Boiler Emissions Testing, Sharpsmart Limited Processing Facility, Rainham

Air Quality Impact Assessment

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Revision History

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1.0	2020-10-30	Craig Aldridge	Annie Danskin	Ruth Fain	Final Version for Issue
2.0	2021-01-14	Craig Aldridge and Annie Danskin	Annie Danskin	Ruth Fain	Final Reassessment based on requests from Environment Agency

Contents

1. Introduction

1.1 Background

ITPEnergised (ITPE) has been commissioned by Reva Environmental Limited on behalf of Sharpsmart Limited (hereafter referred to as 'the client') to undertake an air quality impact assessment (AQIA) for the combustion plant/boiler (hereafter, referred to as the 'Installation') to be operated at the client's waste processing facility in Rainham, London. The facility is located within the Fairview Industrial Estate in Rainham, within the London Borough of Havering Council (LBHC) administrative area. The location of the site is displayed in **Figure 1**.

It is understood that the client recently took over operation of the facility in March 2020 and are applying for a variation in the currently valid environmental permit (EP) for the site. The variation in the EP is to allow for a number of additional waste treatment and processing activities to be carried out on the site, as well as for the operation of a combustion plant/boiler with a higher thermal capacity than was previously used.

The new boiler is a Babcock Wanson Boiler using liquid petroleum gas (LPG) as the fuel to produce steam at 4t/hr to sterilise clinical waste. Reva Environmental carried out an Environment Agency H1 screening assessment of the new Installation. The results of the screening assessment were as follows:

- At 100% of the long-term EAL, the long-term Predicted Environmental Concentration (PEC) for NO_2 is considered significant and requires further assessment;
- The predicted short-term Process Contribution (PC) for NO_2 is 147% of the headroom to the human health EAL and therefore further detailed assessment is required;
- The short-term PC for Carbon Monoxide (CO) is 0.36% of the 8-hour air quality standard (AQS) of 10mg/m^3 and the long-term PC is 0.0034% of the AQS, therefore no further assessment is required.

ITPE previously carried out an AQIA for the Installation, including a detailed dispersion modelling study of the monitored emissions from the Installation stack, to assess the potential impacts on the air quality in the local area. The results were presented in V1.0 of this report, dated 30/10/2020 which was issued to the Environment Agency (EA). Following a review of the AQIA the EA requested that the assessment be amended with the following changes:

- Assessment of maximum emissions concentrations based on the emission limit values for new medium combustion plant other than engines and gas turbines, operating on gaseous fuels other than natural gas, as outlined in the Medium Combustion Plant Directive (MCPD) (The European Parliment and The Council of the European Union, 2015)
- Assessment of impacts on nearby sensitive receptors from sulphur dioxide (SO_2) emissions associated with the boiler in addition to NO_x and NO_2 ;
- Assessment of the ambient concentration impacts from emissions of NO_x and SO_2 on sensitive ecological receptors including local wildlife sites (LWS) for comparison with critical levels; and
- Assessment of nutrient nitrogen deposition and acid deposition as a result of emissions from the Installation against the most stringent critical load levels at ecological receptors in the study area..

This updated version (V2.0) of the report addresses these requests and provides updated contour maps and tables of results for the assessment. Changes to the assessment methodology from the original assessment are detailed throughout the report.

1.2 Scope of Assessment

The scope of the assessment carried out is as follows:

- Desktop review of baseline air quality of the study area;
- Identification of sensitive receptor locations within the study area;

- Characterisation of boiler pollutant emissions;
- Air dispersion modelling to determine the Process Contribution (PC) to pollutant concentration and deposition within the study area for comparison against air quality standards and Environment Agency screening criteria;
- Report on assessment results.

2. Relevant Guidance and Standards

2.1 Relevant Guidance

The assessment has been carried out with consideration to the following guidance and legislation:

- Environment Agency (EA) and Department for Environment, Food & Rural Affairs (Defra) – Guidance, Environmental Permitting: Air Dispersion Modelling Report (EA and Defra, 2019);
- EA and Defra – Guidance, Air Emissions Risk Assessment for your Environmental Permit (EA & Defra, 2020); and
- The European Parliament and Council of the European Union (EU) – Directive on the Limitations of Emissions of Certain Pollutants Into the Air from Medium Combustion Plants (The European Parliment and The Council of the European Union, 2015).
- Air Quality Technical Advisory Group (AQTAG06) – Technical guidance on detailed modelling approach for an appropriate assessment for emissions to air (EA, 2014).

2.2 Air Quality Standards (AQSs) and Critical Levels

This assessment considers the relevant air quality standards (AQSs) for the emitted pollutants which are applicable in England. **Table 1** presents the AQSs set for the protection of human health and designated ecological sites which are relevant to this AQIA. For the ecological sites, the concentration for the AQS is the Critical Level. Critical Loads are location and habitat specific and are discussed in the Assessment Results in Section 5.

Table 1 – Relevant AQSs and Critical Levels Considered in this AQIA

Pollutant	Concentration	Measured As
Human Health		
Nitrogen dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	266 µg/m^3 not to be exceeded more than 35 times a year	15-minute mean
	350 µg/m^3 not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3 not to be exceeded more than 3 times a year	24-hour mean
Designated Ecological Sites		
Oxides of Nitrogen (NO_x)	30 µg/m^3	Annual mean
	75 µg/m^3	24-hour mean

Pollutant	Concentration	Measured As
Sulphur Dioxide (SO_2)	20 µg/m^3	Annual mean

3. Baseline Environment

3.1 Study Area and Sensitive Receptors

The study area has been defined based on professional judgement and a review of sensitive human and ecological receptors within 2km of the site.. Calculations of impacts have been made over a detailed 2km^2 grid of 10m resolution to cover all potential sensitive receptors and enable contour maps to be prepared for comparison with the relevant AQSs, critical levels and critical loads.

3.1.1 Specified Sensitive Human and Ecological Receptors

For the purpose of this assessment, specified receptor points to represent sensitive human receptors closest to the Installation in all directions have been selected. Specified receptor points have also been chosen for a selection of ecological sites.

The human receptors chosen are those which correspond to public amenity and commercial areas where short-term AQSs are relevant if there is the potential for public exposure, and residential properties where both short-term and long-term AQSs are relevant. A height of 1.5m for the human receptors has been applied which represents an average human inhalation height above ground level.

The specified ecological receptors are those which correspond to the closest points of Sites of Special Scientific Interest (SSSI), Local Nature Reserves (LNR), Important Bird and Biodiversity Areas (IBA), and Deciduous Woodland – England sites to the installation. A height of 0m has been applied at these receptors to represent ground level.

The EA requested the inclusion of a number of Local Wildlife Sites (LWS) within 2km of the Installation in the AQIA and provided radial distances to these locations. It was not possible within the timescale of submission of this updated AQIA to obtain mapping data to show the boundaries of each LWS to add them as specified receptor locations, however the radial distances provided were used to plot buffer zones within which any LWS was located.

The dispersion modelling study has predicted the process contribution (PC) to concentration and deposition as a result of maximum emissions (at MCPD ELVs) from the Installation at each of the specified sensitive receptor locations and across a detailed calculation grid at 10m resolution, therefore including calculations at all LWS within 2km.

The specified sensitive receptors considered in this assessment are presented in **Table 2** and displayed in conjunction with the boundaries of designated sites and buffer zones to LWS in **Figure 2**.

This AQIA has reduced the number of specified human receptors compared with version 1.0, as it was recognised that some were places of work where there was no public access or presence.

Table 2 – Specified Sensitive Human and Ecological Receptors Considered

Receptor ID	Receptor Description	Coordinates (m)		
		x	y	z
Human Receptors				
R1	ANR Tyres Shop/Garage	551014	181715	1.5

Receptor ID	Receptor Description	Coordinates (m)		
		x	y	z
R2	CEME Innovation Centre - Outdoor Sitting Area	550845	182097	1.5
R3	Residential Property - New Road A1306	550948	182879	1.5
R4	Residential Property - Passive Close	551708	182470	1.5
R5	Outdoor Football Pitch - Havering College	551702	182379	1.5
R6	Residential Property - Creekside	551685	182167	1.5
R7	Residential Property - New Road A1306	551616	182667	1.5
R8	Residential Property - Palliser Drive	552391	181825	1.5
Ecological Receptors				
E1	SSSI - Inner Thames Marshes	551366	181330	0
E2	SSSI - Ingrebourne Marshes	552051	182515	0
E3	LNR - Rainham Marshes	551329	181306	0
E4	LNR - Ingrebourne Valley	552366	182632	0
E5	LNR - Beam Valley	550347	183334	0
E6	LNR – Crossness	549657	180545	0
E7	IBA - Thames Estuary and Marshes	551389	181344	0
E8	Deciduous Woodland - England	552145	183354	0
E9	Deciduous Woodland - England	551715	180457	0

3.2 Background Concentrations

Background concentrations for NO_x and NO_2 have been derived from 2018-based background concentration maps for the year 2020 available from Defra (Defra, 2020).

Background concentrations for SO_2 have been derived from background concentration maps for the year 2001 available from Defra (Defra, 2020). The 2001 background concentrations are the most up to date available and have therefore been assumed to be representative of levels experienced in 2020.

Background levels of NO_x, NO_2 and SO_2 have been derived for each of the specified sensitive receptor locations considered in this AQIA and are presented in **Table 3**.

Table 3 – 2020 Background Map Concentrations for Sensitive Receptors

Receptor ID	National Grid Square Centre Coordinates		2020 Background Concentrations		
	X (m)	Y (m)	NO_x (µg/m^3)	NO_2 (µg/m^3)	SO_2 (µg/m^3)
Human Receptors					
R1	551500	181500	31.9	21.7	7.8

Receptor ID	National Grid Square Centre Coordinates		2020 Background Concentrations		
	X (m)	Y (m)	NO_x (µg/m^3)	NO_2 (µg/m^3)	SO_2 (µg/m^3)
R2	550500	182500	36.0	24.0	6.4
R3	550500	182500	36.0	24.0	6.4
R4	551500	182500	29.6	20.4	7.7
R5	551500	182500	29.6	20.4	7.7
R6	551500	182500	29.6	20.4	7.7
R7	551500	182500	29.6	20.4	7.7
R8	552500	181500	29.0	20.1	8.2
Ecological Receptors					
E1	551500	181500	31.9	21.7	7.8
E2	552500	182500	27.0	18.9	9.1
E3	551500	181500	31.9	21.7	7.8
E4	552500	182500	27.0	18.9	9.1
E5	550500	183500	28.1	19.5	6.9
E6	549500	180500	25.7	18.0	6.3
E7	551500	181500	31.9	21.7	7.8
E8	552500	183500	24.4	17.3	10.6
E9	551500	180500	27.0	18.7	11.5

4. Assessment Methodology

4.1 Model Description

The atmospheric emissions dispersion modelling study was undertaken using the latest version of ADMS-5 dispersion modelling software (version 5.2.2.0). The software was developed by Cambridge Environmental Research Consultants Limited (CERC) and has undergone extensive use and validation (Cambridge Environmental Research Consultants, 2020).

4.2 Emissions Sources and Data

All emission data used in the original AQIA (report V1.0) was obtained from the emissions monitoring report (Envirodat, 2020) for the Installation which is included in **Appendix A.** The monitored emission concentrations were lower than the emission limit values (ELVs) set by the MCPD (The European Parliment and The Council of the European Union, 2015) for new plant operating with liquid fuels other than gas. In this updated assessment, the normalised pollutant emission concentrations have been changed to equal the ELVs. All other emission data such as actual stack gas temperature were obtained from the emissions monitoring report.

The emissions data used for the Installation in this assessment are presented in **Appendix A**.

4.3 ADMS Model Options

4.3.1 Meteorological Data

The dispersion model has used meteorological data representative of the local area to calculate atmospheric conditions and therefore the dispersion of emissions from the proposed stacks.

The dispersion model has made use of hourly meteorological data measured at Heathrow Airport. Heathrow Airport meteorological station is approximately 43km west of the site of the Installation and is the closest meteorological station with a high data capture for the previous five years.

St James's Park meteorological station in London is noted to be closer to the site of the Installation. However, it has not been used for this assessment due to having a very poor data capture for wind speed and wind direction for 2019. The station's location is also in the city centre of London, which is likely to experience differences in meteorological conditions due to the heavy urbanisation of the city landscape compared to the site of the Installation.

This original AQIA assessment used the previous five years of meteorological data from Heathrow airport (2015 – 2019) to check for sensitivity to inter-annual variations and found the maximum concentrations to be predicted with 2017 data. This updated AQIA only presents results based on 2017 data.

The wind roses for each of the previous five years of hourly meteorological data from Heathrow Airport are presented in **Figure 3**.

4.3.2 Surface Roughness and Minimum-Obukhov Length

A surface roughness of 1m representative of large towns and cities has been selected to represent the area around the Installation.

A surface roughness of 0.3m is considered to be representative of the surface roughness at Heathrow Airport meteorological site.

Monin-Obukhov length (L_{MO}) is used to calculate the minimum stability of the atmosphere. The minimum L_{MO} was selected to be 30mat both the area around the Installation and the location of Heathrow Airport meteorological site.

Model default values of 0.23 and 1.0 for surface albedo and Priestly-Taylor parameter respectively were selected for both the area around the Installation and the location of Heathrow Airport meteorological station.

Precipitation factor for the area around the Installation was selected to be the same as that for the Heathrow Airport meteorological site.

4.3.3 Terrain

Terrain effects have been included in the detailed modelling to account for the changing heights in the land around the Installation. The terrain file included in the model uses a 64m x 64m resolution.

Terrain data have been compiled using the built-in terrain tool within ADMS-5. Terrain data have been compiled from Ordnance Survey Landform Panorama data.

4.3.4 Modelling Scenarios

A conservative approach has been adopted, assuming that the Installation will operate 24 hours a day, 365 days per year. In reality, operational time of the Installation will be less.

4.3.5 Cumulative Effects

It is considered that the background concentrations chosen for this assessment include contributions from all neighbouring industrial, transport, commercial and domestic and transboundary sources.

4.3.6 Treatment of Nitrogen Dioxide

Emissions of NO_x comprise both NO_2 and NO (nitric oxide). Emissions of NO_x will undergo oxidation in the atmosphere to form NO_2, however the rate of conversion will depend on a number of factors before equilibrium in the atmosphere is reached. Estimates of the percentage of NO_2 in the total NO_x emission are made in the model to represent the primary (direct) NO_2 emission and that formed by secondary formation.

The EA guidance (EA & Defra, 2020) provides guidance on assumptions relating to the proportions of NO_2 in an estimated NO_x emission. In line with the guidance, this assessment has considered NO_x emissions as 70% NO_2 when considering compliance with the long-term (annual mean) AQS and as 35% NO_2 when considering compliance with the short-term (1-hour mean) AQS. Using these proportions is considered to be a worst-case assessment according to the EA guidance.

4.3.7 Modelling of Building Effects

Buildings can have a significant effect on the dispersion of pollutants from sources attached to or in close proximity to them and have the potential to entrain pollutants into the cavity region in the immediate leeward side of the building, bringing them rapidly down to ground level. As a consequence, concentrations near the buildings can be increased, with downwind concentrations decreased.

The buildings included as part of the modelling assessment are displayed in **Figure 4**. The parameters of the modelled buildings were sourced from OS Mastermap data and are reported in **Table 4.** For each building the modelled height was the average height between the eaves and the ridge of the roof. The modelled stack was 2.2m above the modelled height of Building 1.

Table 4 – Modelled Building Parameters

Building ID	Length (m)	Width (m)	Average Height (m)
Building 1	46.9	31.5	8.6
Building 2	108.6	41.4	8.4
Building 3	29.8	19.0	7.2
Building 4	55.8	16.0	7.6
Building 5	54.7	46.3	9.35
Building 6	79.6	53.1	9.45
Building 7	43.4	43.1	9.9
Building 8	64.1	48.6	7.25
Building 9.1*	142.0	42.8	11.35
Building 9.2*	51.9	18.9	11.35
Building 9.3*	16.4	13.9	11.35
Building 10	48.5	15.4	7.5
Building 11	42.5	42.3	7.05
Building 12	50.1	16.1	7.95

*Buildings are defined as rectangular or square shapes in ADMS. Therefore, to draw the shape of Building 9 accurately, three separate buildings were defined for different sections of the building (9.1, 9.2, 9.3).

4.3.8 Model Uncertainty

This study is based on the conservative assumption that the Installation operate 24/7 for 365 days of the year. It is therefore considered that actual impacts from the proposed new stack once operational, will be lower than those predicted.

4.4 Calculation of Process Environmental Concentration (PEC) of Emitted Pollutants

The concentrations of emitted pollutants from the Installation (PC) have been predicted across the study area and combined with the existing background concentrations to obtain the Predicted Environmental Concentration (PEC). Relevant PECs have been calculated as follows:

- PEC for long-term concentrations: PC + the background; and
- PEC for short-term concentrations: PC + twice the background.

Short-term concentrations refer to any pollutant concentration which is measured over an averaging time period of one hour or less. Anything above one hour is defined as long-term.

4.5 Calculation of Deposition of Emitted Pollutants

The calculations of both nutrient nitrogen deposition and acid deposition have been calculated using the method provided in the technical guidance on detailed modelling approach for an appropriate assessment for emissions to air under the Habitats Directive 2004 (AQTAG06, March 2014).

4.5.1 Nutrient Nitrogen Deposition

The annual mean PC concentration of NO_x was calculated across the gridded study area and at specified designated ecological sites as described in **Table 2.** The assessment of deposition effects assumes a conservative worst case that all NO_x is NO_2.

The deposition flux was calculated from the modelled PC concentration using the formula:

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

The AQTAG recommended dry deposition velocity for grassland of 0.0015 m/s was used in the calculations.

The AQTAG dry deposition flux conversion factor for NO_2 of 95.9 was used in calculations to convert dry deposition flux to nutrient nitrogen deposition in kg N/ha/yr.

4.5.2 Acid Deposition

Acid Deposition includes the combination of deposition of NO_2 and SO_2. The dry deposition flux was calculated for NO_2 as above. Using the same formula, the dry deposition flux for SO_2 was calculated using the AQTAG06 recommended dry deposition velocity for grassland of 0.012 m/s.

In accordance with AQTAG06, wet deposition of NO_2 and SO_2 is not considered to be significant within a short range and was therefore not included in the calculations of deposition effects.

The AQTAG dry deposition flux conversion factors of 6.84 for NO_2 and 9.84 for SO_2 were used in calculations to convert dry deposition flux to acid deposition in keq/ha/yr.

The total acid deposition was calculated by addition of the acidification due to nitrogen (N) and sulphur (S) together.

4.6 Screening PCs for significance

The assessment of significance of the effects of the PC contributions to concentration, nutrient nitrogen deposition and acid deposition follows the criteria in the EA Air emissions risk assessment guidance (EA & Defra, 2020).Screening at Human Receptors. The EA risk assessment guidance states that:

To screen out a PC for any substance so that you do not need to do any further assessment of it, the PC must meet both of the following criteria:

- the short-term PC is less than 10% of the short-term environmental standard
- the long-term PC is less than 1% of the long-term environmental standard

If you meet both of these criteria you do not need to do any further assessment of the substance.

These criteria have been applied at all specified human receptors using the AQSs in **Table 1.**

4.6.1 Screening at SSSIs

The EA risk assessment guidance goes on to state that:

When there are SPAs, SACs, Ramsar sites and SSSIs within the specified distance, if your emissions that affect SPAs, SACs, Ramsar sites or SSSIs meet both of the following criteria, they're insignificant - you do not need to assess them any further:

- the short-term PC is less than 10% of the short-term environmental standard for protected conservation areas
- the long-term PC is less than 1% of the long-term environmental standard for protected conservation areas.

These criteria have been applied at the identified SSSI conservation sites within 2km of the Installation using the critical levels in **Table 1** and site specific values of critical loads for nutrient nitrogen deposition and acid deposition.

4.6.2 Screening at Local Nature Sites (LNRs, LWSs, IBAs and Deciduous Woodland)

The EA risk assessment guidance goes on to state that:

When there are local nature sites within the specified distance**, i**f your emissions meet both of the following criteria they're insignificant – you do not need to assess them any further:

- the short-term PC is less than 100% of the short-term environmental standard
- the long-term PC is less than 100% of the long-term environmental standard

You do not need to calculate PEC for local nature sites. If your PC exceeds the screening criteria you need to do detailed modelling.

These criteria have been used at the specified ecological receptors identified as LNRs, IBAs and Deciduous Woodland within 2 km of the installation using critical levels in **Table 1,** a range of low (most stringent), medium (average) and high (maximum) critical loads for nutrient nitrogen deposition for the possible range of habitats present and against the most stringent critical load for acid deposition across all habitats in the study area.

LWSs have not been defined as specified receptor locations however these criteria have been applied across the entire modelled grid to ensure that any conservation site is included in the assessment within 2km.

5. Assessment Results

The dispersion model results are summarised in the following sections. All results tables for predicted pollutant concentrations are provided in **Appendix B.**

5.1 Human Receptors

5.1.1 Nitrogen Dioxide (NO_2)

5.1.1.1 Annual Mean

Model predicted 2020 annual mean NO_2 concentrations at each human receptor relevant for long-term exposure are presented in **Appendix B Table B-1**.

The maximum predicted annual mean PC of NO_2 is 0.08µg/m^3 at R6, a residential receptor on Creekside, which is 0.13% of the annual mean AQS.

The predicted annual mean NO_2 PC is below 1% of the annual mean AQS at all receptors where long-term exposure is relevant and is therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020)

The highest predicted annual mean PEC for NO_2 at a location where long-term exposure is relevant is 24.03µg/m^3 at receptor R3 (Residential Property – New Road A1306) which is 60.1% of the AQS.

The predicted NO_2 annual mean PEC is less than 70% of the annual mean AQS at all sensitive human receptors relevant for long-term exposure and is therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) and there is no risk of exceedance of the AQS.

5.1.1.2 1-Hour Mean

The 99.79th percentile of model predicted hourly mean NO_2 concentrations at each human receptor is presented in **Appendix B – Table B-2.**

The highest predicted 99.79th percentile of hourly mean NO_2 PC is 7.91µg/m^3 at receptor R1 (ANR Tyres Shop/Garage) which is 3.96% of the short-term AQS.

All predicted 99.79th percentiles of hourly mean NO_2 PCs are below 10% of the short-term hourly mean AQS and are therefore considered ***insignificant*** as per the EA guidance(EA & Defra, 2020).

The highest predicted 99.79th percentile of hourly mean PEC for NO_2 is 51.3µg/m^3 at receptor R1 (ANR Tyres Shop/Garage), which is 25.6% of the AQS. There is no risk of exceedance of the 1-hour AQS for NO_2 at any sensitive human receptors within the study area.

5.1.2 Sulphur Dioxide (SO_2)

5.1.2.1 24-Hour Mean

The 99.2nd and 100th percentiles of the model predicted daily mean SO_2 concentrations at each human receptor relevant for long-term exposure are presented in **Appendix B Table B-3**.

The highest predicted 99.2nd percentile of the daily mean PC for SO_2 at a location where long-term exposure is relevant is 0.05µg/m^3 at receptor R8 (Residential Property – Palliser Drive) which is 0.04% of the AQS.

All predicted 99.2nd percentiles of daily mean SO_2 PCs are significantly below 1% of the daily mean AQS of125µg/m^3) at all receptors where long-term exposure is relevant and are therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020)

The highest predicted 99.2nd percentile of the daily mean PECs for SO_2 at a location where long-term exposure is relevant is 8.27µg/m^3 at receptor R8 (Residential Property – Palliser Drive) which is 6.61% of the AQS. There is therefore no risk of exceedance of the 24-hour AQS for SO_2.

5.1.2.2 1-Hour Mean

The 99.7th and 100th percentiles of the model predicted hourly mean SO_2 concentrations at each human receptor are presented in **Appendix B Table B-4**.

The highest 99.7th percentile of the predicted hourly mean PC for SO_2 is 3.9µg/m^3 at receptor R1 (ANR Tyres Shop/Garage) which is 1.11% of the AQS.

The 99.7th percentiles of the predicted hourly mean SO_2 PCs are significantly below 10% of the hourly mean AQS of350µg/m^3 at all receptors and are therefore considered ***insignificant*** as per the EA guidance(EA & Defra, 2020) .

The highest 99.7th percentile of the predicted hourly mean PECs for SO_2 is 19.4µg/m^3 at receptor R1 (ANR Tyres Shop/Garage) which is 5.54% of the AQS. There is therefore no risk of exceedance of the 1-hour AQS for SO_2.

5.1.2.3 15 Minute Mean

The 99.9th and 100th percentiles of the model predicted 15-minute mean SO_2 concentrations at each human receptor are presented in **Appendix B Table B-5**.

The highest 99.9th percentile of the predicted 15-minute mean PCs for SO_2 is 4.18µg/m^3 at receptor R1 (ANR Tyres Shop/Garage) which is 1.57% of the AQS.

The 99.9th percentiles of the predicted 15-minute mean SO_2 PCs are significantly below 10% of the 15-minute mean AQS of 266µg/m^3) at all receptors and are therefore considered ***insignificant*** as per the EA guidance(EA & Defra, 2020) .

The highest 99.9th percentile of the predicted 15-minute mean PECs for SO_2 is 19.68µg/m^3 at receptor R1 (ANR Tyres Shop/Garage) which is 7.4% of the AQS. There is therefore no risk of exceedance of the 15-minute AQS for SO_2.

5.1.3 Contour Plots for Comparison of PC Against AQSs at Human Receptors

Contour plots of the modelled pollutant concentrations from the Installation over the 2 km^2 study area are shown in **Figures 5 – 10.** Each plot provides the PC concentration as a percentage of the AQS being considered.

Contour plots have been produced for the following:

- NO_2 Annual Mean PC;
- NO_2 99.79th Percentile (1-Hour Mean) PC;
- NO_2 100th Percentile PC;
- SO_2 99.2nd Percentile PC (24-Hour Mean);
- SO_2 99.7th Percentile PC (1-Hour Mean);
- SO_2 99.9th Percentile PC (15 Minute Mean);

5.2 Ecological Receptors

5.2.1 Concentration of Nitrogen Oxides (NO_x)

Model predicted 2020 annual mean NO_x concentrations at each specified ecological receptor are presented in **Appendix B Table B-6**.

The maximum predicted annual mean NO_x PC is 0.10µg/m^3 at receptors E1 (SSSI – Inner Thames Marshes), E3 (LNR-Rainham Marshes) and E7 (IBA – Thames Estuary and Marshes) which is 0.34% of the critical level of 30µg/m^3.

The predicted annual mean NO_x PC at all specified ecological receptor locations is less than 1% of the critical level and therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) applicable to SSSIs and local nature sites.

The contour map of **Figure 11** shows the calculated annual mean NO_x concentration as a percentage of the critical level across the entire study area. It can be seen that across the entire study area and therefore at any LWS location that has not been modelled explicitly as a receptor, the predicted PC is less than 100% of

the critical level and therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) at all conservation sites.

Based on the calculated PCs screening out of further assessment, it is not necessary to consider the PECs, however it is acknowledged that due to the fact that the background concentration of NO_x is already above the critical level at receptors E1 (SSSI – Inner Thames Marshes), E3 (LNR – Rainham Marshes) and E7 (IBA – Thames Estuary and Marshes) at a value of 31.93µg/m^3, the critical level is exceeded at these locations, with an insignificant contribution from the Installation.

5.2.1.1 24-Hour Mean

Model predicted 2020 daily mean NO_x concentrations at each specified ecological receptor are also presented in **Appendix B Table B-6**.

The highest predicted daily mean NO_x PC is 0.1µg/m^3 at receptors E1 (SSSI Inner Thames Marshes), E3 (LNR-Rainham Marshes) and E7 (IBA – Thames Estuary and Marshes) which is 0.14% of the AQS.

All predicted daily mean NO_x PCs are below 1% of the daily mean AQS and are therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020).

All predicted NO_x daily mean PECs are significantly below the 24-hour mean AQS of75µg/m^3) at all sensitive ecological receptors considered.

The highest predicted daily mean PEC for NO_x was 32.03µg/m^3 at receptors E1 (SSSI Inner Thames Marshes) and E7 (IBA – Thames Estuary and Marshes), which is 42.71% of the AQS.

5.2.2 Concentration of Sulphur Dioxide (SO_2)

Model predicted 2020 annual mean SO_2 concentrations at each specified ecological receptor are presented in **Appendix B Table B-7**.

The maximum predicted annual mean SO_2 PC is 0.018µg/m^3 at receptors E1 (SSSI – Inner Thames Marshes), and E7 (IBA – Thames Estuary and Marshes) which is 0.09% of the critical level of 20µg/m^3.

The predicted annual mean SO_2 PC at all specified ecological receptor locations is less than 1% of the critical level and therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) applicable to SSSIs and local nature sites.

The contour map of Figure 12 shows the calculated annual mean SO_2 concentration as a percentage of the critical level across the entire study area. It can be seen that across the entire study area, and therefore at any LWS location that has not been modelled explicitly as a receptor, the predicted PC is less than 100% of the critical level and therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) at all conservation sites.

Based on the calculated PCs screening out of further assessment, it is not necessary to consider the PECs, however, these have been calculated at the specified ecological receptor locations. The maximum PEC was 11.5µg/m^3 predicted at E9, (an area of Deciduous Woodland), which is 57.5% of the critical level.

5.2.3 Nutrient Nitrogen Deposition

Nutrient nitrogen deposition was calculated at each of the specified ecological receptors using the AQTAG method described in Section 4.5.1.

5.2.3.1 Assessment at SSSIs

For the each SSSI, (E1 and E2), the Air Pollution Information System (APIS) (http://www.apis.ac.uk/), provides the site interest features, listed in order of sensitivity to nitrogen, and information on what critical load to use in impact assessments.

For E1 – Upper Thames Marshes, the interest features are:

- Vascular plant assemblage

- Anas crecca – Teal
- Invertebrate assemblage and
- Lowland damp grasslands.

The only feature for which a critical load range is presented for nutrient nitrogen deposition is Anas crecca-Teal, for non-breeding birds with a broad habitat type of littoral sediment. The empirical critical load is 20-30 kg N/ha/yr.

E1 is the closest point of the SSSI to the Installation, where the maximum PC within the SSSI is predicted. The nutrient nitrogen deposition PC at E1 was therefore calculated and presented as a percentage of the lower value of 20 kg N/ha/yr of the empirical critical load specified by APIS to provide a conservative assessment. The predicted PC nutrient nitrogen deposition at E1 was 0.0144kg N/ha/yr which is 0.07% of the conservative critical load. At less than 1% of the conservative critical load the PC is therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) applicable to SSSIs.

For E2 - Ingrebourne Marshes, the interest features are:

- Fen, marsh and swamp (Phragmites australis swamp and reed-beds)
- Fen, marsh and swamp (Glyceria maxima swamp)
- Invertebrate assemblage
- Lowland open water and their margins

The only feature for which a critical load range is presented for nutrient nitrogen deposition is Fen, marsh and swamp (Phragmites australis swamp and reed-beds). The empirical critical load is 15-30 kg N/ha/yr.

E2 is the closest point of the SSSI to the Installation, where the maximum PC within the SSSI is predicted. The nutrient nitrogen deposition PC at E2 was therefore calculated and presented as a percentage of the lower value of 15 kg N/ha/yr of the empirical critical load specified by APIS to provide a conservative assessment. The predicted PC nutrient nitrogen deposition at E2 was 0.0043 kg N/ha/yr which is 0.03% of the critical load. At less than 1% of the conservative critical load, the PC is therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) applicable to SSSIs.

5.2.3.2 Assessment at LNRs, IBA and Deciduous Woodland

Receptors E2-E9 represent the closest point of specified local nature sites to the Installation. For any given grid reference, APIS does not provide a list of interest features or habitats present; however, it provides indicative values within critical load ranges for use in air pollution impact assessments for all habitat types (http://www.apis.ac.uk/indicative-critical-load-values). A review of this guidance demonstrated that the lowest value to use at the screening stage of an assessment across all habitats is 5kg N/ha/yr, the maximum is 30kg N/ha/yr and an average value is 10kg N/ha/yr.

For the purposes of this assessment to screen for the potential effects of the PC on nutrient nitrogen deposition, the PC has been calculated at each receptor and presented as a percentage of each of the low, medium and high critical loads to assess for potential risk to all habitat types that may be present within each local nature site.

The results are presented with those at the SSSIs in **Table B-7.** The nutrient nitrogen deposition PC is significantly below 100 % (<1%) of each critical load value at the local nature sites and as is therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) applicable to local nature sites.

The contour maps in Figures 13, 14 and 15 present the calculated PC across the entire study area as a percentage of the average, low and high critical load values respectively, and therefore encompass all LWS within 2km of the Installation that were not modelled explicitly. It can be seen that the nutrient nitrogen deposition PC is significantly below 100 % of each critical load value across the entire study area and therefore at all local nature sites and as considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) applicable to local nature sites.

5.2.4 Acid Deposition

Acid deposition was calculated at each of the specified ecological receptors using the AQTAG method described in Section 4.5.2.

5.2.4.1 Assessment at SSSIs

For the each SSSI, (E1 and E2), APIS provides the site interest features, listed in order of sensitivity to acidity and information on what critical load to use in impact assessments.

For E1 – Upper Thames Marshes, the interest features are:

- Vascular plant assemblage
- Anas crecca – Teal
- Invertebrate assemblage and
- Lowland damp grasslands.

There are no acidity critical loads provided for any feature and it is noted that for Anas crecca-Teal, there is *"no expected negative impact on the species due to impacts on the species' broad habitat."*

For E2 - Ingrebourne Marshes, the interest features are:

- Fen, marsh and swamp (Phragmites australis swamp and reed-beds)
- Fen, marsh and swamp (Glyceria maxima swamp)
- Invertebrate assemblage
- Lowland open water and their margins

There are no acidity critical loads provided for any feature and it is noted that for the two Fen, marsh and swamp feature classes that the habitat is not sensitive to acidification.

In order to screen the impacts of the PC acid deposition, the following data were downloaded from APIS for the 5km^2 grid square centred on OS coordinate 552500, 182500 which covers the site, the entire study area and specified receptors:

- Current Acid Deposition for N and S in keq/ha/yr
- Critical Load Values (CLmaxS, CLminN and CLmaxN) for each habitat in the APIS list in keq/ha/yr

The critical load values are presented in **Table B-9** for each habitat.

The APIS Critical Load Function Tool guidance (http://www.apis.ac.uk/clf-guidance) provides an equation to calculate the PC as a percentage of the critical load function depending on whether or not the PEC N Deposition is above or below the value of CLminN.

The PEC N Deposition was calculated at each specified ecological receptor by adding the PC N deposition to the current N deposition and comparing with the lowest value of CLminN across all the habitats, which was 0.321 keq/ha/yr for Bogs as shown in **Table B-10.** The maximum PEC N Deposition is 1.31 keq/ha/yr and therefore above the most stringent CLminN. In accordance with APIS guidance, the following equation applies for the assessment of the PC against the critical load function:

Where PEC N Deposition > CLmin N:

*PC as % of Critical Load Function = ((PC of S+N deposition)/CLmaxN)*100*

The acid deposition PC as a percentage of the critical load function has been calculated by applying the most stringent of the CLmaxN values for all habitats which is 0.49 keq/ha/yr for Bogs. The results are shown in **Table B-10.**

The calculation shows that the PC acid deposition is less than 1% of the critical load function at specified SSSI receptors and is therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) applicable to SSSIs.

5.2.4.2 Assessment at LNRs, IBA and Deciduous Woodland

The assessment of the acid deposition PC as a percentage of the critical load function has been carried out for receptors E2-E9 which represent the closest point of specified local nature sites to the Installation. The results in **Table B-10** show that the PC acid deposition is less than 100% of the critical load function at each receptor and is therefore considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) applicable to local nature sites.

The acid deposition PC was calculated at every receptor across the 2km^2 grid and the values are presented in the contour map of Figure 16.

The contour map in Figures 16 presents the calculated acid deposition PC across the entire study area as a percentage of the most stringent CLmaxN across the study area, and therefore encompasses all LWS within 2km of the Installation that were not modelled explicitly. It can be seen that the acid deposition PC is significantly below 100 % (<20%) of the most conservative critical load function across the entire study area and therefore at all local nature sites and as is considered ***insignificant*** as per the EA guidance (EA & Defra, 2020) applicable to local nature sites.

6. Conclusions

This report is the AQIA undertaken to assess the potential impact the operation of a new LPG boiler (the "Installation") at the Sharpsmart Ltd waste processing facility in Rainham, London, could have on local air quality and nearby sensitive receptor locations.

The AQIA involved a detailed dispersion modelling study using the modelling software ADMS-5 to predict concentrations of NO_x, NO_2 and SO_2 within the study area as a result of the operation of the Installation.

The AQIA predicted that the annual mean and daily mean PCs for NO_2 and SO_2 respectively at relevant human receptors will be below the EA criteria of 1% of the relevant long-term environmental assessment levels and are therefore concluded to be ***insignificant***.

The AQIA predicted that the short-term PCs of NO_2 and SO_2 at all human receptors will be below the EA criteria of 10% of the relevant short-term environmental assessment levels and are therefore concluded to be ***insignificant***.

Predicted long-term and short-term PECs for NO_2 and SO_2 at all human receptors are significantly below the relevant AQSs.

The AQIA predicted the annual mean PCs of NO_x and SO_2 at SSSI sites and all local nature sites to be below the EA criteria of 1% and 100% of the long-term critical levels respectively. The predicted effects are therefore concluded to be ***insignificant***.

The AQIA also predicted the daily mean PECs of NO_x at all specified ecological receptors to be significantly below the daily mean critical level of 75µg/m^3).

The AQIA predicted the PC of nutrient nitrogen deposition at SSSI sites and all local nature sites to be below the EA criteria of 1% and 100% of the low, average and high critical loads respectively. The predicted effects of the Installation on nitrogen nutrient deposition within the study area are therefore concluded to be ***insignificant***.

The AQIA predicted the PC of acid deposition at SSSI sites and all local nature sites to be below the EA criteria of 1% and 100% of the most stringent critical load function across the study area respectively. The predicted effects of the Installation on acid deposition within the study area are therefore concluded to be ***insignificant***.

The overall effect of the Installation operating at MCPD ELVS on local air quality and sensitive habitats is therefore concluded to be ***insignificant***.

7. References

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Figures

N

Boiler Stack

WAY

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KEY

Site Boundary

Boiler Stack

Not To Same Scale

0 20 40 m

Scale 1:800 @ A3

ITPENERGISED

Boiler Emissions Testing
Sharpsmart Limited Processing Facility
Rainham
Air Quality Impact Assessment
Figure 1
Site Location and Boiler Stack Location

Date:	Drawn by:	Checked by:	Version:
29/10/2020	CA	AD	V1

Project Number: 3701

N

E5
E8
R3
R7
E4
R4
E2
R5
R6
R2
R8
R1
E7
E3
E1
E6
E9

KEY

- Site Boundary
- Boiler Stack
- Human Receptor
- Ecological Receptor
- SSSI England
- Local Nature Reserves England
- IBAs UK

Radial Distances to Include Local Wildlife Sites (LWS)

- River Thames and Tidal Tributaries
- Riverside Sewage Treatment Works
- Lower River Beam and Ford Works Ditches
- Wennington Averley and Rainham Marshes
- Mudlands
- Rainham Railsides
- Ingrebourne Valley
- Dagenham Breach and the Lower Beam River in Dagenham
- Belvedere Dykes
- Beam Valley South in Havering
- Beam Valley South in Dagenham and the Wantz Stream
- Erith Marshes

0 300 600 m

Scale 1:15,000 @ A3

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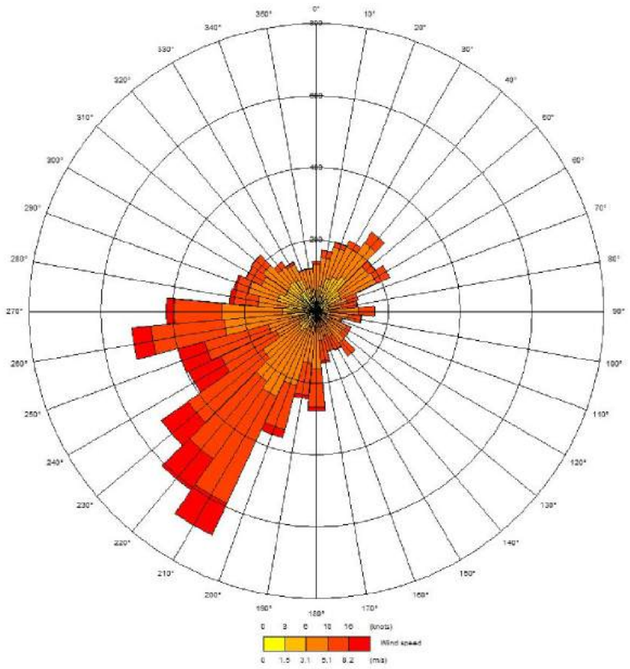
Boiler Emissions Testing
Sharpsmart Limited Processing Facility
Rainham
Air Quality Impact Assessment
Figure 2
Modelled Human and Ecological Receptors

Date: 13/01/2021	Drawn by: CA	Checked by: AD	Version: V2

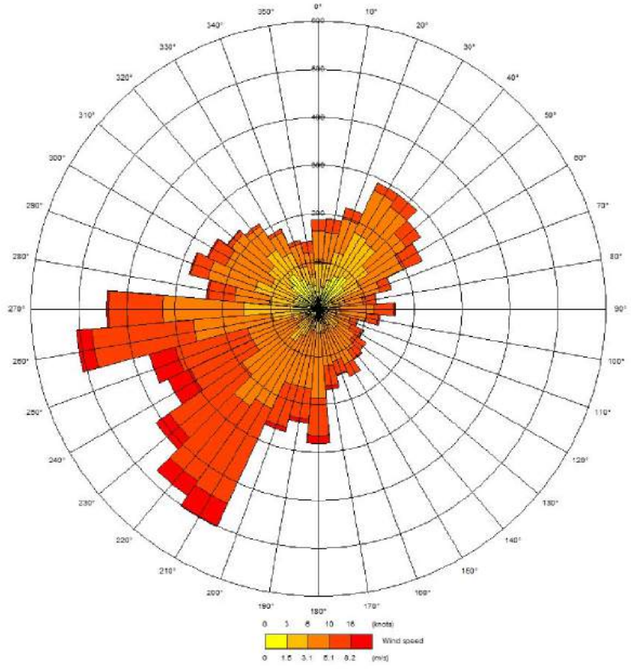
Project Number: 3701

N

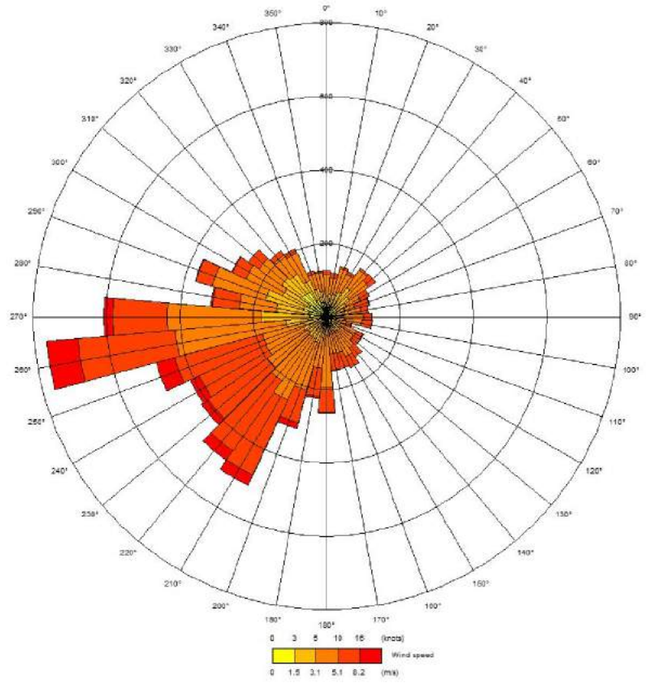
2015



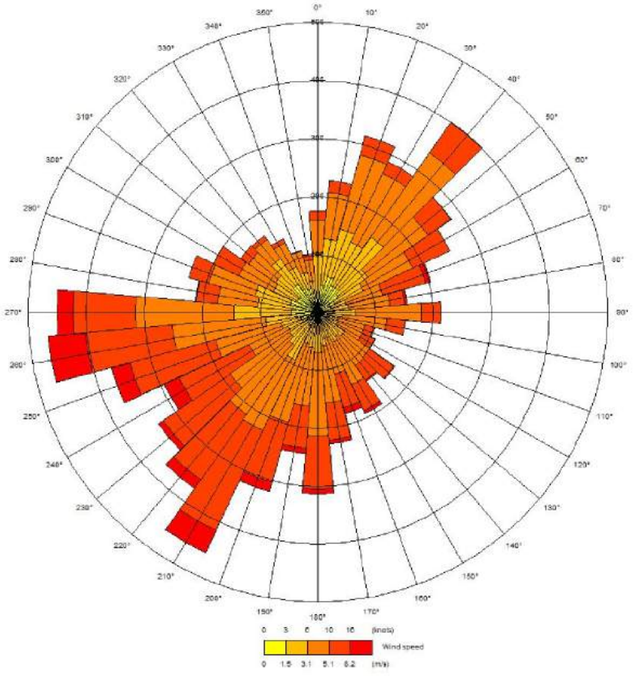
2016



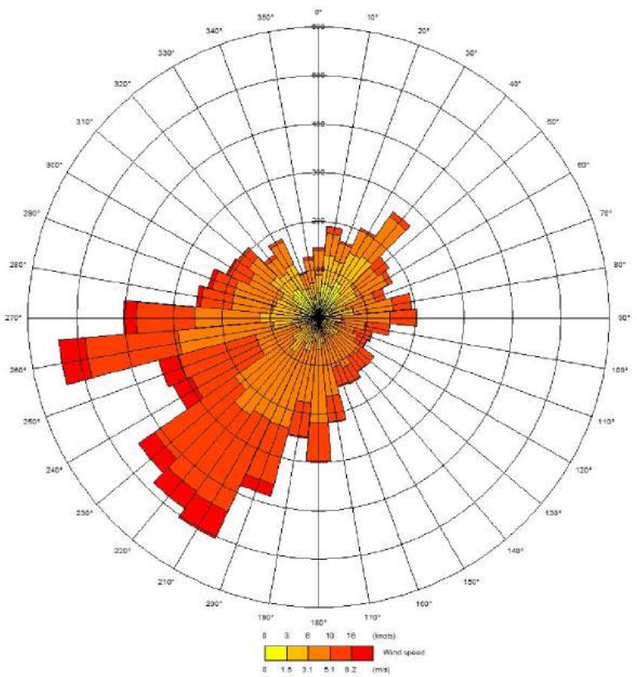
2017



2018



2019



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Boiler Emissions Testing
Sharpsmart Limited Processing Facility
Rainham
Air Quality Impact Assessment

Figure 3

Heathrow Airport Wind Roses: 2015 - 2019

Date:	Drawn by:	Checked by:	Version:
29/10/2020	CA	AD	V1

Project Number: 3701

KEY

- Site Boundary
- Boiler Stack
- Modelled Buildings

0 25 50 m

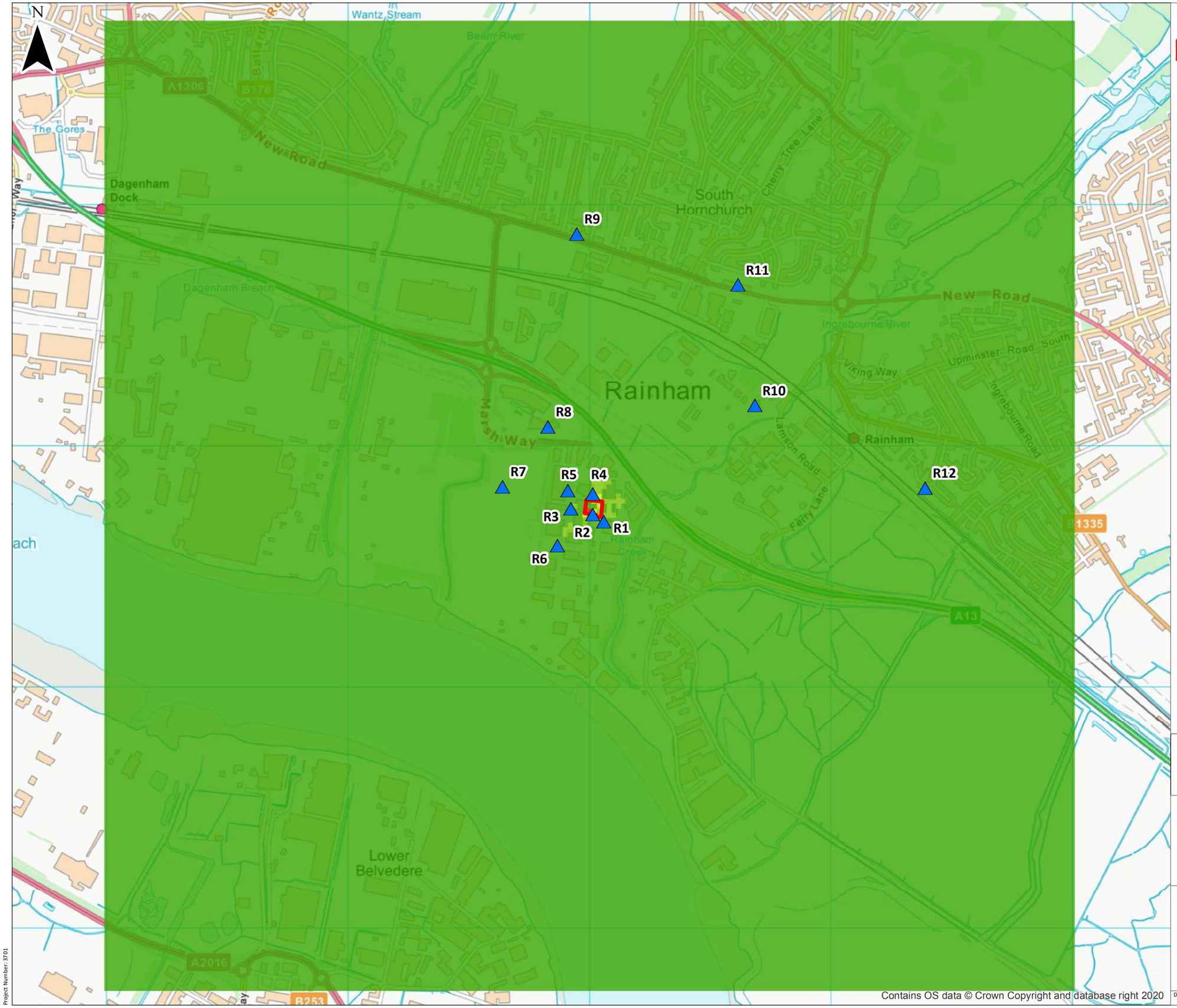
Scale 1:1,500 @ A3

ITPENERGISED

Boiler Emissions Testing
Sharpsmart Limited Processing Facility
Rainham
Air Quality Impact Assessment
Figure 4
Modelled Buildings

Date:	Drawn by:	Checked by:	Version:
13/01/2021	CA	AD	V1

Project Number: 3701



KEY

- Site Boundary
- Human Receptor

NO_2 PC Concentration

µg/m^3

- 0 - 0.4 (<1% of AQS)
- 0.4 - 0.8 (1-2% of AQS)
- 0.8 - 1.2 (2-3% of AQS)
- 1.2 - 1.6 (3-4% of AQS)
- 1.6-2 (4-5% of AQS)
- 2-2.6 (>5% of AQS)

0 300 600 m

Scale 1:15,000 @ A3

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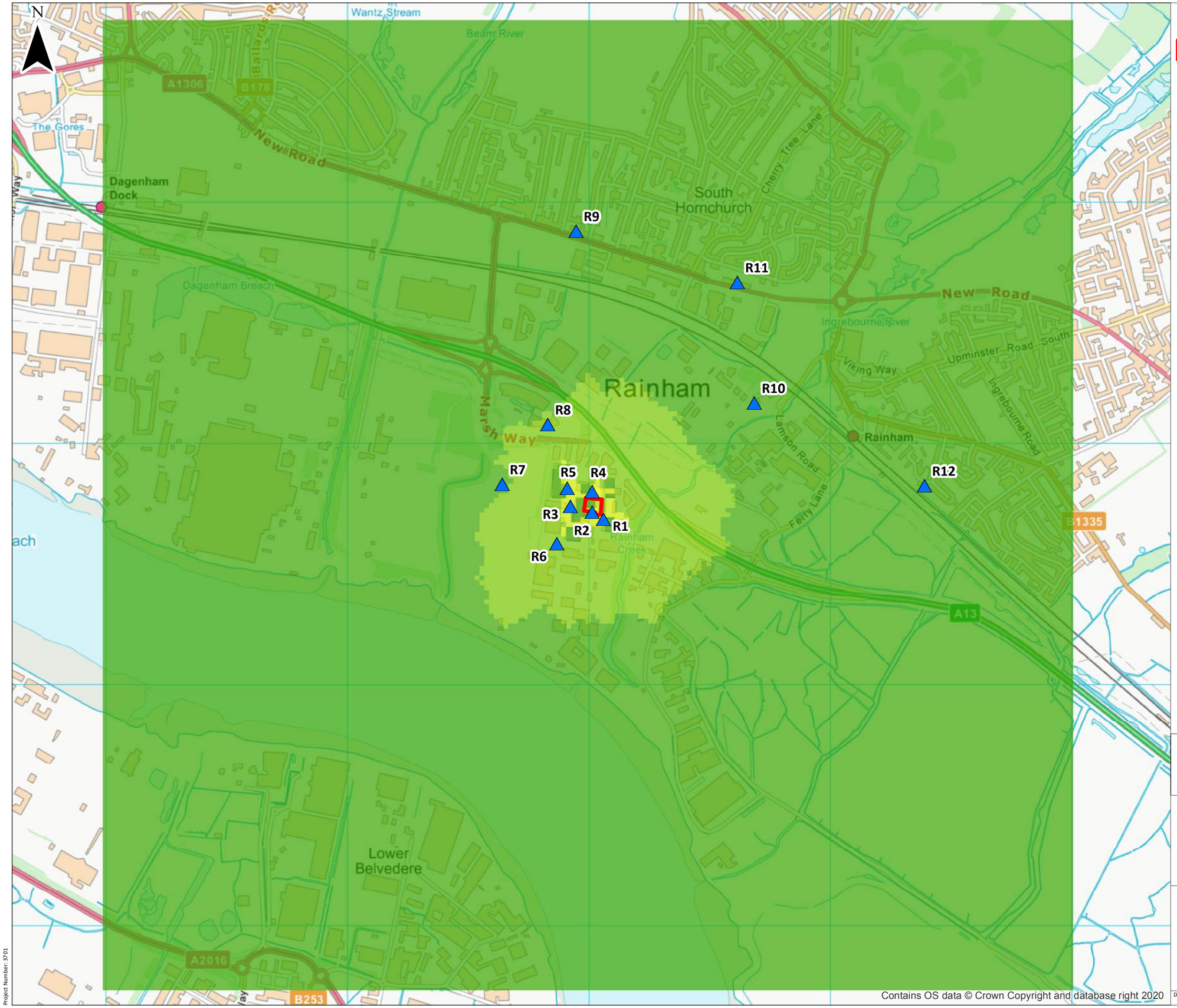
Boiler Emissions Testing
Sharpsmart Limited Processing Facility
Rainham
Air Quality Impact Assessment

Figure 5

NO_2 Annual PC Mean Contour Plot (2017)

Date: 13/01/2021	Drawn by: CA	Checked by: AD	Version: V1

Project Number: 3701



KEY

- Site Boundary
- Human Receptor

99.79th Percentile of Hourly Mean NO_2 PC

µg/m³

- <1.0 (<0.5% of AQS)
- 1.0 - 5.0 (0.5 - 2.5% of AQS)
- 5.0 - 10.0 (2.5 - 5% of AQS)
- 10.0 - 15.0 (5 - 7.5% of AQS)
- 15.0 - 20.0 (7.5 - 10% of AQS)
- >20.0 (>10% of AQS)

0 300 600 m

Scale 1:15,000 @ A3

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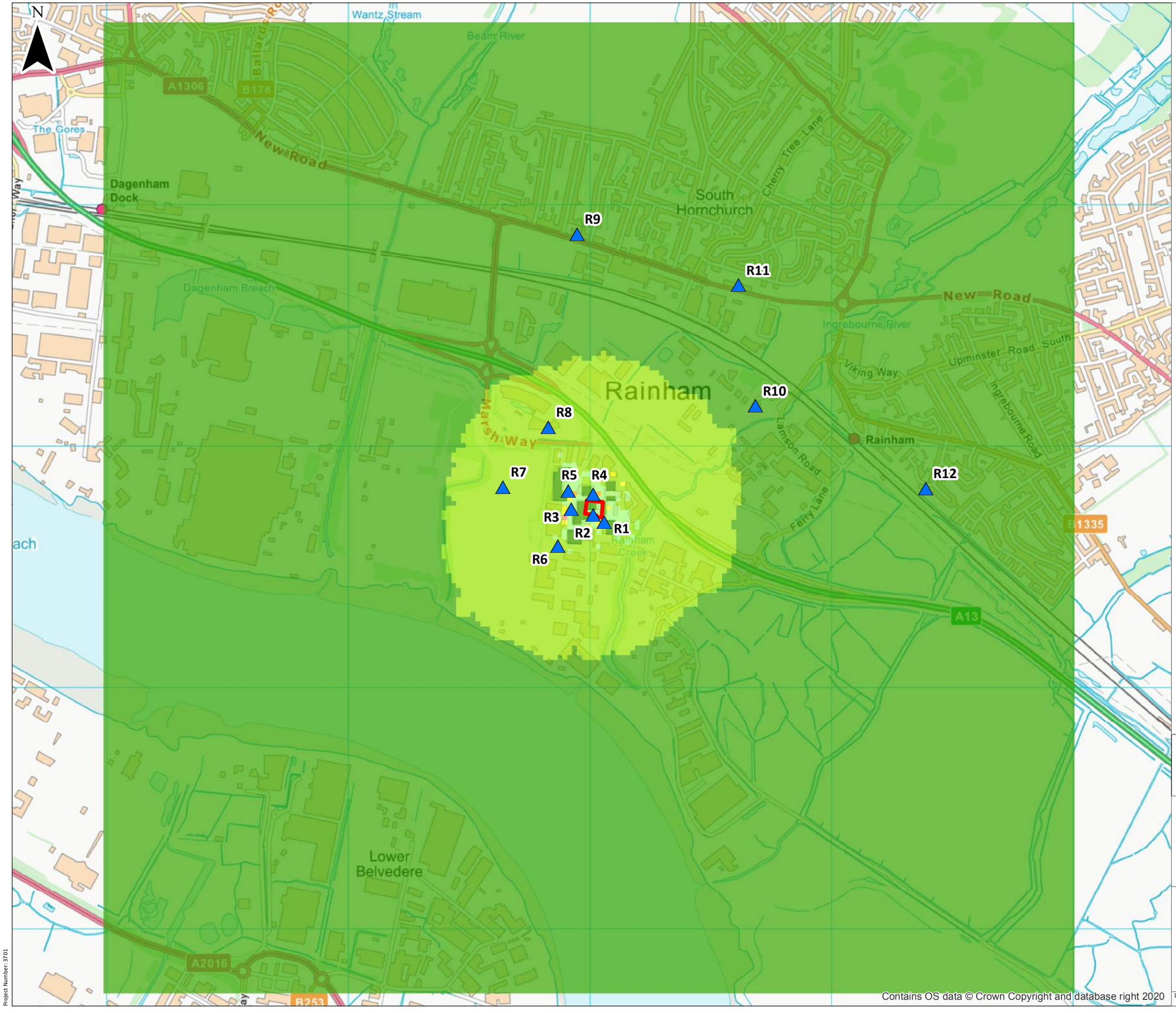
Boiler Emissions Testing
Sharpsmart Limited Processing Facility
Rainham
Air Quality Impact Assessment

Figure 6 - 99.79th Percentile of Hourly Mean NO_2 PC Contour Plot (2017)

Date:	Drawn by:	Checked by:	Version:
13/01/2021	CA	AD	V1

Project Number: 3701



KEY

- Site Boundary
- Human Receptor

100th Percentile of Hourly Mean NO_2 PC

µg/m³

- <1.0 (<0.5% of AQS)
- 1.0 - 5.0 (0.5 - 2.5% of AQS)
- 5.0 - 10.0 (2.5 - 5% of AQS)
- 10.0 - 15.0 (5 - 7.5% of AQS)
- 15.0 - 20.0 (7.5 - 10% of AQS)
- 20.0 - 25.0 (10 - 12.5% of AQS)
- >25.0 (>12.5% of AQS)

0 300 600 m

Scale 1:15,000 @ A3

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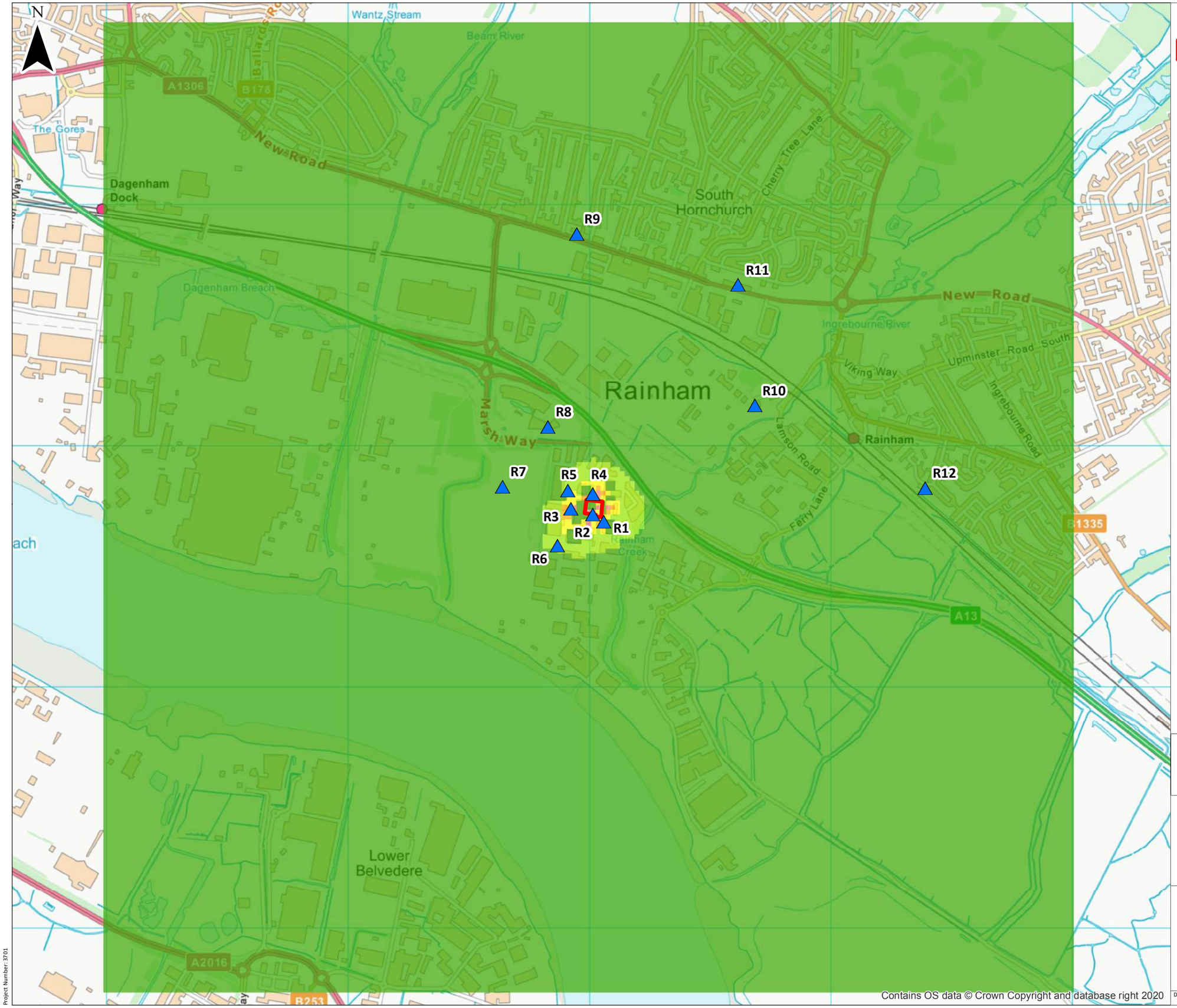
Boiler Emissions Testing
Sharpsmart Limited Processing Facility
Rainham
Air Quality Impact Assessment
Figure 7 - 100th Percentile of Hourly Mean NO_2 PC Contour Plot (2017)

Date:	Drawn by:	Checked by:	Version:
13/01/2021	CA	AD	V1

Project Number: 3701



KEY

- Site Boundary
- Human Receptor

99.2nd Percentile of Daily Mean SO_2 PC

µg/m³

- <0.5 (<0.4% of AQS)
- 0.5 - 1.0 (0.4 - 0.8% of AQS)
- 1.0 - 1.25 (0.8 - 1% of AQS)
- 1.25 - 1.5 (1 - 1.2% of AQS)
- 1.5 - 2.0 (1.2 - 1.6% of AQS)
- >2.0 (>1.6% of AQS)

0 300 600 m

Scale 1:15,000 @ A3

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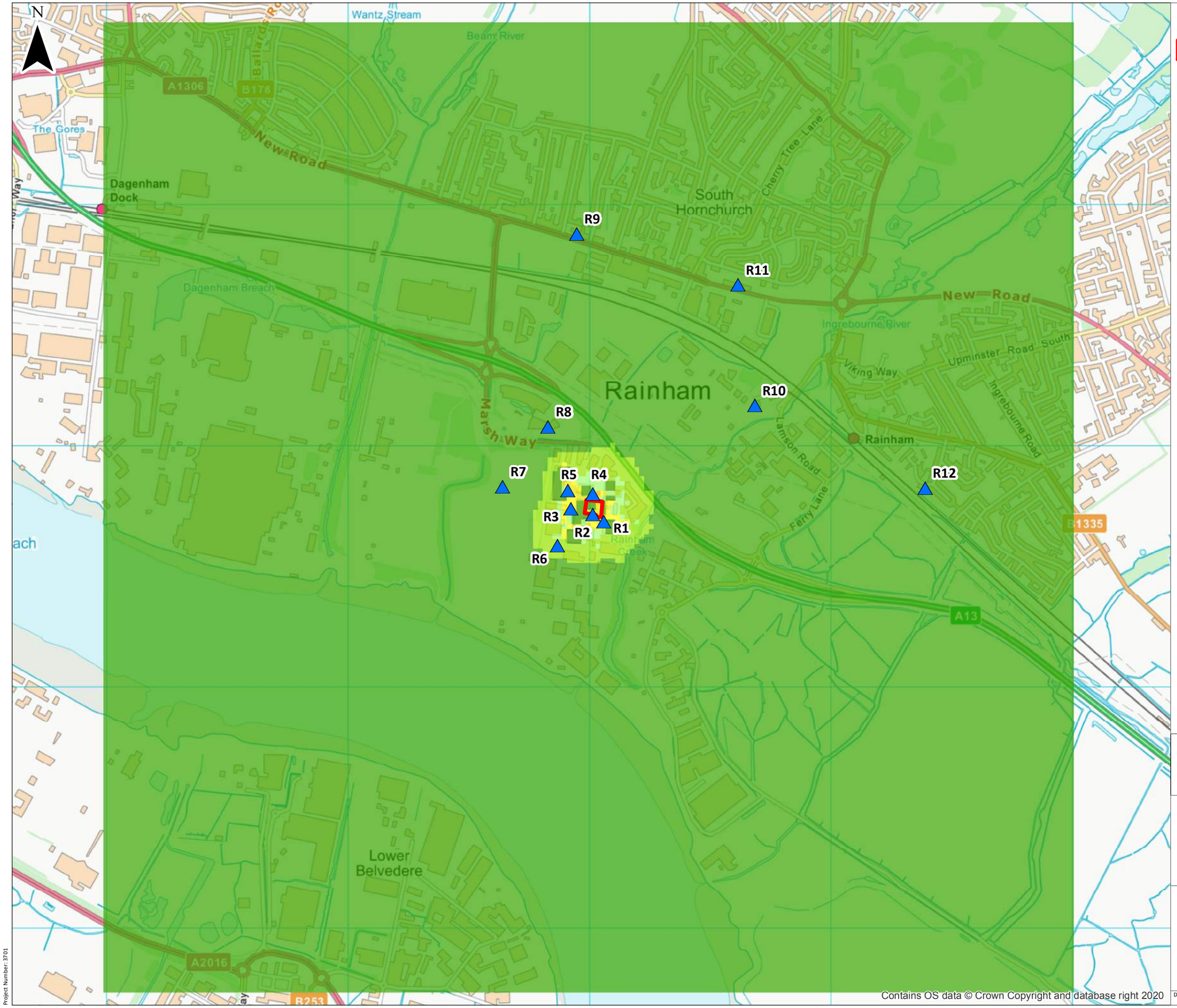
Rainham
Air Quality Impact Assessment

Figure 8 - 99.2nd Percentile of Daily Mean SO_2 PC Contour Plot (2017)

Date: 13/01/2021	Drawn by: CA	Checked by: AD	Version: V1

Project Number: 3701



KEY

- Site Boundary
- Human Receptor

99.7th Percentile of Hourly Mean SO_2 PC

µg/m³

- <0.875 (<0.25% of AQS)
- 0.875 - 1.75 (0.25 - 0.5% of AQS)
- 1.75 - 2.625 (0.5 - 0.75% of AQS)
- 2.625 - 3.5 (0.75 - 1% of AQS)
- 3.5 - 4.375 (1 - 1.25% of AQS)
- 4.375 - 5.25 (1.25 - 1.5% of AQS)
- 5.25 - 35 (1.5 - 10% of AQS)
- >35 (>10% of AQS)

0 300 600 m

Scale 1:15,000 @ A3

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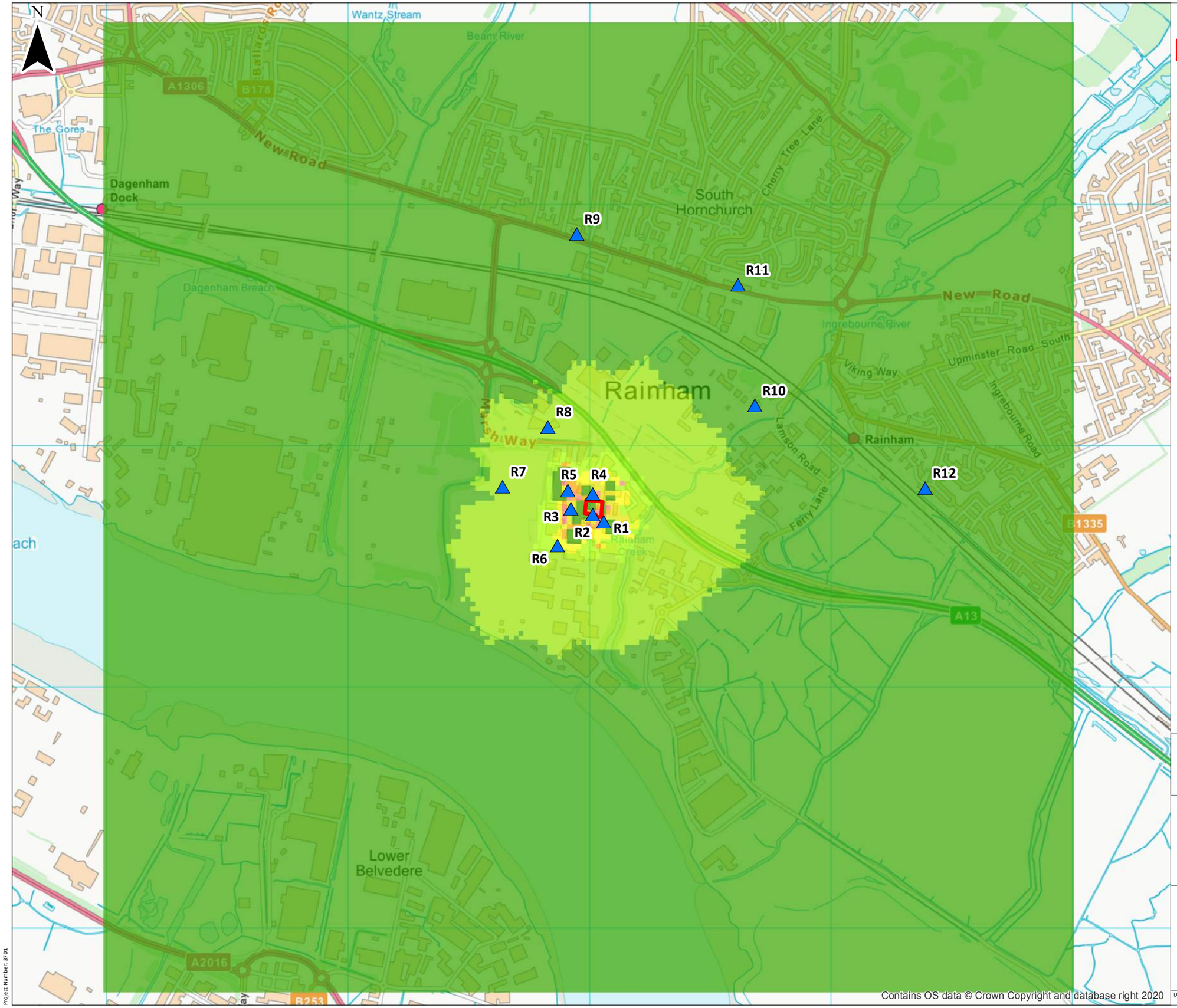
Boiler Emissions Testing
Sharpsmart Limited Processing Facility
Rainham
Air Quality Impact Assessment

Figure 9 - 99.7th Percentile of Hourly Mean SO_2 PC Contour Plot (2017)

Date: 13/01/2021	Drawn by: CA	Checked by: AD	Version: V1

Project Number: 3701



KEY

- Site Boundary
- Human Receptor

99.9th Percentile of 15 Minute Mean SO_2 PC µg/m³

- <0.665 (<0.25% of AQS)
- 0.665 - 1.33 (0.25 - 0.5% of AQS)
- 1.33 - 1.995 (0.5 - 0.75% of AQS)
- 1.995 - 2.66 (0.75 - 1% of AQS)
- 2.66 - 3.325 (1 - 1.25% of AQS)
- 3.325 - 3.99 (1.25 - 1.5% of AQS)
- 3.99 - 26.6 (1.5 - 10% of AQS)
- >26.6 (>10% of AQS)

0 300 600 m

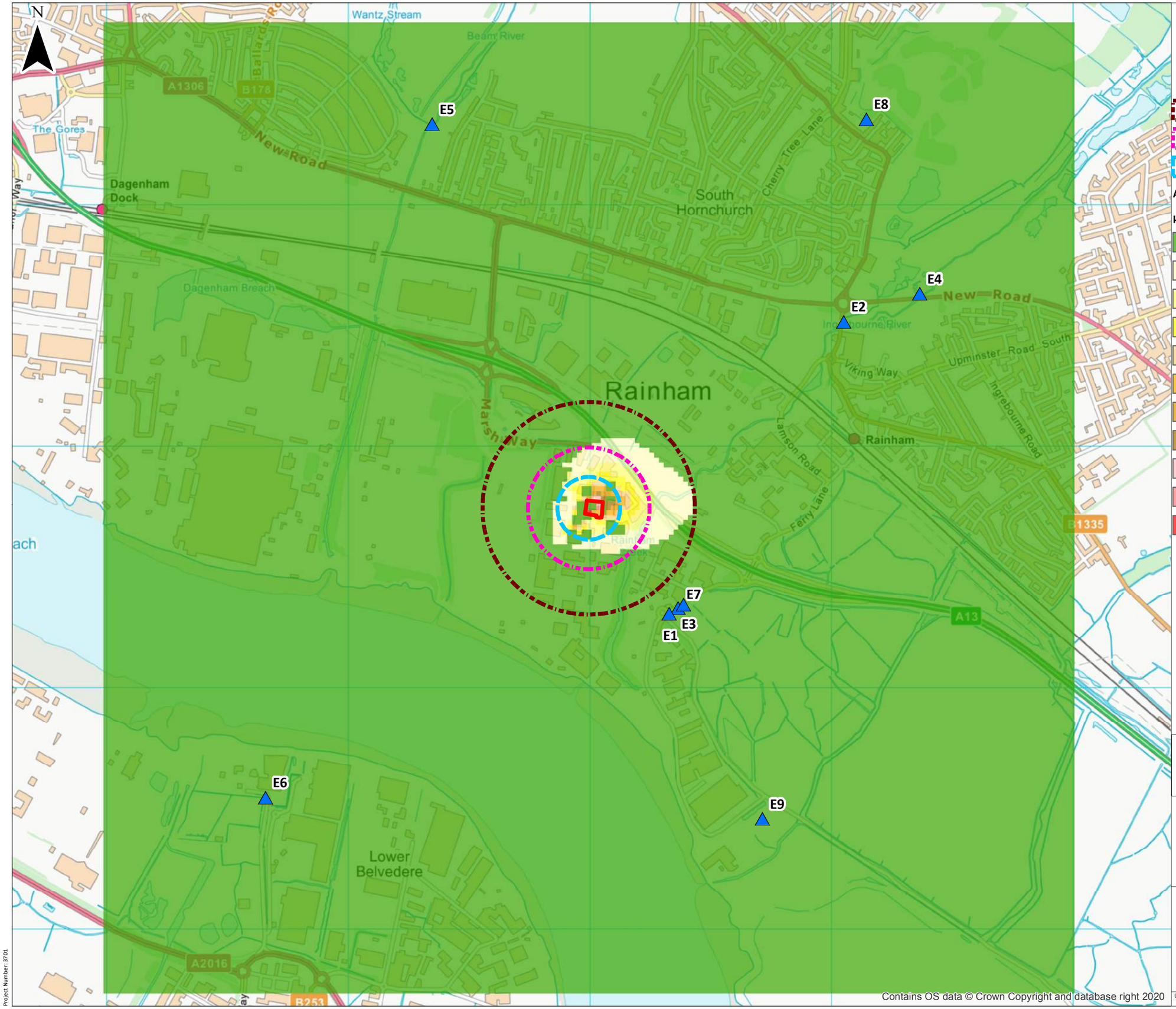
Scale 1:15,000 @ A3

ITPENERGISED

Boiler Emissions Testing
Sharpsmart Limited Processing Facility
Rainham
Air Quality Impact Assessment
Figure 10 - 99.9th Percentile of 15 Minute Mean SO_2 PC Contour Plot (2017)

Date:	Drawn by:	Checked by:	Version:
13/01/2021	CA	AD	V1

Project Number: 3701



KEY

- Site Boundary
- Ecological Receptor
- Lower River Beam and Ford Works Ditches
- Riverside Sewage Treatment Works
- River Thames and Tidal Tributaries Buffer

Annual Mean NO_x PC

µg/m³

- <0.3 (<1% of Critical Level)
- 0.3 - 0.6 (1 - 2% of Critical Level)
- 0.6 - 0.9 (2 - 3% of Critical Level)
- 0.9 - 1.2 (3 - 4% of Critical Level)
- 1.2 - 1.5 (4 - 5% of Critical Level)
- 1.5 - 1.8 (5 - 6% of Critical Level)
- 1.8 - 2.1 (6 - 7% of Critical Level)
- 2.1 - 2.4 (7 - 8% of Critical Level)
- 2.4 - 2.7 (8 - 9% of Critical Level)
- 2.7 - 3 (9 - 10% of Critical Level)
- >3 (>10% of Critical Level)

0 300 600 m

Scale 1:15,000 @ A3

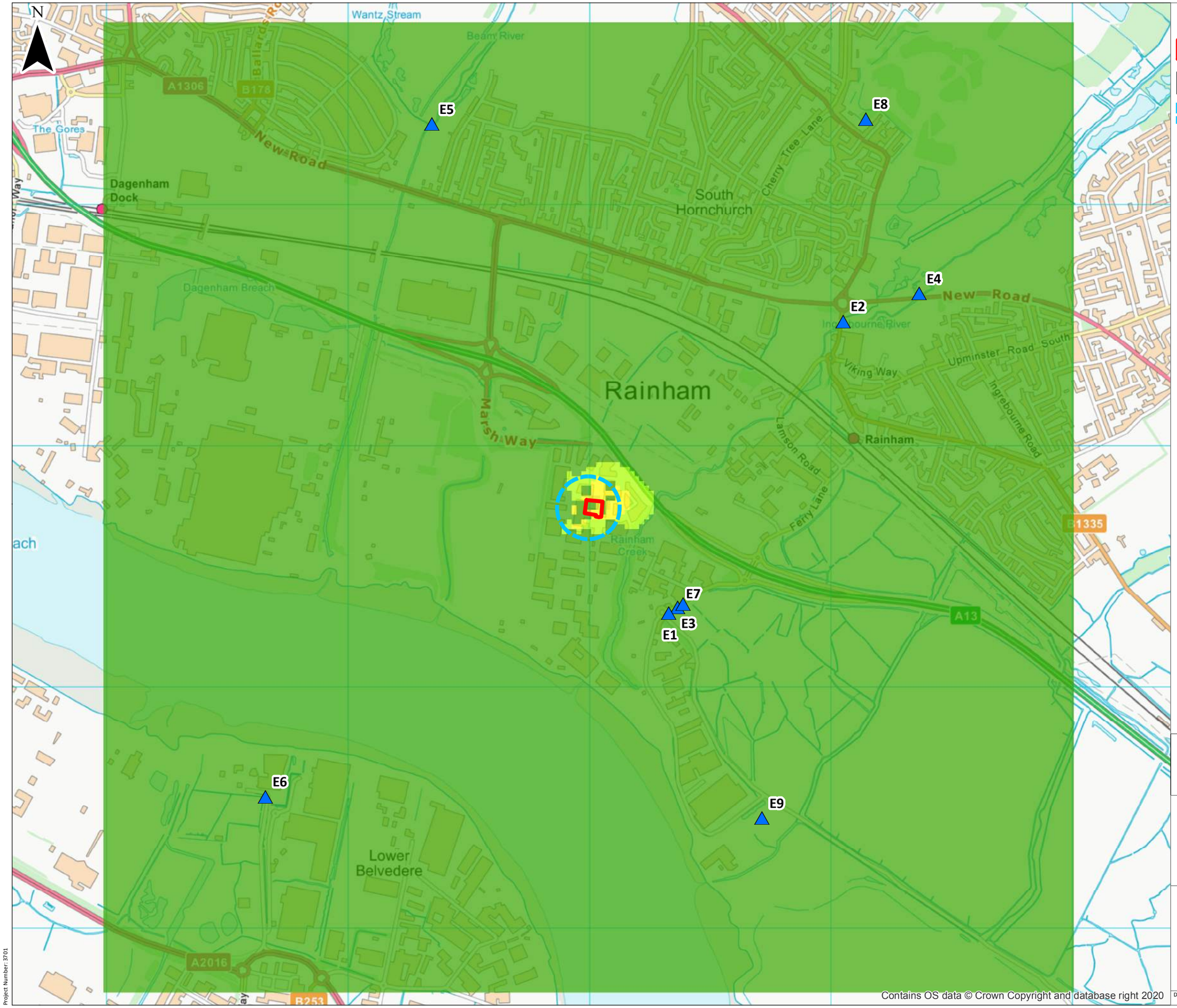
ITPENERGISED

Sharpsmart Limited Processing Facility
Rainham
Air Quality Impact Assessment

Figure 11 - NOx Concentration PC as percentage of Critical Level of 30ug/m3

Date:	Drawn by:	Checked by:	Version:
13/01/2021	CA	AD	V1

Project Number: 3701



KEY

- Site Boundary
- Ecological Receptor
- River Thames and Tidal Tributaries Buffer

Annual Mean SO_2 PC

µg/m^3

- <0.1 (<0.5% of Critical Level)
- 0.1 - 0.2 (0.5 - 1% of Critical Level)
- 0.2 - 0.4 (1 - 2% of Critical Level)
- 0.4 - 0.6 (2 - 3% of Critical Level)
- 0.6 - 0.8 (3 - 4% of Critical Level)
- 0.8 - 1.0 (4 - 5% of Critical Level)
- >1.0 (>5% of Critical Level)

0 300 600 m

Scale 1:15,000 @ A3

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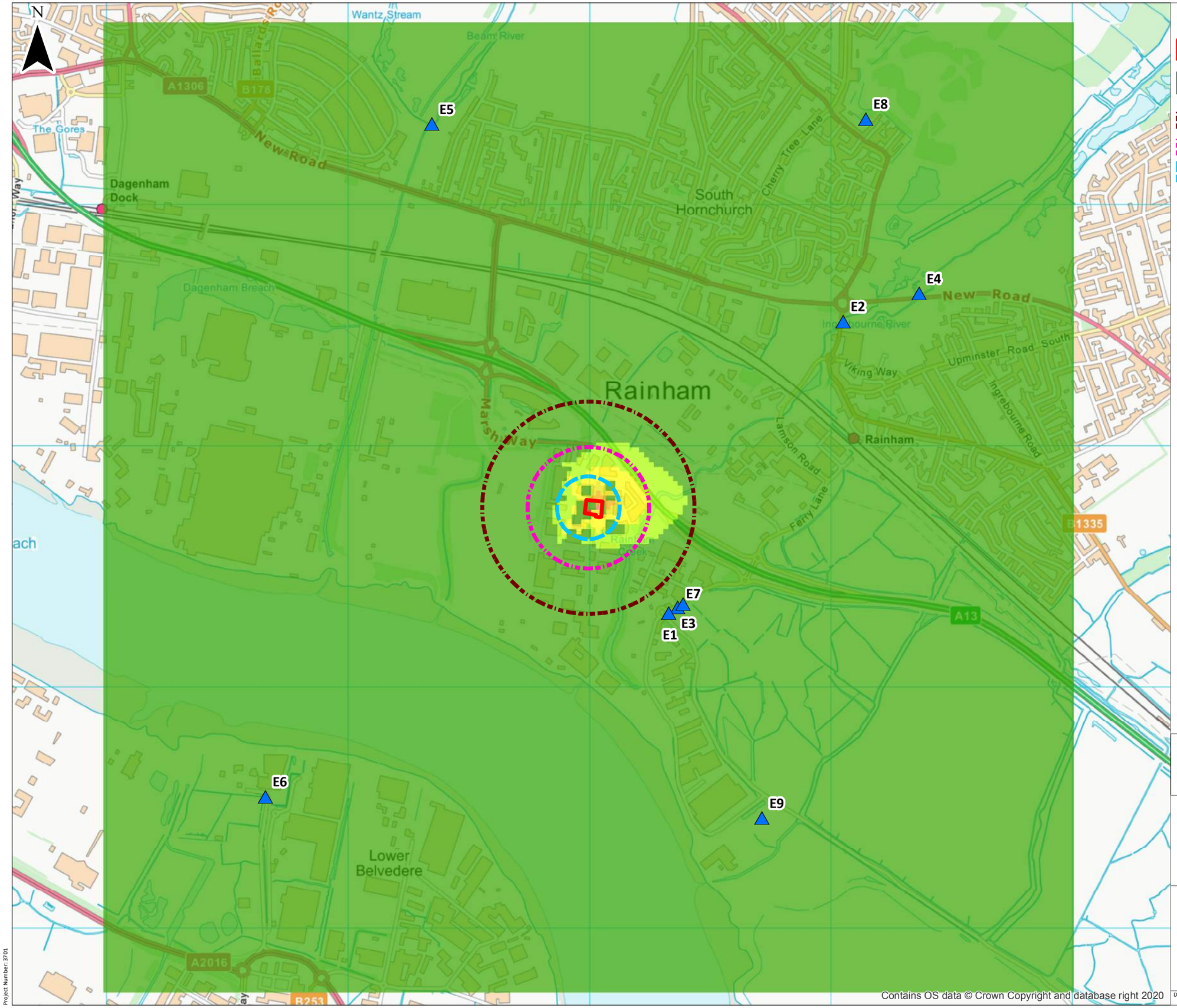
Boiler Emissions Testing
Sharpsmart Limited Processing Facility
Rainham - Air Quality Impact Assessment

Figure 12 - SO_2 Concentration PC (2017) as Percentage of Critical Level of 20µg/m^3

Date:	Drawn by:	Checked by:	Version:
13/01/2021	CA	AD	V1

Project Number: 3701



KEY

- Site Boundary
- Ecological Receptor
- Lower River Beam and Ford Works Ditches Buffer
- Riverside Sewage Treatment Works Buffer
- River Thames and Tidal Tributaries Buffer

Nitrogen Nutrient Deposition PC

kgN/ha/year

- <0.05 (<0.5% of Average Critical Load)
- 0.05 - 0.1 (0.5 -1% of Average Critical Load)
- 0.1 - 0.2 (1 - 2% of Average Critical Load)
- 0.2 - 0.3 (2 - 3% of Average Critical Load)
- 0.3 - 0.4 (3 - 4% of Average Critical Load)
- 0.4 - 0.5 (4 - 5% of Average Critical Load)
- >0.5 (>5% of Average Critical Load)

0 300 600 m

Scale 1:15,000 @ A3

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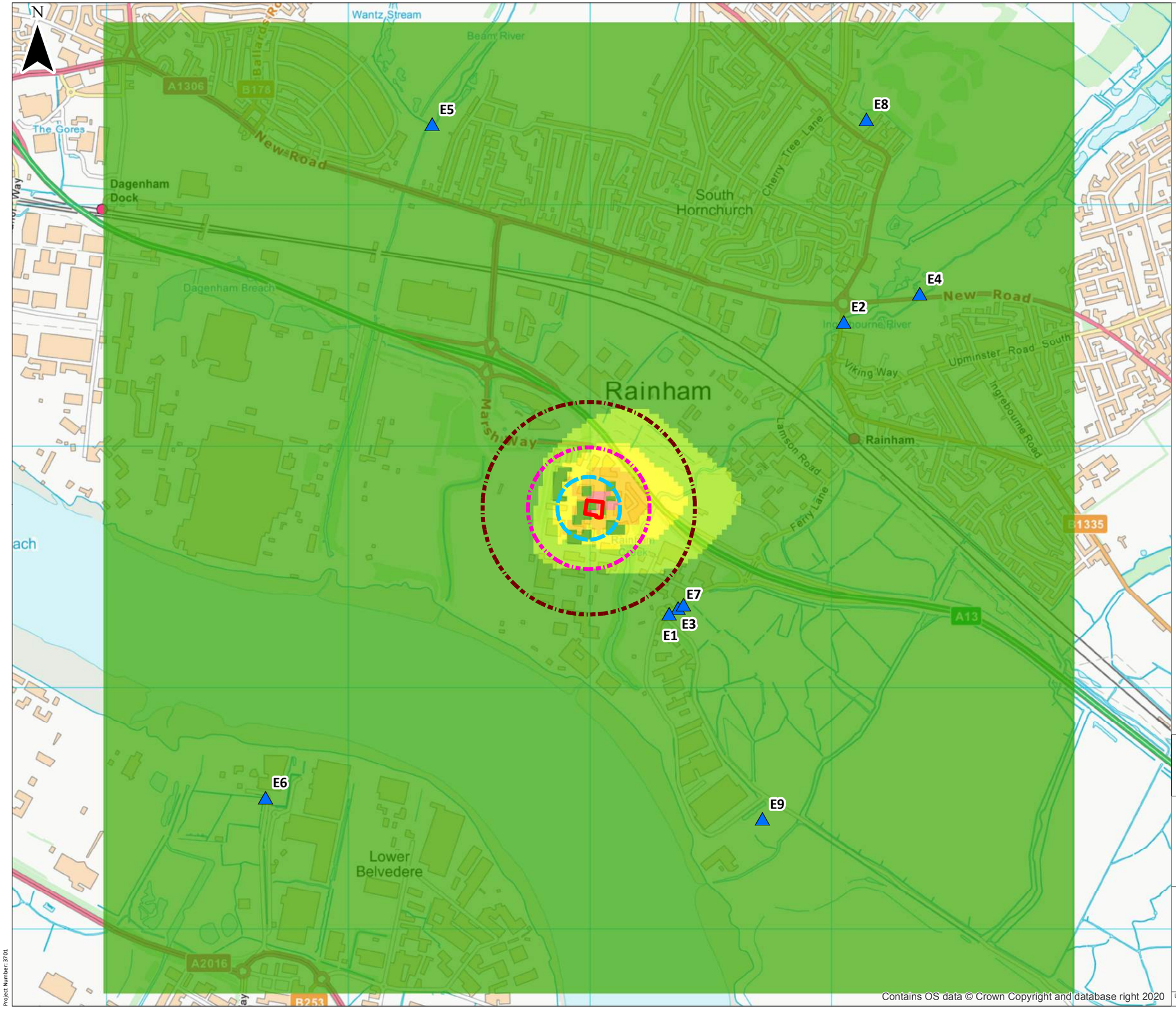
Rainham - Air Quality Impact Assessment

Figure 13

Nitrogen Nutrient Deposition PC (2017)
As Percentage of Average Critical Load of 10kgN/ha/yr

Date:	Drawn by:	Checked by:	Version:
13/01/2021	CA	AD	V1

Project Number: 3701



KEY

- Site Boundary
- Ecological Receptor
- Lower River Beam and Ford Works Ditches
- Riverside Sewage Treatment Works
- River Thames and Tidal Tributaries Buffer

Nitrogen Nutrient Deposition PC

kgN/ha/year

- <0.025 (<0.5% of Critical Load)
- 0.025 - 0.05 (<1% of Critical Load)
- 0.05 - 0.1 (1 - 2% of Critical Load)
- 0.1 - 0.25 (2 - 5% of Critical Load)
- 0.25 - 0.5 (5 -10% of Critical Load)
- >0.5 (>10% of Critical Load)

0 300 600 m

Scale 1:15,000 @ A3

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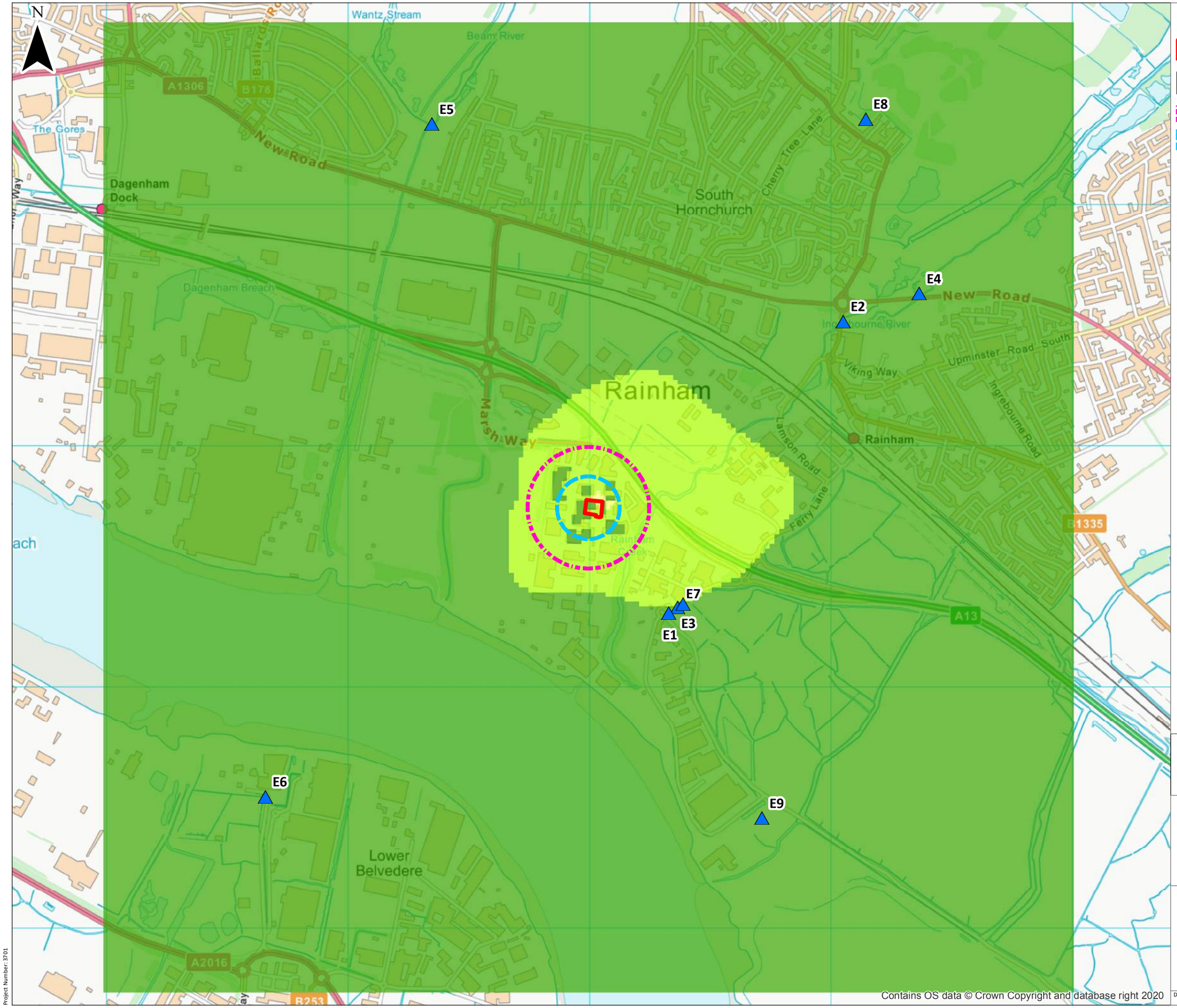
Sharpsmart Limited Processing Facility
Rainham - Air Quality Impact Assessment

Figure 14 - Nitrogen Nutrient Deposition PC Contour Plot (2017) As Percentage of Low Critical Load of 5 kgN/ha/yr

Date:	Drawn by:	Checked by:	Version:
13/01/2021	CA	AD	V1

Project Number: 3701



KEY

- Site Boundary
- Ecological Receptor
- Riverside Sewage Treatment Works
- River Thames and Tidal Tributaries Buffer

Nitrogen Nutrient Deposition PC

kgN/ha/year

- <0.015 (<0.5% of Critical Load)
- 0.015 - 0.3 (<1% of Critical Load)
- 0.3 - 0.4 (1 - 1.3% of Critical Load)
- 0.4 - 0.5 (1.3 - 1.7% of Critical Load)
- 0.5 - 1 (1.7 - 3.3% of Critical Load)
- 1 - 2 (3.3 - 6.7% of Critical Load)
- 2 - 3 (6.7 - 10% of Critical Load)
- >3 (>10% of Critical Load)

0 300 600 m

Scale 1:15,000 @ A3

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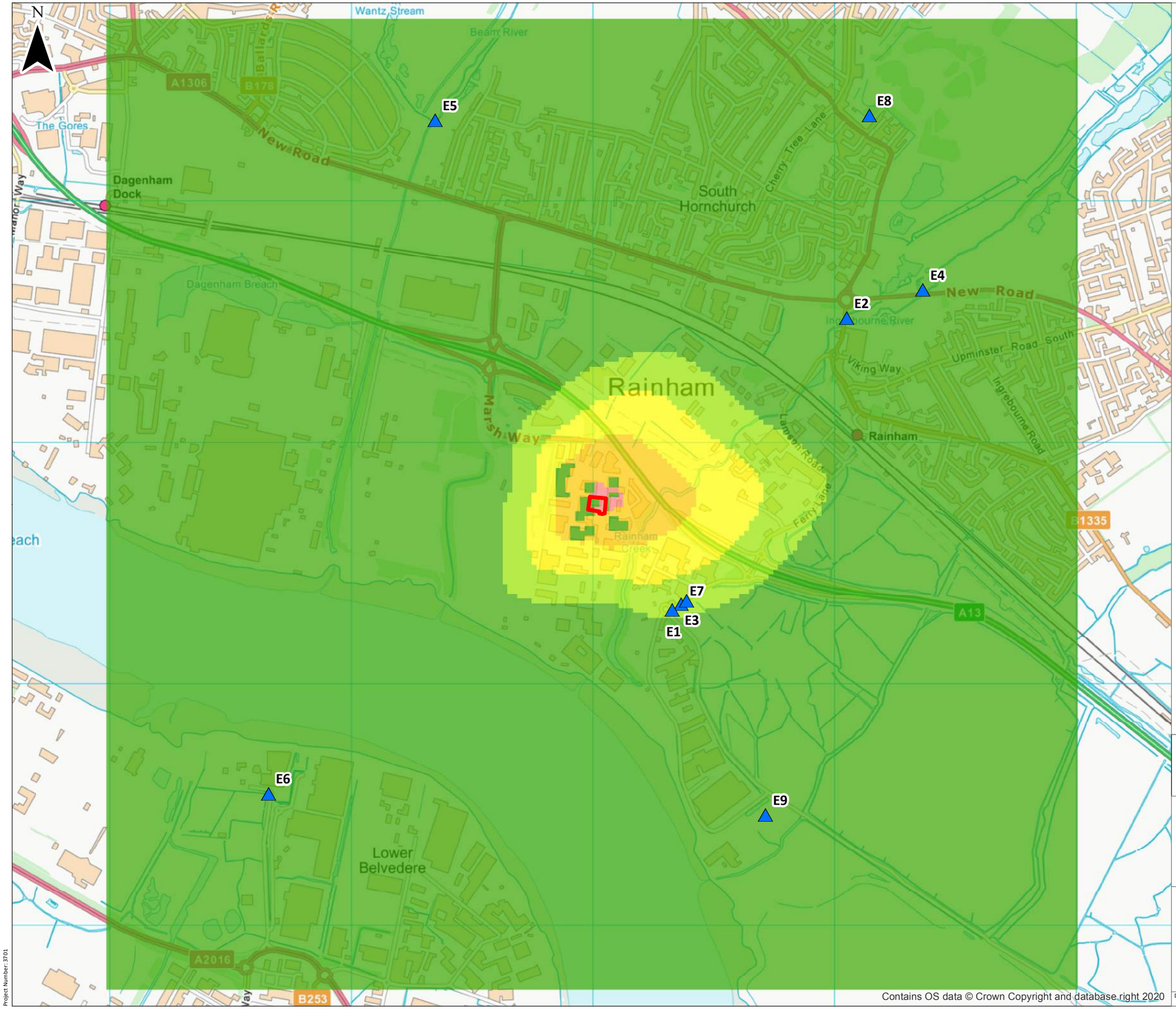
Sharpsmart Limited Processing Facility
Rainham - Air Quality Impact Assessment

Figure 15 - Nitrogen Nutrient Deposition PC Contour Plot (2017) As Percentage of High Critical Load of 30 kgN/ha/yr

Date:	Drawn by:	Checked by:	Version:
13/01/2021	CA	AD	V1

Project Number: 3701



KEY

- Site Boundary
- Ecological Receptor

Acid Deposition PC

keq/ha/yr

- <0.002415 (<0.5% of Critical Load)
- 0.002415 - 0.00483 (<1% of Critical Load)
- 0.00483 - 0.01 (1 - 2% of Critical Load)
- 0.01 - 0.05 (2 - 10% of Critical Load)
- 0.05 - 0.1 (10 - 20% of Critical Load)
- >0.1 (>20% of Critical Load)

0 300 600 m

Scale 1:15,000 @ A3

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Sharpsmart Limited Processing Facility
Rainham - Air Quality Impact Assessment
Figure 16 - Acid Deposition PC Contour Plot (2017) as a percentage of CLmaxN of 0.49 keq/ha/year across study area

Date:	Drawn by:	Checked by:	Version:
13/01/2021	CA	AD	V1

Project Number: 3701

Appendix A Emission Data Model Inputs and Monitoring Report

Table A-1 – Stack and Emission Data Model Inputs

Stack and Emission Parameters			
Grid Location (X & Y)	550996	&	181743
Stack Height (m)	2.2m above roof level		
Effective Internal Diameter (m)	0.356		
Stack Area (m^2)	0.1		
Normal Conditions			
Normal Temperature of Exhaust Gas (°C)	0	in K:	273.15
Normal % O_2	3		
Normal % H_2O	0		
Normal Volume Flow Rate (Nm^3/s)	0.431		
Normal Pollutant Emission Concentration (Nmg/m^3)			
NO_x	200		
SO_2	35		
Total Pollutant Mass Emission Rate (g/s)			
NO_x	0.086		
SO_2	0.015		
Actual Conditions			
Actual Exit Velocity (m/s)	9.5		
Actual Temperature of Exhaust Gas (°C)	180	in K:	453.15
Actual % O_2	5.9		
Actual % H_2O	10		
Actual Volume Flow Rate (m^3/s)	0.95		
Actual Pollutant Emission Concentration (mg/m^3)			
NO_x	90.9		
SO_2	15.9		
Total Pollutant Mass Emission Rate (g/s)			
NO_x	0.086		
SO_2	0.015		

Report for the Periodic Monitoring of Emissions to Air from the Babcock Wanson Boiler (LPG as Fuel) Located at Rainham Clinical Treatment Centre, Rainham site. Part 1: **Executive Summary** Permit Number: EPR/PP3707BB/T001 Operator: Sharpsmart Ltd Installation: Rainham - Babcock Wanson Boiler	MCERTS UKAS TESTING 4251

Monitoring dates:	24th October 2020
Job Number:	**R20471**
Version:	1
Address:	**Sharpsmart Ltd** Unit 44 Enterprise City Meadowfield Avenue Spennymoor County Durham, DL16 6JF
Monitoring Organisation:	**EnviroDat Ltd**
Address:	Cutbush Commercial Cutbush Lane East Reading, RG2 9AF
Date of Report:	26th October 2020
Report Approved By:	Yu Shen
MCERTS Registration Number:	MM 06 727 (Level II, TE1, 2, 3 & 4)
Function:	Senior Project Manager (Team Leader)
Signed:	Shenyu

CONTENTS

Notes to Report.

a). EnviroDat Ltd, Report Template V12.

c). Opinions and Interpretations herein are outside the scope of UKAS/MCerts Accreditation.

PART 1: EXECUTIVE SUMMARY

1.1 Monitoring Objectives

Sharpsmart Ltd operates the steam boiler at their facility located at Rainham Clinical Treatment Centre, Rainham. This plant has the potential to pollute the atmosphere. Consequently, these processes are subject to regulation and periodic environmental monitoring is necessary under this regulation.

The Babcock Wanson Boiler combusts with LPG fuel and produces steam (4t/hr) which is used to sterilise the clinical waste.

EnviroDat Ltd was commissioned to monitor the pollutants within the boiler emissions - as prescribed in the operational permit - in order to establish the sites environmental compliance.

The pollutants monitored, as required under EPR/PP3707BB/T001, are summarised below:

Substances to be monitored	**Emission Point Identification**
	Boiler
Oxides of Nitrogen (NO_x as NO_2)	✓
Carbon Monoxide (CO)	✓
Oxygen (O_2 . for correction)	✓
Special requirements	**None requested**

1.2 Monitoring Results

Emission Point Reference	Substance to be Monitored	Emission Limit Value	Periodic Monitoring Result	Estimate of Uncertainty (2σ at 95% confidence)	Units	Reference Conditions	Date of Sampling	Start and End Times	Monitoring Method Reference	Accreditation for use of Method (see note below)	Operating Status
Boiler	Oxides of Nitrogen (as NO_2)	n/a	**101**	±4.6	$mg(N)m^{-3}$	101.3kPa, 273K, dry gas, 3% Oxygen	24/10/2020	12:00-13:29	BS EN 14792	A	At Normal% MCR
	Carbon Monoxide	n/a	**9.7**	±3.3	$mg(N)m^{-3}$				BS EN 15058	A	
	Oxygen	-	**5.90**	±0.35	%	101.3kPa, 273K, dry gas			BS EN 14789	A	

NOTE:

A. EnviroDat Ltd MCerts/UKAS Accredited for sampling and analysis.

B. EnviroDat Ltd Mcerts/UKAS Accredited for sampling only, UKAS Accredited analysis conducted by sub-contract laboratory.

C. EnviroDat Ltd UKAS Accredited for sampling only (further clarification is given in section 1.4). Analysis of this component is not UKAS Accredited.

D. The method for sampling and analysis is not UKAS or MCerts Accredited, method follows documented in-house procedure (further clarification is given in section 1.4).

E. The method for sampling is not UKAS or MCerts Accredited, UKAS Accredited analysis conducted by sub-contract laboratory.

1.3 Operating Information

Emission Point Reference	Date	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load	Comparison of Operator CEMS and Periodic Monitoring Results			
								Substance	CEMS Results	Periodic Monitoring Results	Units
Boiler	24/10/2020	Combustion	Continuous	LPG	N/A	None	Modulating Mode	N/A	N/A	N/A	N/A

1.4 Monitoring Deviations

Emission Point Reference	Substance Deviations	Monitoring Deviations	Other Relevant Issues
Boiler	None	None	The boiler has intermittent firing as the steam demand, the results were still taken from an average 60 minutes worth of data between 12:00 and 13:29.
Boiler	None	None	The 3% oxygen reference and dry condition is used for the report condition as it is not stated on the permit.

PART 2: SUPPORTING INFORMATION

2.1 Appendix I: General Information

2.1.1 Monitoring organisation staff details

Monitoring at Rainham was conducted by the following EnviroDat Engineer:

Team Leader, Yu Shen - MCERTs Level II (TE1, 2, 3 & 4) MM06 727

2.1.2 Monitoring method details

Parameter	Standard Reference Method/Alternative	EnviroDat Procedure	MCerts Accreditation
Oxides of Nitrogen (as NO_2)	BS EN 14792	SP14792	MCerts
Carbon Monoxide (CO)	BS EN 15058	SP15058	MCerts
Oxygen (O_2)	BS EN 14789	SP14789	MCerts

2.1.3 Monitoring organisation equipment and gas check list references

EQUIPMENT – LR68HDA			
Item	**Reference**	**Calibration Due**	**PAT Due**
Portable Gas Analyser	PGA#02	09-Jun-21	Oct-20
Gas Conditioner	COND#01	07-Sep-21	Oct-20
NOx Converter	CONV#02	10-Nov-20	Oct-20
Data Logger	DL#03	08-Oct-21	-
Digital Barometer	DB#27	05-Jan-21	-
Heated Filter Head	HFH#01	05-Jan-21	Oct-20
Heated Line	HL#13	08-Oct-21	-
Heated Line Controller	HLC#13	08-Oct-21	Oct-20
Tape Measure	TM#05	01-Oct-21	-
Timepiece	TP#24	03-Sep-21	-
GAS CYLINDERS – LR68HDA			
	Certificate No.	**Level (ppm)**	**Validity**
'Zero' Gas (%)	VC2920016	99.999%	n/a
Carbon Monoxide Span Gas	VCD11866	149.0	13-Sep-21
Nitric Oxide Span Gas	VCD11866	93.8	13-Sep-21
Oxygen Span Gas (%)	VCDY5514	7.59	13-Sep-21

2.2 Appendix II: Emission Point Reference Data & Results

2.2.1 Photo of Sampling Location on Boiler

Sampling from 10mm hole on 0.30m diameter vertical stack located 4m above the ground level. Accessed by the step ladder for the probe insertion only.

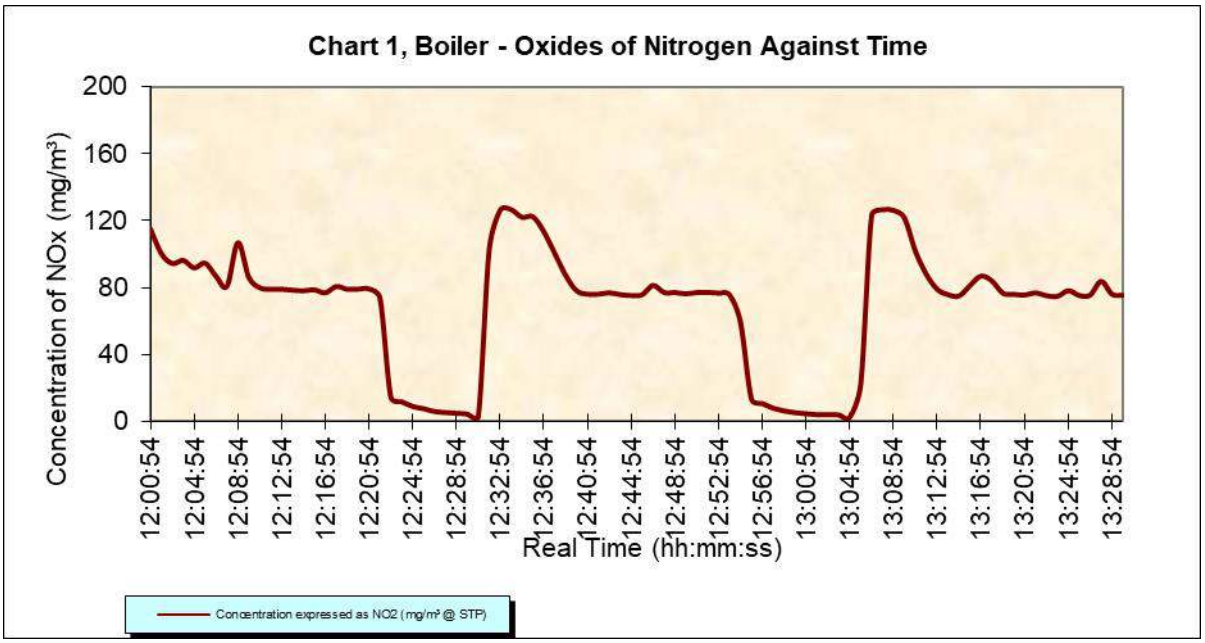
2.2.2 Homogeneity testing

BS EN 15259 stipulates that the exhaust gases emitted from combustion processes are tested to ensure homogeneity and that a representative sample is obtained during the monitoring, subject to a number of caveats as elucidated in Environment Agency guidance MID15259. The details of the testing at each emission point are summarised below:

Stack	Result of Homogeneity Testing
Boiler	N/A –homogeneity testing only required on stacks exceeding 1.13 m diameter, as specified in MID 15259. Homogeneity assumed & single point sampling acceptable.

2.2.3 Gas analyser site measurements and calibrations

The data in the following Charts 1 - 2 and Table 1 are expressed in mgm^{-3} @ STP and is uncorrected for O_2. This data was subsequently converted to reference oxygen concentrations (Section 1.2). Calibration data is shown in Table 2.



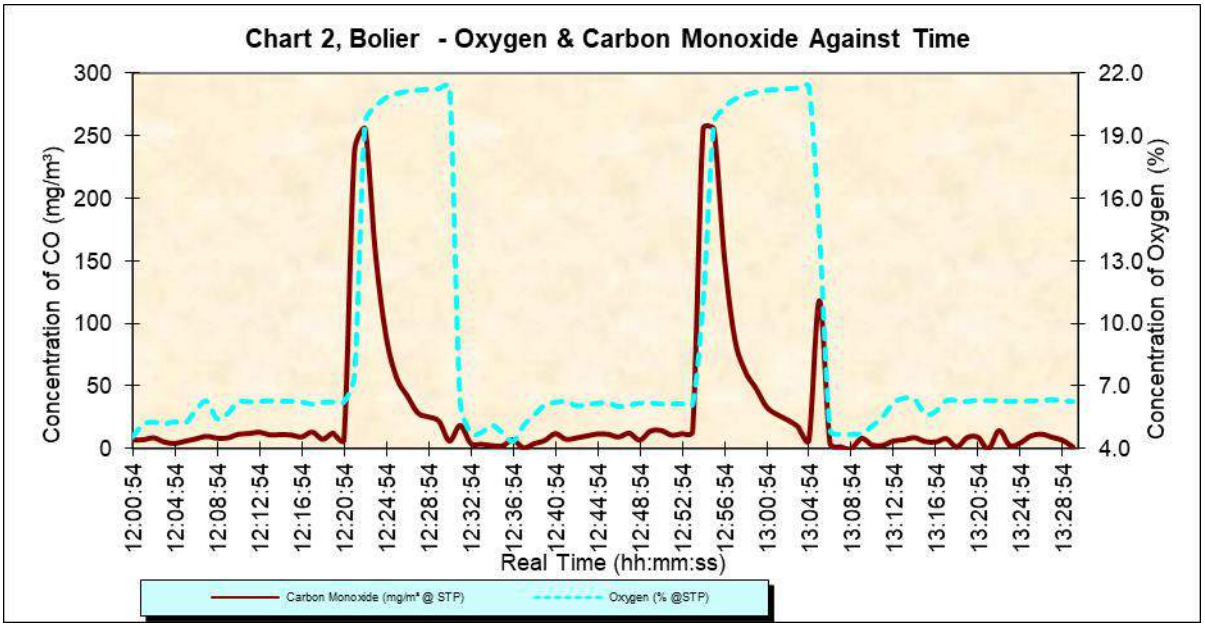


Table 1 – Boiler, Raw Data – Without Oxygen Corrected

Time	Oxygen (%)	CO (mg/m³)	NO_x (mg/m³)	Comment
12:00:54	4.5	7.0	114.8	
12:01:54	5.1	7.2	100.1	
12:02:54	5.3	8.8	94.3	
12:03:54	5.2	5.4	96.1	
12:04:54	5.3	4.2	91.7	
12:05:54	5.2	6.1	94.5	
12:06:54	5.8	8.0	86.7	
12:07:54	6.3	10.0	80.8	
12:08:54	5.4	8.5	106.7	
12:09:54	5.7	8.7	86.0	
12:10:54	6.2	11.6	79.9	
12:11:54	6.2	12.1	79.0	
12:12:54	6.3	13.2	79.0	
12:13:54	6.3	11.2	78.4	
12:14:54	6.3	11.3	78.0	
12:15:54	6.3	11.0	78.6	
12:16:54	6.2	9.5	76.8	
12:17:54	6.1	13.4	80.6	
12:18:54	6.2	7.6	78.9	
12:19:54	6.2	12.5	79.1	
12:20:54	6.2	7.0	79.2	
12:21:54	7.5	238.0	73.8	**Boiler OFF**
12:22:54	19.6	256.0	14.7	
12:23:54	20.4	155.5	12.0	
12:24:54	20.8	89.7	9.2	
12:25:54	21.0	56.7	7.9	
12:26:54	21.1	42.3	6.2	
12:27:54	21.2	28.6	5.6	
12:28:54	21.2	25.5	5.2	
12:29:54	21.3	22.0	4.7	
12:30:54	21.4	6.2	3.1	
12:31:54	6.3	18.7	102.5	
12:32:54	4.7	4.3	126.0	**Boiler ON**
12:33:54	4.8	3.7	126.4	
12:34:54	5.1	2.6	121.8	
12:35:54	4.8	2.3	122.1	
12:36:54	4.3	7.3	113.2	
12:37:54	5.1	0.7	100.3	
12:38:54	5.6	4.1	87.2	
12:39:54	6.1	6.6	78.0	

Time	Oxygen (%)	CO (mg/m³)	NO_x (mg/m³)	Comment
12:40:54	6.2	12.1	76.1	
12:41:54	6.3	7.6	76.1	
12:42:54	6.0	8.7	76.9	
12:43:54	6.1	10.3	75.8	
12:44:54	6.2	11.8	75.3	
12:45:54	6.2	11.6	75.8	
12:46:54	6.0	9.4	81.2	
12:47:54	6.1	12.5	77.0	
12:48:54	6.2	7.0	77.0	
12:49:54	6.2	14.1	76.3	
12:50:54	6.1	14.8	77.0	
12:51:54	6.1	10.9	77.1	
12:52:54	6.1	12.1	76.7	
12:53:54	6.1	13.7	75.6	
12:54:54	11.0	256.0	59.1	**Boiler OFF**
12:55:54	19.6	256.0	13.6	
12:56:54	20.4	153.6	10.9	
12:57:54	20.8	87.4	8.2	
12:58:54	21.0	61.7	6.6	
12:59:54	21.1	48.3	5.5	
13:00:54	21.2	33.5	4.9	
13:01:54	21.2	27.4	4.4	
13:02:54	21.3	23.0	4.4	
13:03:54	21.3	17.3	4.2	
13:04:54	21.4	7.0	2.9	
13:05:54	14.4	118.5	22.4	
13:06:54	4.9	4.4	123.0	
13:07:54	4.7	1.6	126.3	
13:08:54	4.7	0.0	125.9	
13:09:54	4.7	8.3	121.4	
13:10:54	5.1	3.0	101.7	**Boiler ON**
13:11:54	5.5	2.7	87.9	
13:12:54	6.2	6.2	79.0	
13:13:54	6.4	7.2	75.7	
13:14:54	6.4	8.9	75.0	
13:15:54	5.7	5.8	81.2	
13:16:54	5.8	5.4	86.8	
13:17:54	6.3	8.1	84.0	
13:18:54	6.3	1.6	76.7	
13:19:54	6.2	9.0	76.0	
13:20:54	6.3	9.2	75.6	
13:21:54	6.3	0.0	76.8	

Time	Oxygen (%)	CO (mg/m³)	NO_x (mg/m³)	Comment
13:22:54	6.3	14.5	75.2	
13:23:54	6.2	2.7	74.7	
13:24:54	6.3	4.6	78.2	
13:25:54	6.3	10.2	75.2	
13:26:54	6.3	11.8	75.5	
13:27:54	6.3	9.2	83.7	
13:28:54	6.3	6.9	76.0	
13:29:54	6.2	1.6	75.4	

Table 2 – Boiler, Analyser Calibration Data

ANALYSER CALIBRATION DATA						
Pre Sampling Check						
		NO (ppm)	**CO (ppm)**	**O_2 (%)**	**VOC's (ppm)**	
Range		100	200	25		
Zero Gas	**Cylinder No.**	VC2920016				
Span Gas	**Cylinder No.**	VCD11866		VCDY5514		
	Certified Value	93.8	149	7.59		
Zero Check	**Value**	0.1	1	0.12		
<2 x repeatability (Yes/No)		YES	YES	YES		
Down Line Zero & Span Check						
Zero Gas	**Value**	0.1	0.9	0.13		
	<2% of span	**YES**	**YES**	**YES**		
Span Gas	**Value**	92.8	147	7.59		
	Within 2% of span	YES	YES	YES		
Post Sampling Drift Check						
Zero Gas	**Value**	0.8	1	0.1		
	Drift (%)	0.7	0.1	0.4		
	Validation	**No Correction Required**	**No Correction Required**	**No Correction Required**		
Span Gas	**Value**	93	148.5	7.61		
	Drift (%)	0.5	0.9	0.7		
	Validation	**No Correction Required**	**No Correction Required**	**No Correction Required**		

2.3 Appendix III: Uncertainty Calculation

NOx - Measurement performance related to stationary conditions		
Performance characteristic	**Uncertainty**	**Value of uncertainty quantity**
Standard deviation of repeatability at zero	u_{r0}	0.80
Standard deviation of repeatability at span level	u_{rs}	0.10
Lack of fit	u_{fit}	0.47
Drift	u_{0dr}	1.67
volume or pressure flow dependence	u_{spres}	0.01
atmopsheric pressure dependence	u_{apres}	0.24
ambient temperature dependence	u_{temp}	0.23
NH3 (20 mg/m3)	u_{interf}	0.14
CO2 (15%)	-	0.02
H2O (30%)	-	0.01
Error in logger voltage	-	0.10
Dependence on voltage	u_{volt}	0.03
Converter efficiency	u_{ceff}	0.39
losses in the line (leak)	u_{leak}	0.98
Uncertainty of calibration gas	u_{calib}	0.98

NOx Measurement uncertainty		Result	84.72	mg/m^3
Combined uncertainty			2.29	mg/m^3
Expanded uncertainty	k = 2		4.58	mg/m^3
Uncertainty corrected to std conds			4.58	mg.m-3 (corrected)
Expanded uncertainty	**expressed with a level of confidence of 95%**		**#VALUE! % ELV**	
Expanded uncertainty	**expressed with a level of confidence of 95%**		**4.58 $mg.m^{-3}$ of result**	

CO - Measurement performance related to stationary conditions		
Performance characteristic	**Uncertainty**	**Value of uncertainty quantity**
Standard deviation of repeatability at zero	u_{r0}	0.80
Standard deviation of repeatability at span level	u_{rs}	0.10
Lack of fit	u_{fit}	0.58
Drift	u_{0dr}	1.49
volume or pressure flow dependence	u_{spres}	0.00
atmopsheric pressure dependence	u_{apres}	0.23
ambient temperature dependence	u_{temp}	0.00
CO2 (15%)	u_{interf}	0.00
N2O (40mgm3)	-	0.00
CH4 (57mgm3)	-	0.00
H2O (1%)	-	0.00
Dependence on voltage	u_{volt}	0.03
Error in Logger reading	-	0.20
losses in the line (leak)	u_{leak}	0.09
Uncertainty of calibration gas	u_{calib}	0.09

CO Measurement uncertainty		Result	8.17	mg/m^3
Combined uncertainty			1.64	mg/m^3
Expanded uncertainty	k = 2		3.27	mg/m^3
Uncertainty corrected to std conds			3.27	mg.m-3 (corrected)
Expanded uncertainty	**expressed with a level of confidence of 95%**		**#VALUE! % ELV**	
Expanded uncertainty	**expressed with a level of confidence of 95%**		**3.27 $mg.m^{-3}$ of result**	

Oxygen - Measurement performance related to stationary conditions		
Performance characteristic	**Uncertainty**	**Value of uncertainty quantity**
Standard deviation of repeatability at zero	u_{r0}	0.20
Standard deviation of repeatability at span level	u_{rs}	0.03
Lack of fit	u_{fit}	0.07
Drift	u_{0dr}	0.10
volume or pressure flow dependence	u_{spres}	0.00
atmopsheric pressure dependence	u_{apres}	0.01
ambient temperature dependence	u_{temp}	0.03
CO2 (15%)	-	0.00
NO(300)	-	0.06
NO2(30)	-	0.00
dependence on voltage	u_{volt}	0.02
losses in the line (leak)	u_{leak}	0.07
Error in Logger voltage	-	0.03
Uncertainty of calibration gas	u_{calib}	0.07

O2 Measurement uncertainty		Result	5.90	%vol
Combined uncertainty			0.18	%vol
% of value			3.00	%
Expanded uncertainty	**expressed with a level of confidence of 95%**		**6.01 % of value**	
Expanded uncertainty	**expressed with a level of confidence of 95%**		**0.35 % vol**	

Appendix B Assessment Results

Table B – 1 – Model Predicted 2020 Annual Mean NO_2 Concentrations at Human Receptors Relevant for Long Term Exposure

Receptor ID	Background Concentration (µg/m³)	AQS (µg/m³)	NO_x PC (µg/m³)	NO_2 PC (µg/m³)	PC as % of AQS	NO_2 PEC (µg/m³)	PEC as % of AQS
R3	24.02	40	0.03	0.02	0.04%	24.04	60.10%
R4	20.37	40	0.05	0.03	0.08%	20.40	51.01%
R6	20.37	40	0.08	0.05	0.13%	20.42	51.06%
R7	20.37	40	0.04	0.03	0.07%	20.40	50.99%
R8	20.14	40	0.05	0.03	0.08%	20.17	50.42%

Table B – 2 – Model Predicted 2020 1-Hour Mean NO_2 Concentrations at Human Receptors relevant for Short-Term Exposure

Receptor ID	Background Concentration (µg/m³)	AQS (µg/m³)	99.79th Percentile					100th Percentile		
			NO_x PC (µg/m³)	NO_2 PC (µg/m³)	PC as % of AQS	NO_2 PEC* (µg/m³)	PEC as % of AQS	NO_x PC (µg/m³)	NO_2 PC (µg/m³)	PC as % of AQS
R1	21.69	200	22.61	7.91	3.96%	51.30	25.65%	26.00	9.10	4.55%
R2	24.02	200	3.06	1.07	0.54%	49.12	24.56%	4.63	1.62	0.81%
R3	24.02	200	1.01	0.35	0.18%	48.40	24.20%	1.26	0.44	0.22%
R4	20.37	200	1.13	0.40	0.20%	41.13	20.57%	1.53	0.54	0.27%
R5	20.37	200	1.24	0.43	0.22%	41.17	20.59%	1.76	0.62	0.31%
R6	20.37	200	1.58	0.55	0.28%	41.29	20.65%	2.08	0.73	0.36%
R7	20.37	200	1.00	0.35	0.18%	41.09	20.54%	1.18	0.41	0.21%
R8	20.14	200	0.91	0.32	0.16%	40.59	20.29%	0.96	0.34	0.17%

*PEC is PC plus 2 x background for short -term average calculations

Table B – 3 – Model Predicted 2020 SO_2 24-Hour Mean Percentile Concentrations at Human Receptors

Receptor ID	Background Concentration ($\mu g/m^3$)	99.2nd Percentile					100th Percentile				
		AQS ($\mu g/m^3$)	SO_2 PC ($\mu g/m^3$)	SO_2 PC as % of AQS	SO_2 PEC ($\mu g/m^3$)	SO_2 PEC as % of AQS	AQS ($\mu g/m^3$)	SO_2 PC ($\mu g/m^3$)	SO_2 PC as % of AQS	SO_2 PEC ($\mu g/m^3$)	SO_2 PEC as % of AQS
R3	6.40	125	0.03	0.02%	6.43	5.14%	125	0.03	0.03%	6.43	5.15%
R4	7.68	125	0.04	0.03%	7.72	6.18%	125	0.05	0.04%	7.73	6.18%
R6	7.68	125	0.06	0.05%	7.74	6.19%	125	0.07	0.06%	7.75	6.20%
R7	7.68	125	0.04	0.03%	7.72	6.18%	125	0.04	0.03%	7.72	6.18%
R8	8.22	125	0.05	0.04%	8.27	6.61%	125	0.05	0.04%	8.27	6.62%

Table B – 4 – Model Predicted 2020 SO_2 1-Hour Mean Percentile Concentrations at Human Receptors

Receptor ID	Background Concentration ($\mu g/m^3$)	99.7th Percentile					100th Percentile				
		AQS ($\mu g/m^3$)	SO_2 PC ($\mu g/m^3$)	SO_2 PC as % of AQS	SO_2 PEC ($\mu g/m^3$)	SO_2 PEC as % of AQS	AQS ($\mu g/m^3$)	SO_2 PC ($\mu g/m^3$)	SO_2 PC as % of AQS	SO_2 PEC ($\mu g/m^3$)	SO_2 PEC as % of AQS
R1	7.75	350	3.90	1.11%	19.40	5.54%	350	4.53	1.30%	20.03	5.72%
R2	6.40	350	0.49	0.14%	13.29	3.80%	350	0.81	0.23%	13.61	3.89%
R3	6.40	350	0.17	0.05%	12.97	3.70%	350	0.22	0.06%	13.02	3.72%
R4	7.68	350	0.19	0.05%	15.55	4.44%	350	0.27	0.08%	15.63	4.46%
R5	7.68	350	0.20	0.06%	15.56	4.45%	350	0.31	0.09%	15.67	4.48%
R6	7.68	350	0.27	0.08%	15.63	4.47%	350	0.36	0.10%	15.72	4.49%
R7	7.68	350	0.16	0.05%	15.52	4.44%	350	0.21	0.06%	15.57	4.45%
R8	8.22	350	0.14	0.04%	16.58	4.74%	350	0.17	0.05%	16.61	4.74%

Table B – 5 – Model Predicted 2020 SO_2 15-Minute Mean Percentile Concentrations at Human Receptors

Receptor ID	Background Concentration ($\mu g/m^3$)	99.9th Percentile					100th Percentile				
		AQS ($\mu g/m^3$)	SO_2 PC ($\mu g/m^3$)	SO_2 PC as % of AQS	SO_2 PEC ($\mu g/m^3$)	SO_2 PEC as % of AQS	AQS ($\mu g/m^3$)	SO_2 PC ($\mu g/m^3$)	SO_2 PC as % of AQS	SO_2 PEC ($\mu g/m^3$)	SO_2 PEC as % of AQS
R1	7.75	266	4.18	1.57%	19.68	7.40%	266	4.65	1.75%	20.15	7.58%
R2	6.40	266	0.86	0.32%	13.66	5.14%	266	1.06	0.40%	13.86	5.21%
R3	6.40	266	0.31	0.12%	13.11	4.93%	266	0.37	0.14%	13.17	4.95%
R4	7.68	266	0.35	0.13%	15.71	5.90%	266	0.42	0.16%	15.78	5.93%
R5	7.68	266	0.36	0.14%	15.72	5.91%	266	0.50	0.19%	15.86	5.96%
R6	7.68	266	0.47	0.18%	15.83	5.95%	266	0.59	0.22%	15.95	6.00%
R7	7.68	266	0.31	0.12%	15.67	5.89%	266	0.34	0.13%	15.70	5.90%
R8	8.22	266	0.28	0.10%	16.72	6.28%	266	0.28	0.11%	16.72	6.29%

Table B – 6 – Model Predicted 2020 NO_x Annual Mean and 24-Hour Mean NO_x Concentrations at Ecological Receptors

Receptor ID	Background Concentration (µg/m³)	Annual Mean					24-Hour Mean				
		AQS (µg/m³)	NO_x PC (µg/m³)	NO_x PC as % of AQS	NO_x PEC (µg/m³)	NO_x PEC as % of AQS	AQS (µg/m³)	NO_x PC (µg/m³)	NO_x PC as % of AQS	NO_x PEC (µg/m³)	NO_x PEC as % of AQS
E1	31.93	30	0.10	0.34%	32.03	106.76%	75	0.10	0.14%	32.03	42.70%
E2	26.99	30	0.03	0.11%	27.02	90.08%	75	0.03	0.04%	27.02	36.03%
E3	31.93	30	0.10	0.32%	32.02	106.74%	75	0.10	0.13%	32.02	42.70%
E4	26.99	30	0.02	0.07%	27.01	90.05%	75	0.02	0.03%	27.01	36.02%
E5	28.07	30	0.01	0.03%	28.08	93.60%	75	0.01	0.01%	28.08	37.44%
E6	25.68	30	0.01	0.04%	25.70	85.65%	75	0.01	0.01%	25.70	34.26%
E7	31.93	30	0.10	0.34%	32.03	106.76%	75	0.10	0.14%	32.03	42.71%
E8	24.38	30	0.02	0.05%	24.40	81.33%	75	0.02	0.02%	24.40	32.53%
E9	27.00	30	0.02	0.06%	27.02	90.07%	75	0.02	0.02%	27.02	36.03%

Table B – 7 – Model Predicted 2020 SO_2 Annual Mean Concentrations at Ecological Receptors

Receptor ID	Background Concentration (µg/m³)	Annual Mean				
		AQS (µg/m³)	SO_2 PC (µg/m³)	SO_2 PC as % of AQS	SO_2 PEC (µg/m³)	SO_2 PEC as % of AQS
E1	7.75	20	0.018	0.09%	7.77	38.8%
E2	9.06	20	0.006	0.03%	9.07	45.3%
E3	7.75	20	0.017	0.08%	7.77	38.8%
E4	9.06	20	0.004	0.02%	9.06	45.3%
E5	6.87	20	0.002	0.01%	6.87	34.4%
E6	6.33	20	0.002	0.01%	6.33	31.7%
E7	7.75	20	0.018	0.09%	7.77	38.8%
E8	10.60	20	0.003	0.01%	10.60	53.0%
E9	11.50	20	0.003	0.02%	11.50	57.5%

Table B – 8 – Model Predicted 2020 Nutrient Nitrogen Deposition at Specified Ecological Receptors

Receptor ID	PC Nitrogen Deposition (kg N/ha/yr)	Lowest APIS Critical Load (kg N/ha/yr)	PC as Percentage of the Lowest APIS Critical Load	PC as Percentage of a Low critical load of 5 kg N/ha/yr	PC as Percentage of an Average critical load of 10 kg N/ha/yr	PC as Percentage of a High critical load of 30 kg N/ha/yr
E1	0.0144	20	0.072	0.29	0.14	0.05
E2	0.0043	15	0.029	0.09	0.04	0.01
E3	0.0144	-	-	0.29	0.14	0.05
E4	0.0028	-	-	0.06	0.03	0.01
E5	0.0014	-	-	0.03	0.01	0.005
E6	0.0014	-	-	0.03	0.01	0.005
E7	0.0144	-	-	0.29	0.14	0.05
E8	0.0028	-	-	0.06	0.03	0.01
E9	0.0028	-	-	0.06	0.03	0.01

Table B – 9 – Critical Load Values for Habitat Types within Grid Square 552500, 182500

Habitat	CLmaxS keq/ha/yr	CLminN keq/ha/yr	CLmaxN keq/ha/yr
Acid Grassland	0.88	0.438	1.318
Arable & Horticultural	Not sensitive to acidity		
Bogs	0.169	0.321	0.49
Broadleaved, Mixed and Yew Woodland	1.697	0.357	2.054
Calcareous Grassland	4	1.071	5.071
Coastal and Floodplain Grazing Marsh	No comparable acid critical load classes. Empirical CL value of 4		
Coastal Saltmarsh	No comparable acid critical load classes. Empirical CL value of 4		
Coniferous Woodlands	1.697	0.357	2.054
Dunes, Shingle & Machair	0.88	0.714	1.594
Fens, Marsh and Swamp	Not sensitive to acidity		
Hedgerows	1.697	0.357	2.054
Improved Grassland	Not sensitive to acidity		
Inland Rock & Scree	4	1.071	5.071
Maritime Cliff & Slopes	No comparable acid critical load classes. Empirical CL value of 4		
Montane Habitats	0.88	0.393	1.273

Habitat	CLmaxS keq/ha/yr	CLminN keq/ha/yr	CLmaxN keq/ha/yr
Neutral Grassland	4	1.071	5.071
Wood Pasture and Parkland	1.697	0.357	2.054

Table B – 10 – Model Predicted 2020 Acid Deposition at Specified Ecological Receptors

Receptor ID	Current APIS Nitrogen Deposition (keq/ha/yr)	Current APIS Sulphur Deposition (keq/ha/yr)	PC Nitrogen Deposition (keq/ha/yr)	PC Sulphur Deposition (keq/ha/yr)	Total PC Deposition (keq/ha/yr)	PEC N Dep (keq/ha/yr)	Lowest APIS CLminN (keq/ha/yr)	Lowest APIS CLmaxN (keq/ha/yr)	PC Total Acid Deposition as % of CL function (CLmaxN)
E1	1.31	0.19	0.0010	0.0021	0.0032	1.31	0.321	0.49	0.64
E2	1.31	0.19	0.0003	0.0007	0.0010	1.31	0.321	0.49	0.21
E3	1.31	0.19	0.0010	0.0020	0.0030	1.31	0.321	0.49	0.62
E4	1.31	0.19	0.0002	0.0005	0.0007	1.31	0.321	0.49	0.14
E5	1.31	0.19	0.0001	0.0002	0.0003	1.31	0.321	0.49	0.07
E6	1.31	0.19	0.0001	0.0002	0.0003	1.31	0.321	0.49	0.07
E7	1.31	0.19	0.0010	0.0021	0.0032	1.31	0.321	0.49	0.64
E8	1.31	0.19	0.0002	0.0004	0.0006	1.31	0.321	0.49	0.11
E9	1.31	0.19	0.0002	0.0004	0.0006	1.31	0.321	0.49	0.11

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