the assessed receptor locations. In reality, given the nature of STOR plant they are likely to operate

for significantly less hours per year and the results presented are therefore considered to be conservative; and,

- There is an element of uncertainty in all measured and modelled data. All values presented in this report are considered reasonable estimates.

6 RESULTS

6.1 Operational Phase

The main potential impact of the development is considered to be the effect on local air quality at existing sensitive receptors in the area immediately surrounding the site.

The contour plots, for annual and hourly mean NO_2 and annual and 24-hourly mean NO_x are presented in Appendix B, for the meteorological year in which the maximum PCs were predicted at the gridded receptor locations.

6.1.1 Human Receptors

The maximum concentrations predicted in the three modelled meteorological years at each discrete human receptor locations are presented in Table 6.1, for annual and hourly mean NO_2 concentrations and 8-hour mean CO concentrations. Both the PC and PEC are presented along with the percentage of the relevant AQS that the PC or PEC represents. The short-term PC (hourly mean NO_2) has also been presented as a percentage of the short-term AQS minus twice the long-term background concentration, in accordance with Defra & EA 2016 guidance.

Table 6.1: Predicted Pollution Concentrations at Discrete Human Receptors Considered, Highest Results presented between 2016-2018 for each Receptor.

Pollutant & Averaging Period	AQS (µg/m^3)	Location	PC (µg/m^3)	PC as % of Objective	PC as % of Objective minus twice long-term background concentrations	PEC (µg/m^3)	PEC as % of Objective
Annual Mean NO_2	**40**	*H01*	*3.30*	*8.25*		*24.80*	*62.00*
		H02	*6.58*	*16.46*		*22.32*	*55.79*
		H03	0.87	2.18		16.60	41.51
		H04	*2.02*	*5.04*		*17.75*	*44.37*
		H05	*1.19*	*2.98*		*14.14*	*35.35*
		H06	*5.51*	*13.77*		*22.35*	*55.88*
		H07	4.19	10.49		21.04	52.60
		H08	1.16	2.90		22.66	56.65
		H09	1.57	3.91		17.46	43.65
		H10	0.54	1.34		17.38	43.45
		H11	2.25	5.62		23.75	59.37
		H12	1.37	3.43		17.10	42.76
		H13	0.67	1.68		16.40	41.01
		H14	0.25	0.62		13.39	33.47
		H15	0.51	1.28		17.67	44.18
		H16	1.20	3.01		17.10	42.74
		H17	3.39	8.47		20.23	50.58
		H18	0.47	1.19		17.32	43.29
		H19	1.04	2.61		17.29	43.21
		H20	0.30	0.75		13.44	33.59

Pollutant & Averaging Period	AQS (µg/m^3)	Location	PC (µg/m^3)	PC as % of Objective	PC as % of Objective minus twice long-term background concentrations	PEC (µg/m^3)	PEC as % of Objective
		H21	0.14	0.35		10.89	27.23
		H22	0.13	0.33		10.88	27.21
		H23	0.52	1.31		38.32	95.81
		H24	0.44	1.10		38.24	95.60
		H25	0.36	0.91		38.16	95.41
99.79th Percentile of 1-Hour NO_2 Means	**200**	H01	47.52	23.76	30.27	90.52	45.26
		H02	78.98	39.49	46.87	110.45	55.22
		H03	12.56	6.28	7.45	44.03	22.01
		H04	25.25	12.63	14.98	56.72	28.36
		H05	23.22	11.61	13.34	49.13	24.56
		H06	48.32	24.16	29.06	82.01	41.01
		H07	17.70	8.85	10.64	51.39	25.69
		H08	14.80	7.40	9.43	57.80	28.90
		H09	13.33	6.66	7.92	45.12	22.56
		H10	6.50	3.25	3.91	40.19	20.10
		H11	22.34	11.17	14.23	65.34	32.67
		H12	23.49	11.74	13.94	54.95	27.48
		H13	13.77	6.89	8.17	45.24	22.62
		H14	5.24	2.62	3.02	31.52	15.76
		H15	6.43	3.22	3.88	40.75	20.37
		H16	10.21	5.10	6.07	42.00	21.00
		H17	16.12	8.06	9.69	49.81	24.90

Pollutant & Averaging Period	AQS (µg/m^3)	Location	PC (µg/m^3)	PC as % of Objective	PC as % of Objective minus twice long-term background concentrations	PEC (µg/m^3)	PEC as % of Objective
		H18	5.76	2.88	3.47	39.45	19.72
		H19	6.42	3.21	3.83	38.91	19.45
		H20	5.59	2.80	3.22	31.87	15.93
		H21	4.33	2.17	2.43	25.83	12.92
		H22	3.85	1.92	2.16	25.35	12.67
		H23	9.50	4.75	7.63	85.10	42.55
		H24	7.07	3.54	5.68	82.67	41.34
		H25	6.21	3.10	4.99	81.81	40.90
8-hour running mean CO (across 24-hour period)	**10,000**	*H01*	*490.19*	*4.90*	*5.25*	*1158.19*	*11.58*
		H02	*886.38*	*8.86*	*9.50*	*1554.38*	*15.54*
		H03	127.62	1.28	1.37	795.62	7.96
		H04	*259.07*	*2.59*	*2.78*	*927.07*	*9.27*
		H05	*268.07*	*2.68*	*2.85*	*852.07*	*8.52*
		H06	*469.35*	*4.69*	*5.02*	*1119.35*	*11.19*
		H07	156.30	1.56	1.67	806.30	8.06
		H08	135.74	1.36	1.45	785.74	7.86
		H09	134.34	1.34	1.43	744.34	7.44
		H10	62.63	0.63	0.67	712.63	7.13
		H11	194.49	1.94	2.08	844.49	8.44
		H12	214.81	2.15	2.30	882.81	8.83
		H13	99.17	0.99	1.06	767.17	7.67
		H14	49.70	0.50	0.53	607.70	6.08

Pollutant & Averaging Period	AQS (µg/m^3)	Location	PC (µg/m^3)	PC as % of Objective	PC as % of Objective minus twice long-term background concentrations	PEC (µg/m^3)	PEC as % of Objective
		H15	59.81	0.60	0.64	685.81	6.86
		H16	104.99	1.05	1.12	714.99	7.15
		H17	141.45	1.41	1.51	791.45	7.91
		H18	50.34	0.50	0.54	700.34	7.00
		H19	45.09	0.45	0.48	685.09	6.85
		H20	64.84	0.65	0.69	622.84	6.23
		H21	32.49	0.32	0.34	560.49	5.60
		H22	27.41	0.27	0.29	555.41	5.55
		H23	71.89	0.72	0.77	739.89	7.40
		H24	66.22	0.66	0.71	748.22	7.48
		H25	51.08	0.51	0.55	759.08	7.59
Italicised text indicates results not at location of relevant exposure and therefore objective not applicable at this location. Percentage calculations based on unrounded numbers.							

Table 6.2 below shows the maximum concentrations predicted at discrete relevant human receptor locations, as well as the maximum concentration predicted within the modelled grid. Both the maximum PC and maximum PEC are presented along with the percentage of the relevant AQS that the PC or PEC represents.

Table 6.2: Maximum Predicted Pollutant Concentrations – Human

Pollutant & Averaging Period	AQS / EAL ($\mu g/m^3$)	Location	PC ($\mu g/m^3$)	PC as % of Objective	PEC ($\mu g/m^3$)	PEC as % of Objective
Maximum Predicted Concentration at Specific Receptors						
Annual Mean NO_2	**40**	H07 (max PC)	4.19	10.49	21.04	52.60
		H23 (Max PEC)	0.52	1.31	38.32	95.81
99.79th Percentile of 1-Hour NO_2 Means	**200**	H02	78.98	39.49	110.45	55.22
8-hour running mean CO (across 24-hour period)	**10,000**	H12	214.81	2.15	882.81	8.83
Location of Maximum Predicted Concentration						
Annual Mean NO_2	**40**	*331063.7 186149.1*	*186149. 25.58 1*	*63.96*	*39.27*	*98.16*
99.79th Percentile of 1-Hour NO_2 Means	**200**	*331013.7 186149.1*	*102.13*	*51.07*	*129.49*	*64.75*
8-hour running mean CO (across 24-hour period)	**10,000**	*331013.7 186149.1*	*1168.70*	*11.69*	*1740.94*	*17.41*

Italicised text indicates results not at location of relevant exposure and therefore objective not applicable at this location.

Percentage calculations based on unrounded numbers.

Nitrogen Dioxide

As shown in Table 6.1, PECs of annual and 1-hour mean NO_2 at all discrete human receptors and grid locations are below the relevant AQSs, with the worst-case meteorological data. Therefore, the operation of the plant at the site is not predicted to result in any exceedances of the annual or hourly mean NO_2 AQS at the relevant modelled discrete receptor or grid locations.

At relevant discrete receptor locations, several predicted PCs of annual mean NO_2 concentration are greater than 1% of the objective. Predicted PECs are below 70% of the annual mean NO_2 AQS at the majority of receptors, but higher than 95% at H23, H24 and H25.

Predicted PCs of 1-hour mean NO_2 concentration are below 20% of the 1-hour mean NO_2 AQS minus twice the long-term NO_2 background concentration at the majority of discrete receptors, meeting the Defra & EA (2016) secondary screening criteria, although receptors H01, H02 and H06 exceed this screening criteria. However, it should be noted that these receptor locations are commercial buildings, where members of the public would be unlikely to spend one hour or longer on a regular basis, i.e. they are unlikely to be present 18 times a year for 1 hour or more and the AQS is unlikely to apply here but have been included for a conservative assessment.

In addition, a worst-case scenario has been applied when assessing impacts; the emission sources have been assumed to be operating continuously during the year, which is not anticipated to be the case in reality. As such, the modelling undertaken has provided a 'worst case' assessment of emissions generated by the gas generator plant and the predicted concentrations are therefore likely to overestimate actual impacts at the small number of modelled discrete receptor locations where the screening criteria were exceeded.

Carbon Monoxide

Table 6.1 shows the 8-hour mean CO concentrations resulting from the operation of the development, at all of the assessed discrete human receptor locations considered. The highest predicted 8-hour CO PEC at a relevant discrete receptor location was predicted to be 882.81µg/m^3 at H12 with 2018 meteorological data. The highest predicted 8-hour CO PEC across the grid was predicted to be 1740.94µg/m^3 at 331013.7, 186149.1 with 2017 meteorological data.

The development is not predicted to result in any exceedances of the 8-hour rolling mean CO AQS at any of the modelled discrete receptor locations or grid locations. In addition, all PCs are less than 10% of the 8-hour mean CO AQS, in accordance with the primary screening criteria from the Defra & EA (2016) guidance.

6.1.2 Ecological Receptors

The maximum concentrations predicted across the three modelled meteorological years at each discrete ecological receptor location are also presented in Table 6.3 below, for annual and 24-hourly mean NO_x concentrations.

Table 6.3: Predicted Pollution Concentrations at Discrete Ecological Receptors Considered, Highest Results presented between 2016-2018 for each Receptor.

Pollutant & Averaging Period	AQS / EAL (µg/m^3)	Location	PC (µg/m^3)	PC as % of Objective	PC as % of Objective minus twice long-term background concentrations	PEC (µg/m^3)	PEC as % of Objective
Annual Mean NO_X	**30**	E01	0.27	0.91		18.26	60.86
		E02	0.20	0.65		13.37	44.56
		E03	0.21	0.68		16.69	55.62
		E04	0.19	0.64		14.67	48.90
		E06	0.21	0.69		16.69	55.63
		E08	0.43	1.42		22.69	75.64
		E09	1.80	5.99		19.53	65.11
		E10	0.24	0.81		18.23	60.77
		E11	2.59	8.64		26.28	87.59
		E12	0.29	0.97		26.57	88.57
		E13	0.23	0.77		26.51	88.37
		E14	0.36	1.18		25.30	84.33
24-Hour Mean NO_X	**75**	E01	6.79	9.05	17.39	42.76	57.01
		E02	2.74	3.65	5.63	29.08	38.78
		E03	3.21	4.28	7.64	36.17	48.23
		E04	3.27	4.36	7.09	32.22	42.96
		E06	3.39	4.52	8.06	36.35	48.47
		E08	8.96	11.95	29.42	53.50	71.33
		E09	12.85	17.13	32.50	48.32	64.42

Pollutant & Averaging Period	AQS / EAL (µg/m^3)	Location	PC (µg/m^3)	PC as % of Objective	PC as % of Objective minus twice long-term background concentrations	PEC (µg/m^3)	PEC as % of Objective
		E10	6.48	8.64	16.60	42.45	56.60
		E11	13.31	17.75	48.19	60.69	80.91
		E12	3.08	4.11	13.73	55.64	74.19
		E13	2.28	3.03	10.14	54.84	73.11
		E14	3.10	4.13	12.33	52.98	70.65
Percentage calculations based on unrounded numbers.							

Table 6.4 below shows the maximum concentrations predicted at discrete relevant ecological receptor locations, as well as the maximum concentration predicted within the modelled grid.

Table 6.4: Maximum Predicted Pollutant Concentrations – Ecological

Pollutant & Averaging Period	AQS / EAL (µg/m^3)	Location	PC (µg/m^3)	PC as % of Objective	PEC (µg/m^3)	PEC as % of Objective
Maximum Predicted Concentration at Specific Receptors						
Annual Mean NO_x	**30**	E11 River Usk (max PC)	2.59	8.64	26.28	87.59
		E12 River Usk (max PEC)	0.29	0.97	26.57	88.57
24-Hour Mean NO_x	**75**	E11 River Usk	13.31	17.75	60.69	80.91
Location of Maximum Predicted Concentration						
Annual Mean NOx	**30**	*331063.7 186149.1*	*36.55*	*121.83*	*55.43*	*184.77*
24-Hour Mean NOx	**75**	*331013.7 186149.1*	*231.97*	*309.29*	*269.74*	*359.65*
Italicised text indicates results not at location of relevant exposure and therefore objective not applicable at this location. Percentage calculations based on unrounded numbers.						

Nitrogen Oxides

As shown in Table 6.4, PECs of both annual and 24-hour mean NO_x PECs at any of the discrete ecological receptor locations are not predicted to result in any exceedances of the AQS or EAL. Some locations within the grid do predict exceedance of the annual and 24-hour NO_x AQS or EAL, but these are not locations of relevant ecological receptors.

At discrete receptor locations, predicted PECs of annual mean NO_x concentration are below 70% of the NO_x AQS, apart from E08, E11, E12, E13 and E14, however the PECs remain below the AQS. Some grid locations also predict PECs >70% of the AQS, but these are not locations of relevant ecological receptors.

Predicted PCs of 24-hour mean NO_x concentration are mostly below 20% of the 24-hour mean NO_x EAL minus twice the long-term NO_x background concentration, meeting the Defra & EA (2016) secondary screening criteria, although receptors E08, E09 and E11 exceed this screening criteria. However, the PECs at these locations remain below the EAL.

Although some of the screening criteria are exceeded, it must be noted that a worst-case scenario has been applied when assessing impacts. The emission sources have been assumed to be operating continuously during the year, which is not anticipated to be the case in reality. As such, the modelling undertaken has provided a 'worst case' assessment of emissions generated by the gas generator plant and the predicted concentrations are therefore likely to overestimate actual impacts at the modelled discrete receptor and grid locations where the screening criteria were exceeded. Furthermore, the PECs remain below the AQS and EAL at all relevant discrete receptor locations.

6.1.2.1 Nitrogen Deposition

Results obtained from the dispersion modelling have been used to calculate nitrogen deposition, based on the maximum concentration for any of the modelled discrete ecological receptor locations at the designated ecologically sensitive sites considered within the assessment; results are summarised in Table 6.5.

The highest PC as a percentage of the critical load is 1.31% predicted at E11 – River Usk SSSI, indicating that that PC would have minimal impact on nitrogen deposition at any of the ecosystems assessed. Furthermore, the total predicted nitrogen deposition (i.e. PECs) are all below the lower critical loads for the relevant habitats.

Table 6.5: Nitrogen Deposition Results for Discrete Ecological Receptors

Receptor Locations	Lower Critical Load (kg N/ha/year)	N Deposition PC (kg N/ha/year)	Background N Deposition (kg N/ha/year)	Total N Depositon (PEC) (kg N/ha/year)	PC as % of critical Level (%)	PEC as % of critical Level (%)
E01	20	0.028	12.74	12.77	0.14%	63.84%
E02	20	0.020	12.74	12.76	0.10%	63.80%
E03	20	0.021	12.74	12.76	0.10%	63.80%
E04	20	0.019	12.74	12.76	0.10%	63.80%
E06	20	0.021	12.74	12.76	0.10%	63.80%
E08	20	0.043	17.64	17.68	0.21%	88.41%
E09	20	0.181	17.64	17.82	0.91%	89.11%
E10	20	0.025	12.74	12.76	0.12%	63.82%
E11	20	0.261	17.64	17.90	1.31%	89.51%
E12	20	0.029	17.64	17.67	0.15%	88.35%
E13	20	0.023	17.64	17.66	0.12%	88.32%
E14	20	0.036	17.64	17.68	0.18%	88.38%

6.1.2.2 Acid Deposition

The results obtained from the dispersion modelling for acid deposition have been input into the Critical Load Function Tool provided on the APIS website along with the critical load data for the habitat. For E08 (Gwent Levels St Brides SSSI), the PC as a percentage of the critical load function was 0.06%, and the PEC was 30.63%. This indicates that the

PC would have a minimal impact on acid deposition at this ecosystem. For the remaining 11 discrete ecological receptors, the impact of the plant emissions on acid deposition could not be determined as the APIS website advises 'there is no comparable acid critical load class for which the CL function is calculated'. However, the acid deposition PCs are all below 0.02 keq/ha/year, so it is unlikely that there would be any significant effects on acid deposition at the surrounding ecosystems.

6.1.3 Overall Significance of Operating Plant on Air Quality

As identified above:

- Some of the screening criteria from the Defra and EA guidance are exceeded, however the guidance notes these are for the use in determining whether detailed dispersion modelling is required and that consideration should be given to whether the total PECs exceed relevant environmental standard;
- There are no predicted exceedances of the PECS for the annual mean NO_2, 1-hour mean NO_2, 8-hour mean CO, annual mean NO_x or 24-hour mean NO_x AQSs or EALs at any of the relevant discrete off-site modelled human and ecological receptor locations;
- It must be noted that despite annual and 1-hour mean NO_2, annual and 24-hour mean NO_x having some exceedance of screening criteria at some locations, a conservative approach assuming year-round operation was used to assess impacts. In reality, the impact at these receptors is likely to be lower than estimated.
- No significant impact on nitrogen or acid deposition on ecosystems in the surrounding area is expected.

In light of the above, and because there are no predicted exceedances of the NO_2, CO and NO_x AQSs or EAL, the air quality impact from the operation of the site is not considered to be significant such that mitigation measures have not been recommended.

7 SUMMARY AND CONCLUSIONS

An assessment of air quality impacts of the operation of power generation plant at a site adjacent to Docks Way, Newport has been undertaken with reference to existing air quality in the area and relevant air quality legislation, policy and guidance.

The potential impact of the gas-fired plant on local air quality has been assessed using AERMOD, an advanced dispersion model developed for regulatory purposes, and used meteorological data measured between 2016 and 2018 at the Rhoose (Cardiff) weather station. Buildings/structures to account for downwash effects have been included in the air dispersion model. Concentrations of the key air pollutants (NO_2, NO_x, and CO) have been predicted at existing sensitive human receptors (such as residences) and ecological receptors and hypothetical gridded receptors at a regular spacing of 50m covering the modelled domain of size 4km x 4km and 250m covering 20km x 20km approximately centred over the electricity generating plant. Background concentrations were used in combination with the predicted PC from the operation of the plant in order to determine the total PEC for each pollutant and relevant averaging period. It is understood that the plant is operated in accordance with the emissions parameters specified in Section 5.1.2 of this report.

The results have been compared to screening criteria from the Defra and EA guidance, which some exceedances of this criteria predicted; however the guidance notes this criteria should be used to determine whether detailed dispersion modelling is required (which has already been undertaken within this report) and goes on to recommend the PEC results are compared to relevant environmental standards.

The highest predicted impacts at any of the modelled off-site discrete receptor locations representative of relevant exposure in any of the three modelled meteorological years have been reported and compared to the relevant AQSs or EAL (i.e. annual and hourly mean NO_2 concentrations, annual and 24-hourly mean NO_x concentrations and 8-hourly mean CO concentrations). There were no predicted exceedances of any of these AQSs or EALs at any of the relevant modelled discrete receptor locations in any of the modelled meteorological years. No significant impact on nitrogen or acid deposition on ecosystems in the surrounding area is expected.

It is noted that a worst-case scenario has been applied when assessing impacts by assuming that the emission sources are operating continuously during the year, which is given the nature of the STOR plant is not anticipated to be the case in reality. As such, the modelling undertaken has provided a ‘worst case’ assessment of emissions generated by the gas generator plant and the predicted concentrations are therefore likely to overestimate actual impacts at the modelled discrete receptor where the screening criteria were exceeded.

As this assessment has predicted no exceedances of the relevant AQSs or EALs, the operational phase impacts on local air quality are determined to be not significant.

Additional mitigation measures have not been recommended and the residual impacts are considered likely to be acceptable.

8 REFERENCES

Air Quality (England) Regulations 2000, 928. London, Her Majesty's Stationery Office.

Air Quality (England) (Amendment) Regulations 2002, 3043. London, Her Majesty's Stationery Office.

Council Directive (EC) 2008/50 of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe entered into force on 11 June 2008. Official Journal of the European Union, L152/1.

Department of Environment, Food and Rural Affairs, 2007. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1). London, Her Majesty's Stationary Office.

Department of Environment, Food and Rural Affairs, 2007. The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 2). London, Her Majesty's Stationary Office.

Department of Environment, Food and Rural Affairs, 2016. Part IV of the Environment Act 1995: Local Air Quality Management: Technical Guidance LAQM.TG(16).

Department of Environment, Food and Rural Affairs, 2016. MAGIC Map [online] Available at: http://magic.defra.gov.uk. [Accessed March/April 2019].

Environment Act 1995. London, Her Majesty's Stationery Office.

Environment Agency, 2014. AQTAG06: Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air (Environment Agency, 2014) ('AQTAG.06').

Environment Agency, 2018. Emissions from specified generators: guidance on dispersion modelling for oxides of nitrogen assessment from specified generators [Interim Guidance].

Environment Agency and Defra, 2016. Air Emissions Risk Assessment for your Environmental Permit [online]. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit. [Accessed March/April 2019].

Her Majesty's Stationery Office, 2010. Environmental Protection: The Air Quality Standards Regulations 2010, [online] Available at: http://www.legislation.gov.uk/uksi/2010/1001/pdfs/uksi_20101001_en.pdf.

Newport City Council, 2018. Newport City Council 2018 Air Quality Progress Report, September 2018.

APPENDIX A
FIGURES

This appendix contains the following figures for use with this report:

Figures A1 and A2	Receptors and Point Sources included in the Dispersion Modelling Assessment
Figures A3-A5	Windroses for the Rhoose (Cardiff) Weather Station - 2016 to 2018

Figure A1: Receptors and Point Sources North of the Site Included in the Dispersion Modelling Assessment

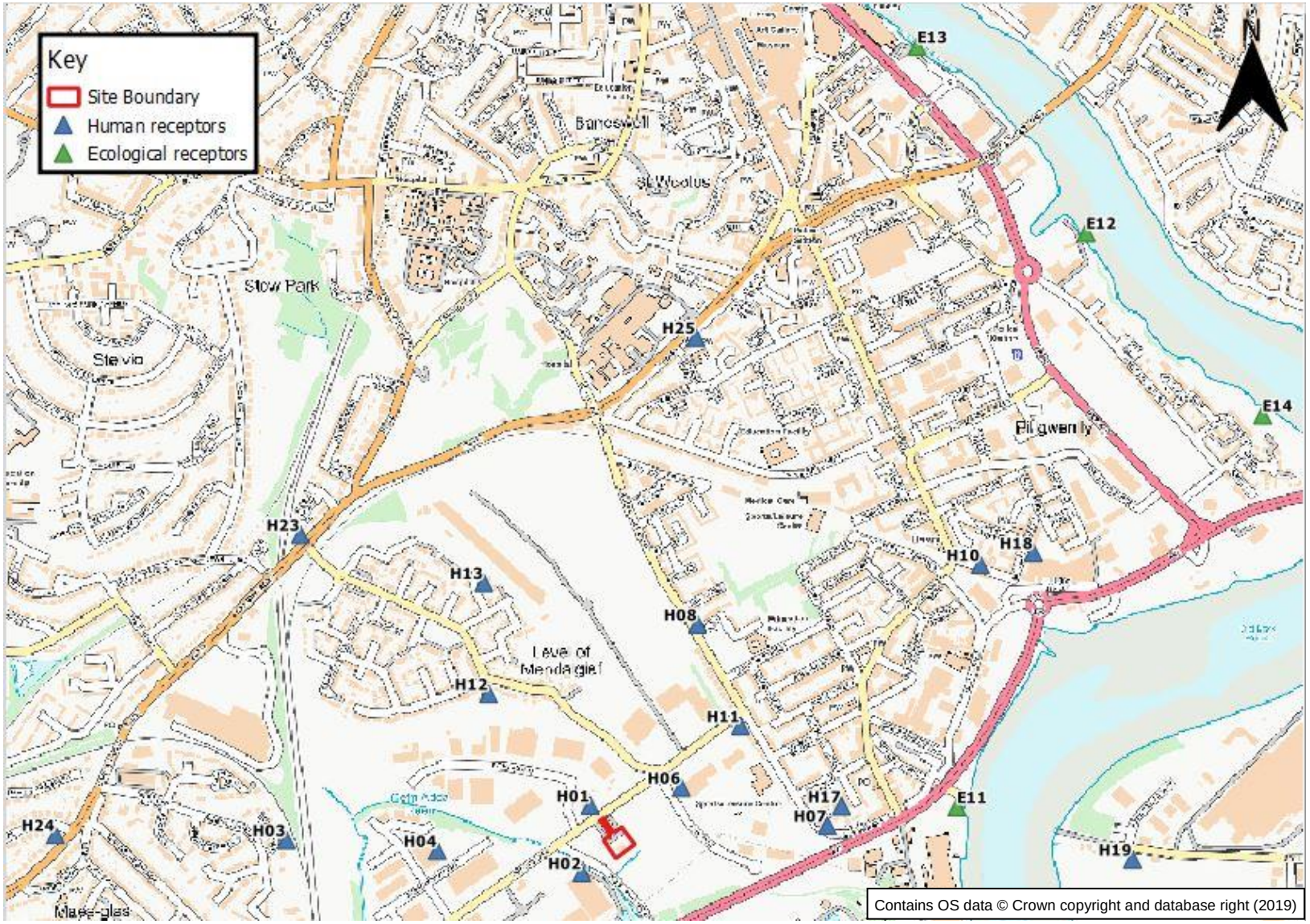
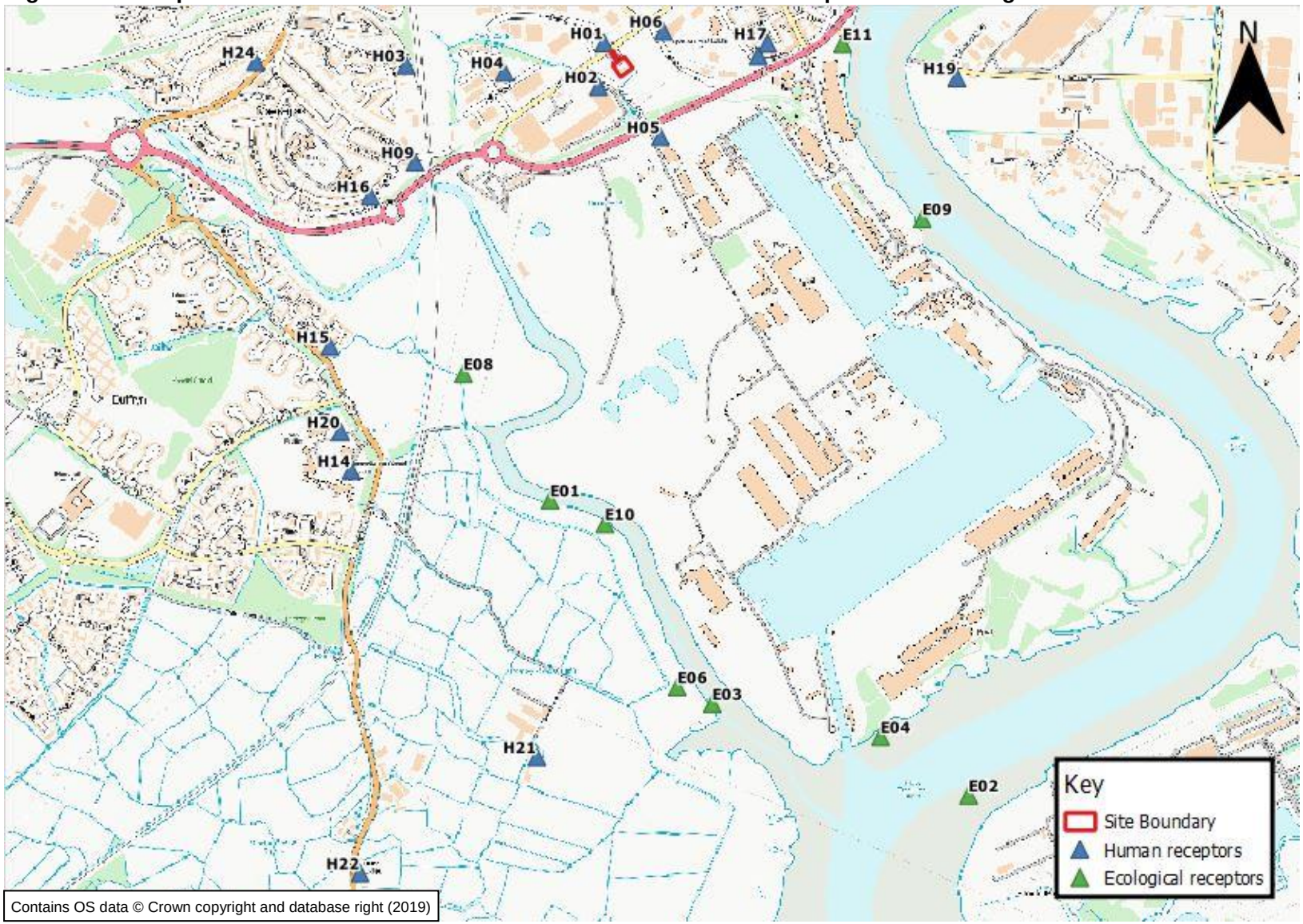


Figure A2: Receptors and Point Sources South of the Site Included in the Dispersion Modelling Assessment



Contains OS data © Crown copyright and database right (2019)

Figure A3: Windrose for the Rhoose Weather Station – 2016

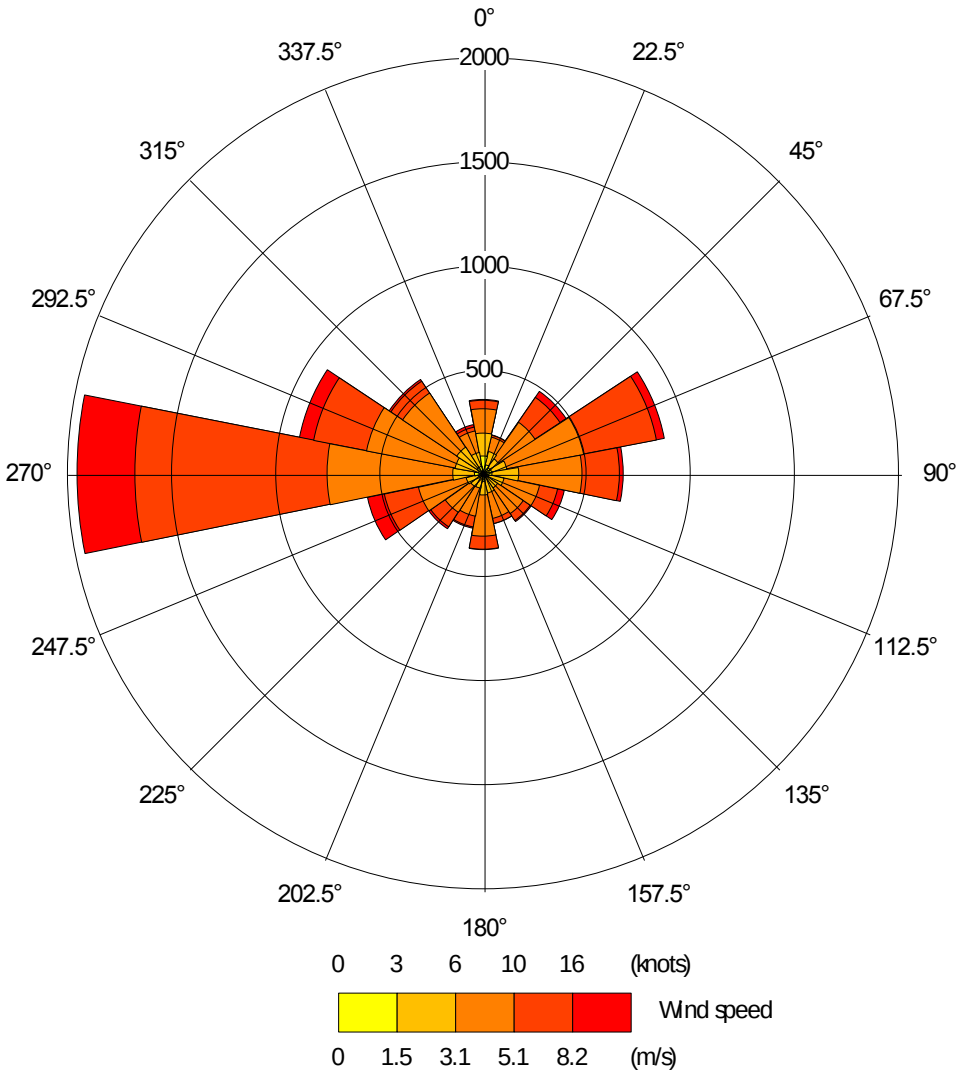


Figure A4: Windrose for the Rhoose Weather Station – 2017

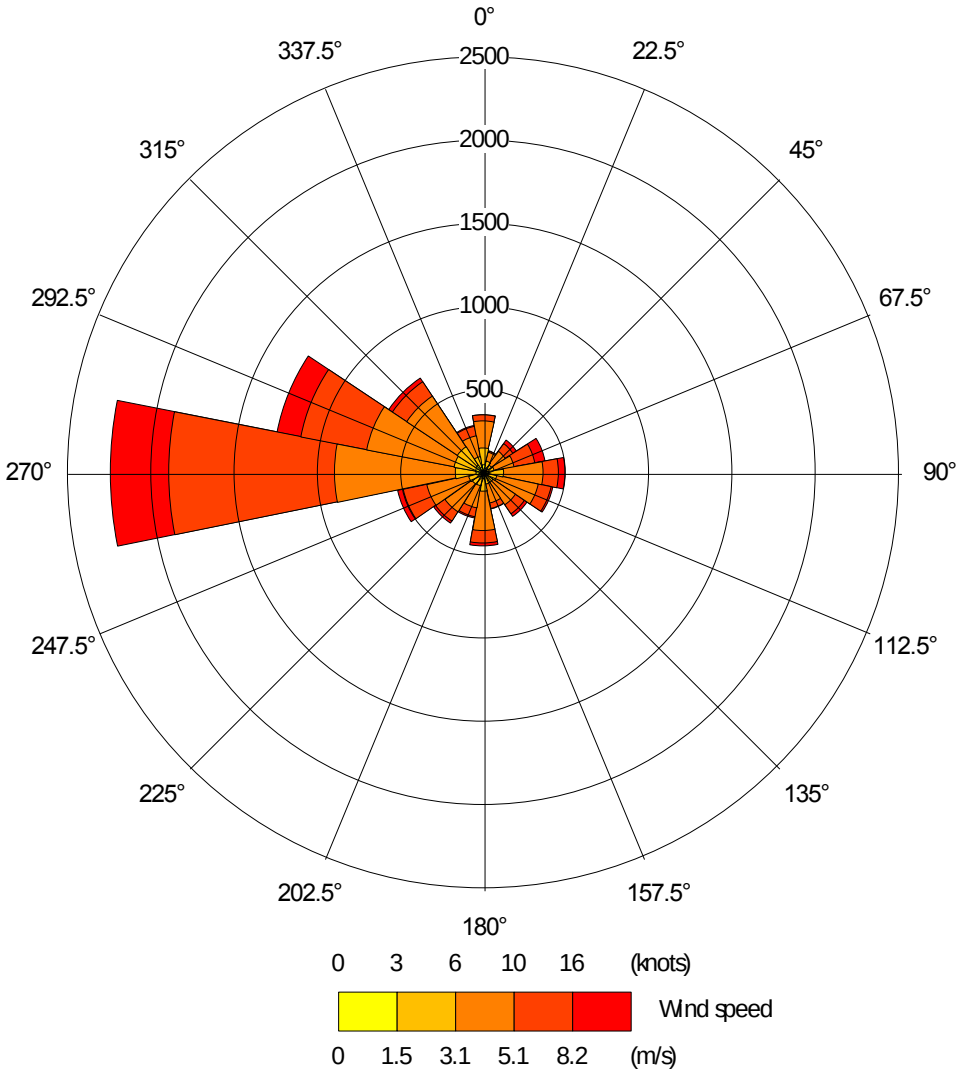
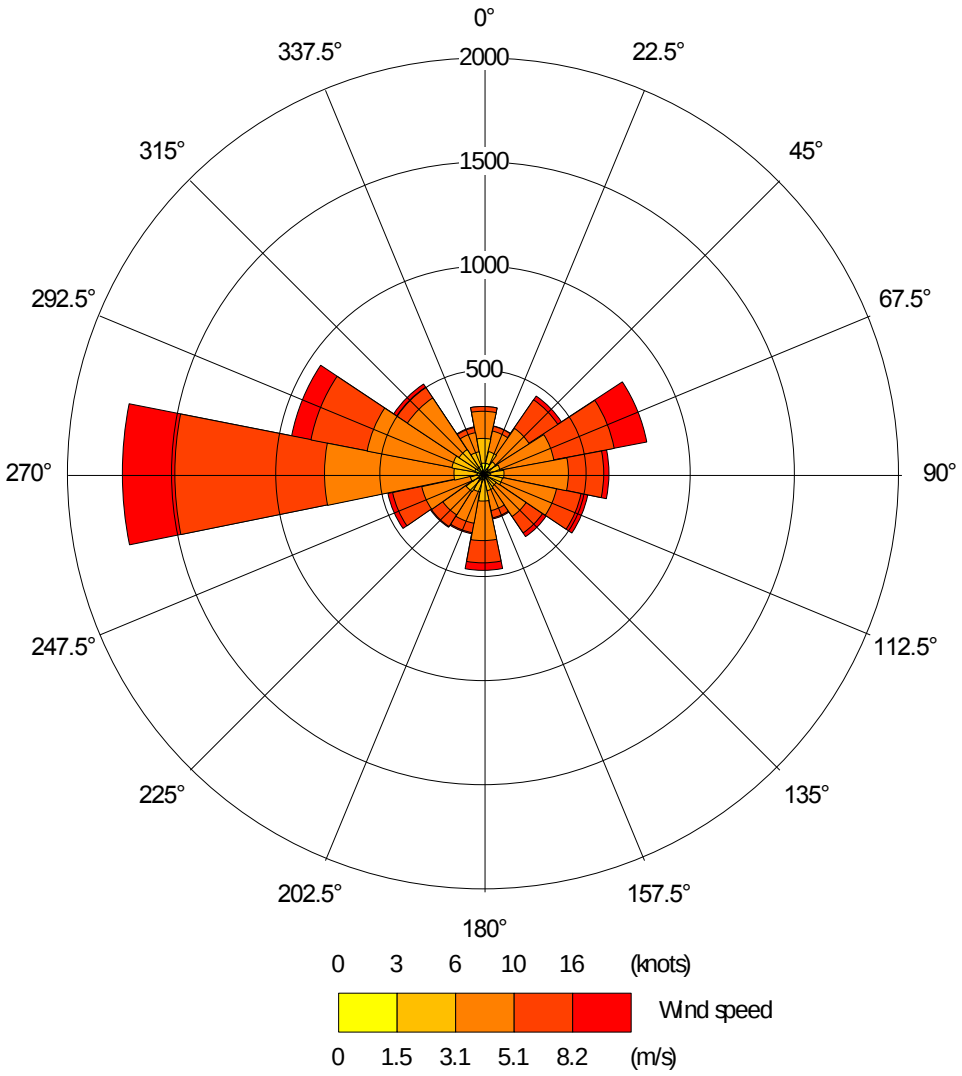


Figure A5: Windrose for the Rhoose Weather Station – 2018



APPENDIX B
CONTOUR PLOTS - PREDICTED POLLUTANT CONCENTRATIONS

This annex contains contour plot (isopleths) illustrating the dispersion profiles of emission components released from the plant. The data is based on the meteorological data year which experienced the highest pollutant concentrations.

Figure B1: Predicted Annual Mean NO_2 Concentrations (µg/m^3) PC – relevant for human receptor locations

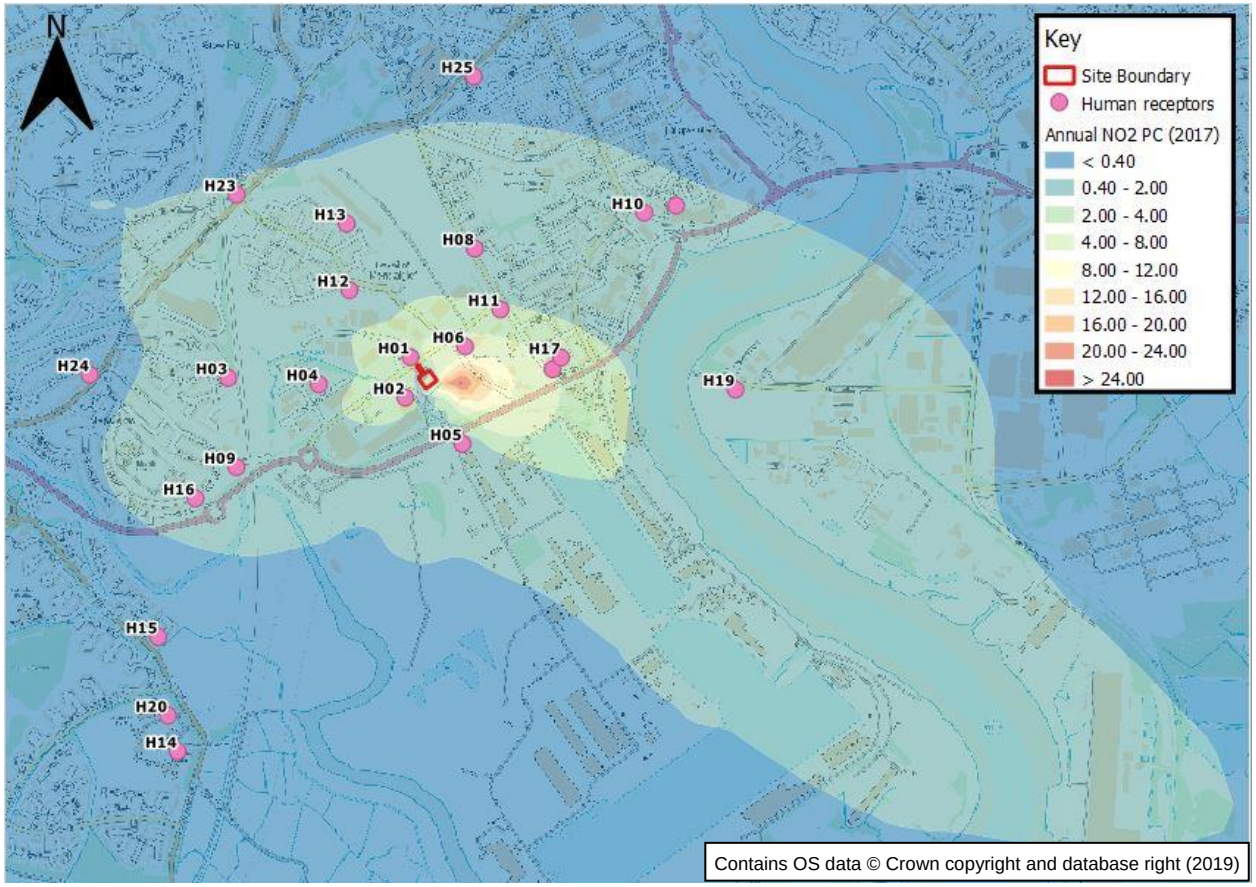


Figure B2: Predicted Annual Average NO_2 Concentrations (µg/m^3) PEC – relevant for human receptor locations

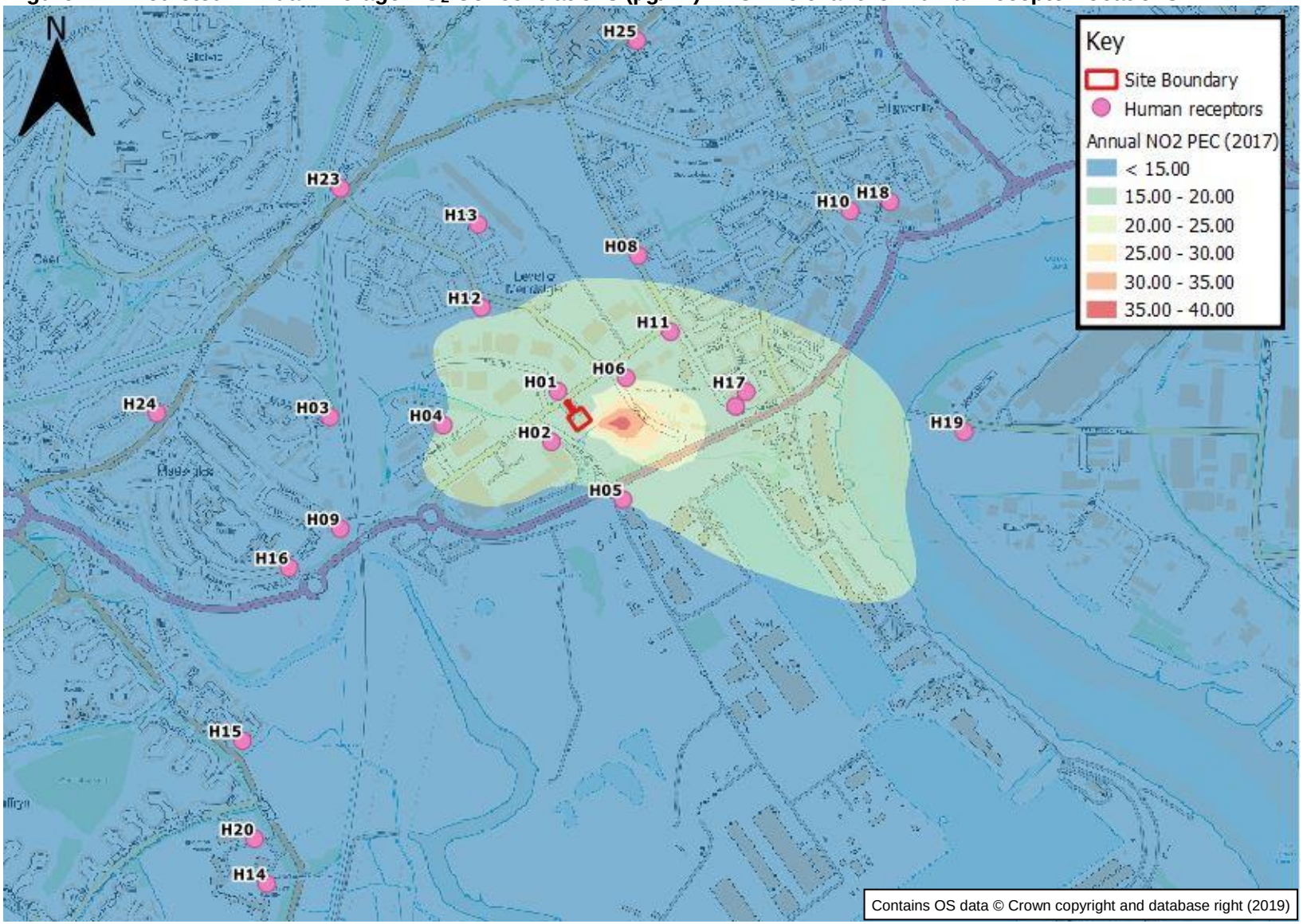


Figure B3: Predicted 99.79th Percentile of Hourly NO_2 Concentrations (µg/m³) PC – relevant for human receptor locations

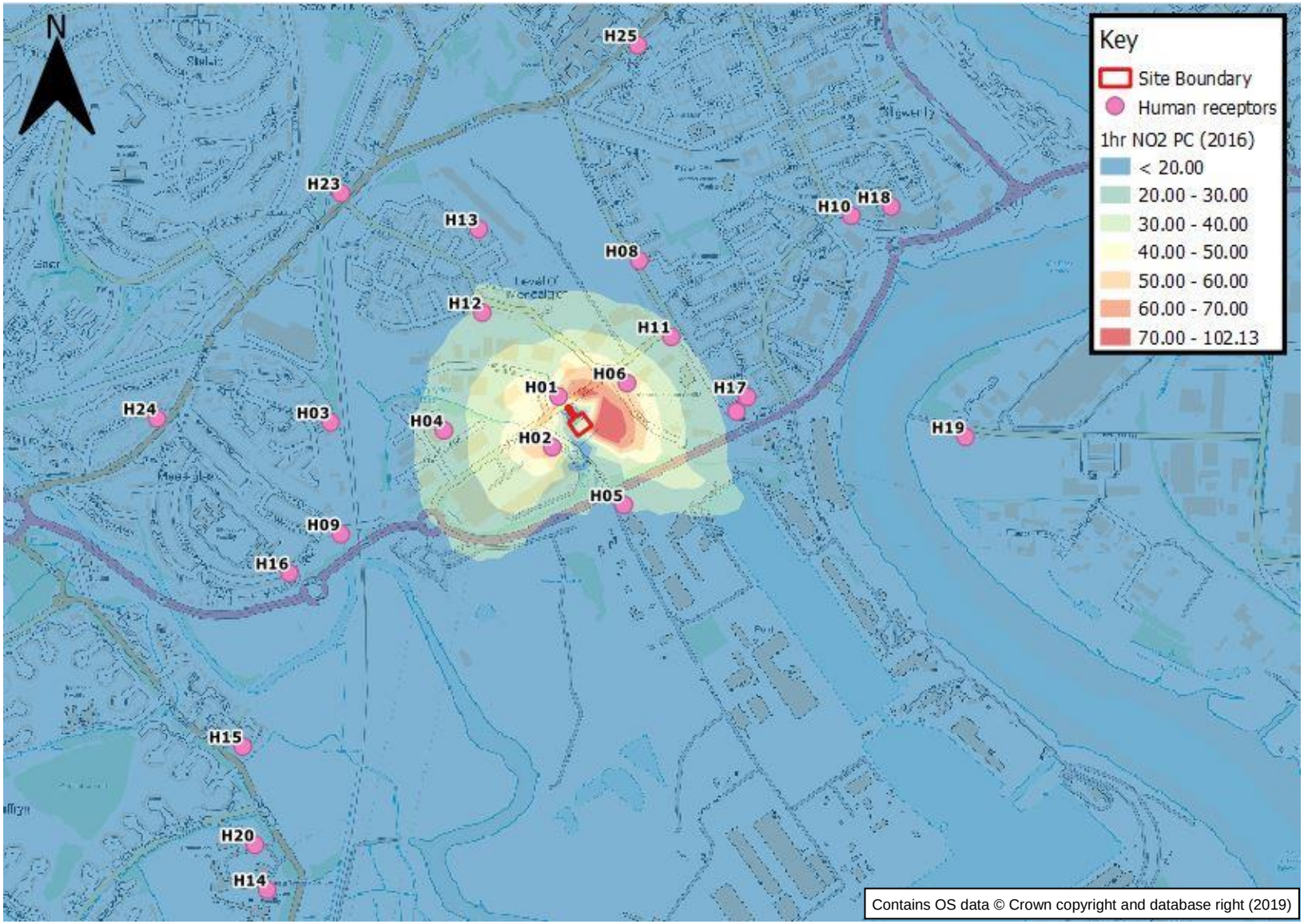


Figure B4: Predicted 99.79th Percentile of Hourly NO_2 Concentrations (µg/m³) PEC – relevant for human receptor locations

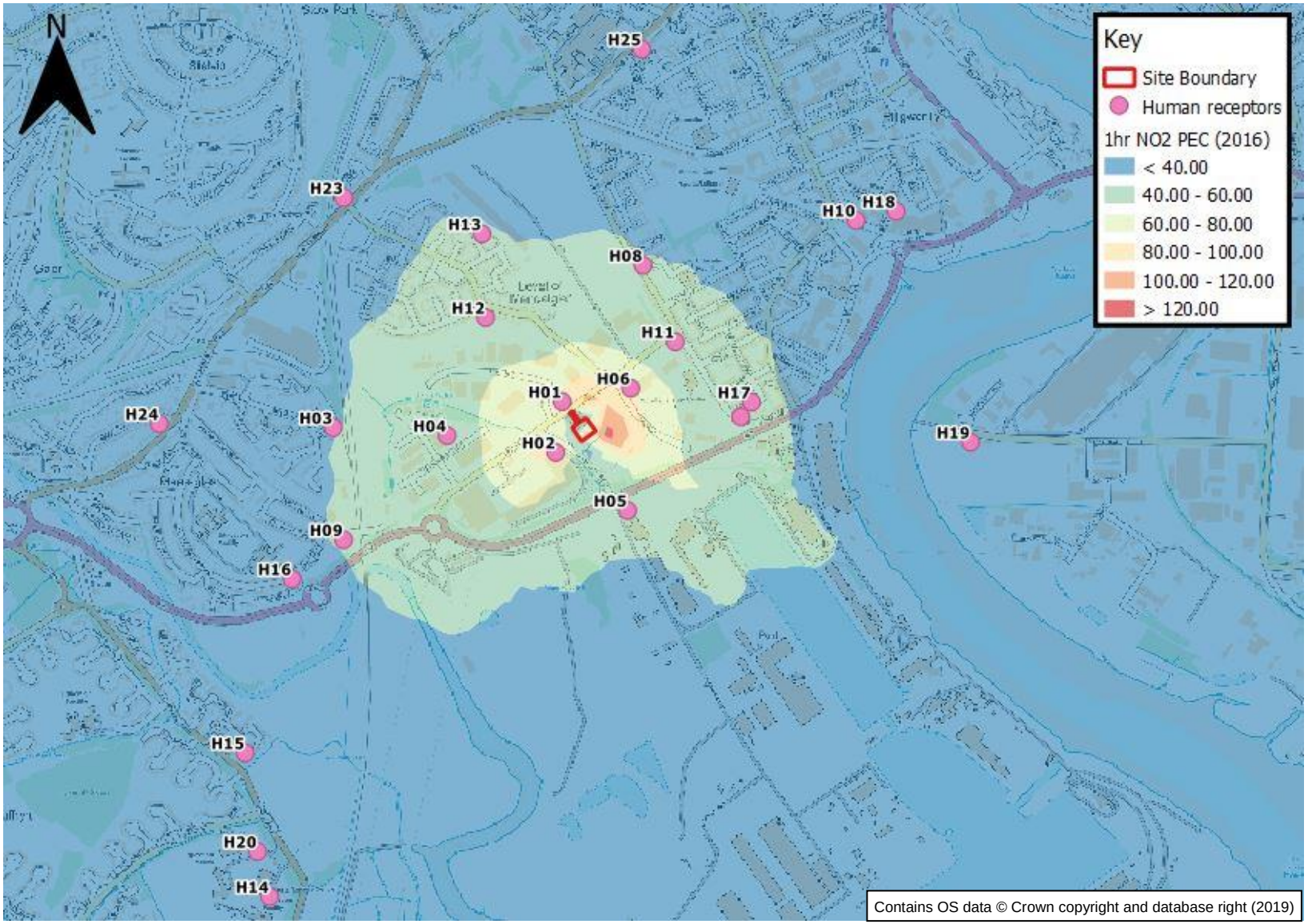


Figure B5: Predicted Annual Average NO_x Concentrations (µg/m^3) PC – relevant for ecological receptor locations

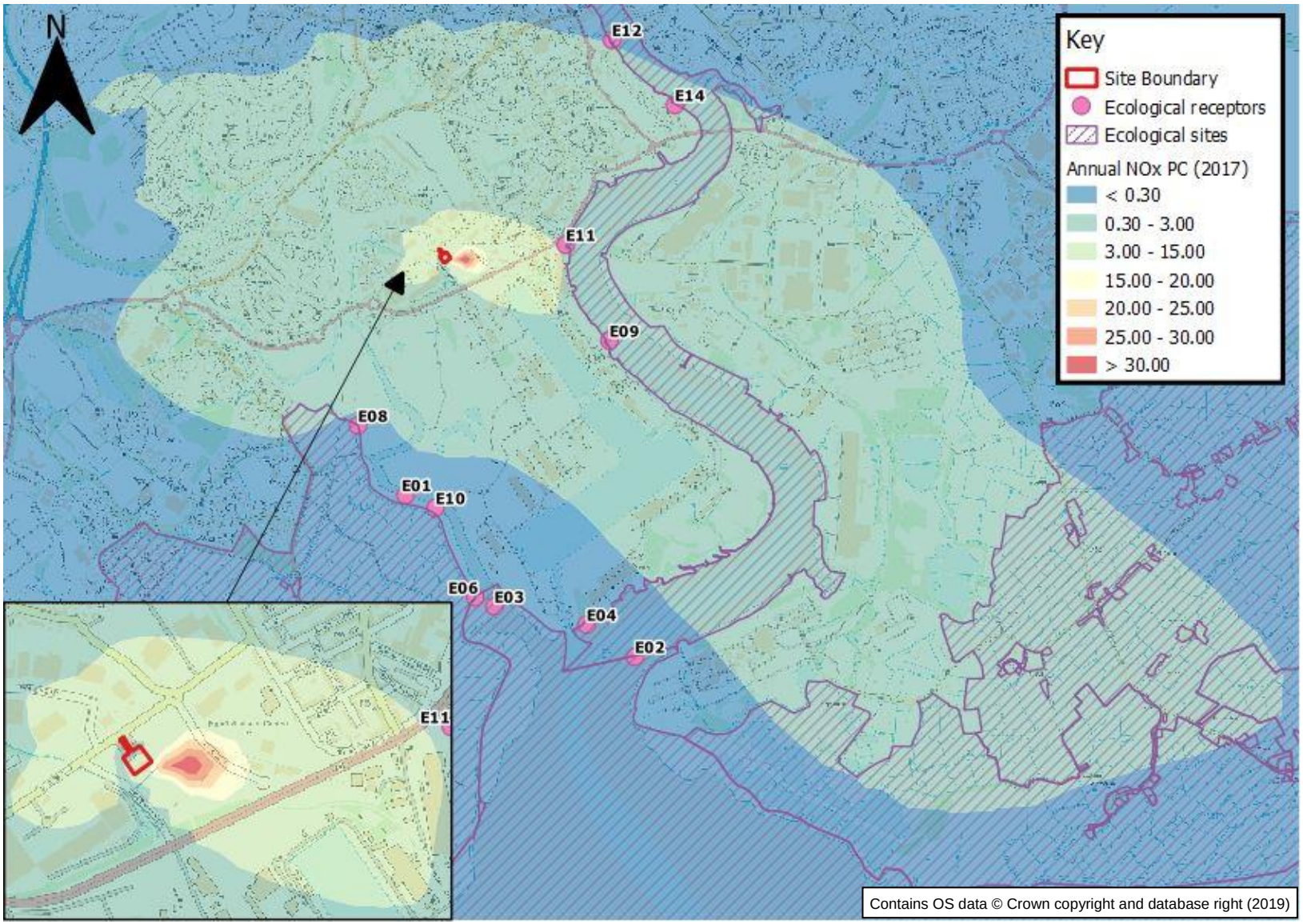


Figure B6: Predicted Annual Average NO_x Concentrations (µg/m^3) PEC – relevant for ecological receptor locations

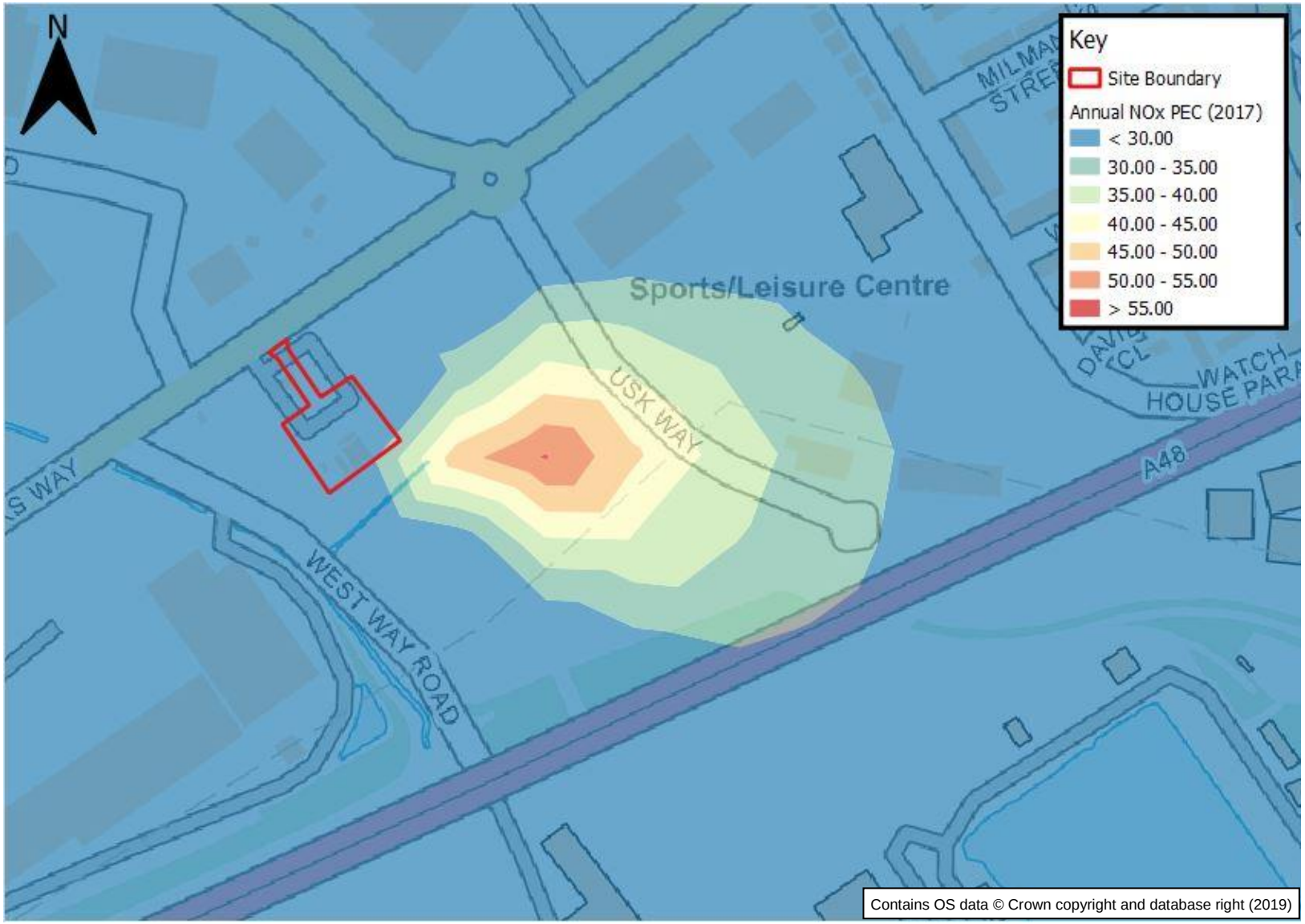


Figure B7: Predicted 24-hourly Average NO_x Concentrations (µg/m^3) PC – relevant for ecological receptor locations

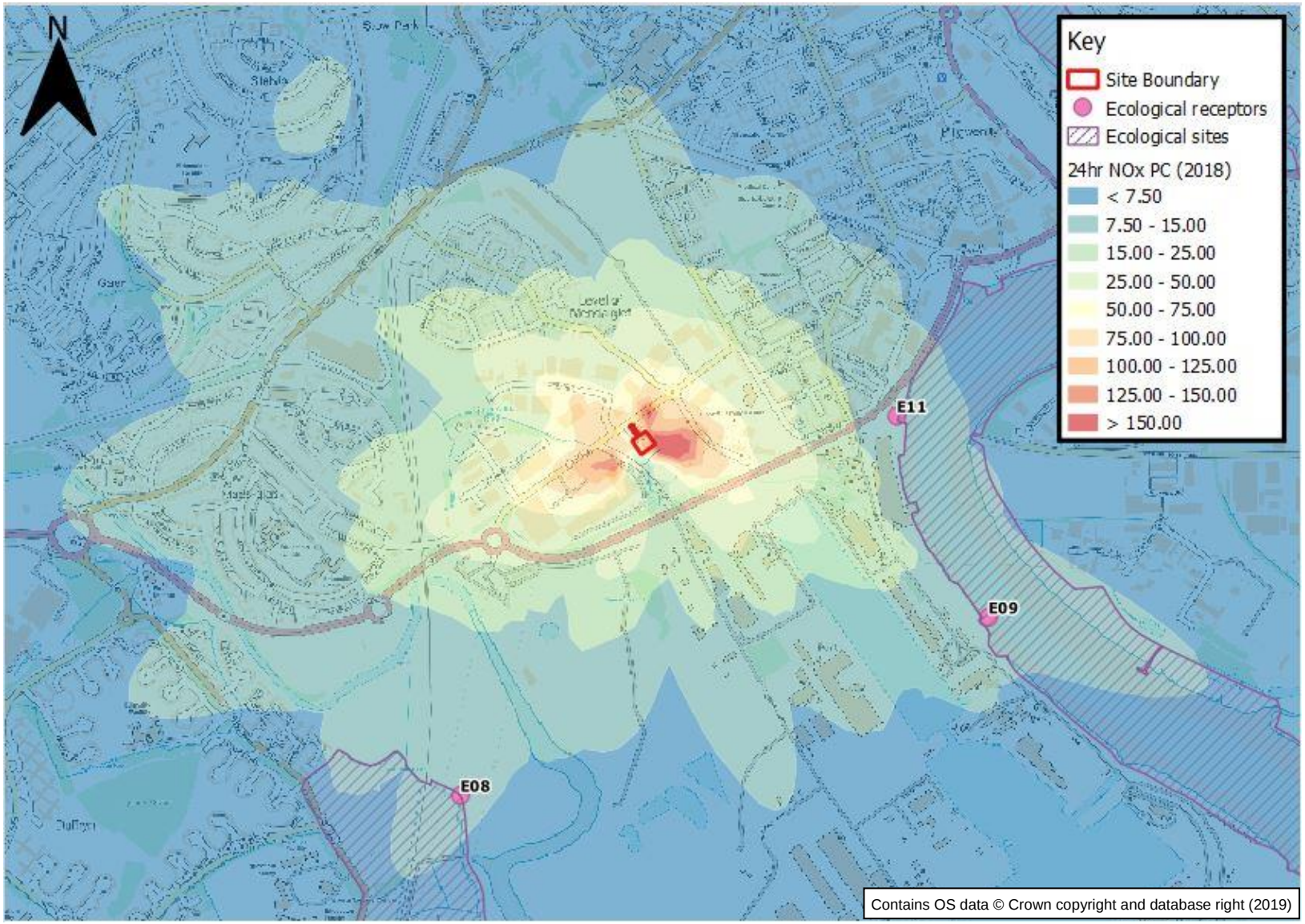


Figure B8: Predicted 24-hourly Average NO_x Concentrations (µg/m³) PEC – relevant for ecological receptor locations