Client: Brownhills Skip Hire Limited
Address: Brownhills Skip Hire Ltd, Collier Close, Brownhills, Walsall, WS8 7EU

Brownhills Skip Hire Limited
Collier Close, Brownhills, Walsall, WS8 7EU

Air Quality Assessment
Application for Small Waste Incinerator Plant (SWIP) to Authorise an Advanced Thermal Treatment Plant

19 April 2022

Our Reference: Brownhills Skip Hire Ltd-RP03-Final (AQA)

Waste And Industry Compliance Ltd

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Brownhills Skip Hire Ltd-RP03-Final (AQA)

Version & Status	Date Produced	Prepared by	Checked and Authorised by
Draft v1.0	14/04/2022	Liam Shelmerdine (Air Quality Consultant)	Ger Parry (Air Quality Consultant) Steve Barnes (Director)
Draft v2.0	14/04/2022	Liam Shelmerdine (Air Quality Consultant)	Ger Parry (Air Quality Consultant) Steve Barnes (Director)
Final	19/04/2022	Liam Shelmerdine (Air Quality Consultant)	Ger Parry (Air Quality Consultant) Steve Barnes (Director)

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1 INTRODUCTION

1.1 BACKGROUND

1.1.1 Waste and Industry Compliance Ltd has been instructed by Brownhills Skip Hire Ltd ('**the Operator**') to commission an Air Quality Assessment (AQA) in support of the operation of a Small Waste Incineration Plant (SWIP) at Collier Close, Walsall.

1.1.2 The plant has the potential to cause air quality impacts as a result of atmospheric emissions during normal operation. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and assess potential changes in pollution levels as a result of the installation.

1.2 SITE LOCATION AND CONTEXT

1.2.1 The site is located on land off Collier Close, Brownhills, Walsall, WS8 7EU, at approximate National Grid Reference (NGR): 406350, 305250. Reference should be made to Figure 1 for a map of the site and surrounding area.

1.2.2 It is proposed to install and operate a SWIP which will utilise Refuse Derived Fuel (RDF). The operation of the plant may result in atmospheric emissions from the combustion of RDF. These have the potential to cause air quality impacts at sensitive locations within the vicinity of the site and have therefore been quantified within this report.

2 LEGISLATION AND POLICY

2.1 LEGISLATION

2.1.1 The Air Quality Standards Regulations (2010) came into force on 11th June 2010 and include Air Quality Limit Values (AQLVs) for the following pollutants:

- Nitrogen dioxide (NO_2);
- Sulphur dioxide (SO_2)
- Lead
- Particulate matter with an aerodynamic diameter of less than 10µm (PM_{10});
- Particulate matter with an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$);
- Benzene (C_6H_6);
- Carbon monoxide (CO).

2.1.2 Air quality target values have also been provided for several additional pollutants. These include:

- Ozone;
- Arsenic (As);
- Cadmium (Cd);
- Nickel (Ni); and,
- Benzo(a)pyrene.

2.1.3 Part IV of the Environment Act (1995) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and published in July 2007[1]. The AQS sets out Air Quality Objectives (AQOs) that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale. These are generally in line with the AQLVs, although the requirements for the determination of compliance vary.

2.1.4 Table 1 presents the AQOs and AQLVs for pollutants considered within this assessment.

Table 1: Air Quality Objectives / Limit Value

Pollutant	Air Quality Objective / Air Quality Limit Value	
	Concentration	**Averaging Period**
NO_2	40	Annual mean
	200	1-hour mean, not to be exceeded on more than 18 occasions per annum

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

Pollutant	Air Quality Objective / Air Quality Limit Value	
	Concentration	Averaging Period
PM_{10}	40	Annual mean
	50	24-hour mean, not to be exceeded on more than 35 occasions per annum
C_6H_6	5	Annual mean
CO	10,000	8-hour running mean
$PM_{2.5}$	20	Annual mean
SO_2	266	15-minute mean, not to be exceedance on more than 35 occasions per annum
	350	1-hour mean, not to be exceedance on more than 24 occasions per annum
	125	24-hour mean, not to be exceedance on more than 3 occasions per annum
As	0.006	Annual mean
Cd	0.005	Annual mean
Ni	0.010	Annual mean

2.1.5 Table 2 summarises the advice provided in DEFRA guidance[2] on where the AQOs for pollutants considered within this report apply.

Table 2: Examples of Where the Air Quality Objectives Apply

Averaging Period	Objective Should Apply At	Objective Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed	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	Kerbside sites where the public would not be expected to have regular access

[2] Local Air Quality Management Technical Guidance (TG16), DEFRA, 2021.

Averaging Period	Objective Should Apply At	Objective Should Not Apply At
	Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer	
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes	

2.2 WHO GUIDELINES

2.2.1 The World Health Organisation (WHO) provides recommended levels for health-harmful concentrations of key air pollutants both outdoors and inside buildings and homes, based on global synthesis of scientific evidence. These are often utilised by national and international governing bodies when determining appropriate air quality standards for inclusion in relevant legislation. For example, the WHO guidelines were used to inform the AQLVs and AQTVs stated within European Union Directive 2008/50/EC.

2.2.2 The WHO air quality guidelines (AQG) for pollutants considered in this assessment are summarised in Table 3.

Table 3: 2021 WHO Guideline Levels

Pollutant	Averaging Period	Interim Target (µg/m^3)				AQG level (µg/m^3)
		1	2	3	4	
NO_2	Annual mean	40	30	20	-	10
	24-hour mean	120	50	-	-	25
PM_{10}	Annual mean	70	50	30	20	15
	24-hour mean	150	100	75	50	45
$PM_{2.5}$	Annual mean	35	25	15	10	5
	24-hour mean	75	50	37.5	25	15
SO_2	24-hour mean	125	50	-	-	-

2.2.3 It should be noted that the WHO values are guidelines only and there is no legislative or planning requirement to consider these criteria within the UK. As such, when determining the potential for air quality impacts at sensitive receptor locations, the assessment predictions were compared with the relevant AQOs and AQLVs stated within UK Legislation, rather than the WHO guideline levels.

2.3 CRITICAL LOADS AND LEVELS

2.3.1 A critical load is defined by the UK Air Pollution Information System (APIS)[3] as:

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

2.3.2 A critical level is defined as:

[3] UK Air Pollution Information System, www.apis.ac.uk.

"Concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge."

2.3.3 A critical load refers to deposition of a pollutant, while a critical level refers to pollutant concentrations in the atmosphere (which usually have direct effects on vegetation or human health).

2.3.4 When pollutant loads (or concentrations) exceed the critical load or level it is considered that there is a risk of harmful effects. The excess over the critical load or level is termed the exceedance. A larger exceedance is often considered to represent a greater risk of damage.

2.3.5 Maps of critical loads and levels and their exceedances have been used to show the potential extent of pollution damage and aid in developing strategies for reducing pollution. Decreasing deposition below the critical load is seen as means for preventing the risk of damage. However, even a decrease in the exceedance may infer that less damage will occur.

2.3.6 Critical loads have been designated within the UK based on the sensitivity of the receiving habitat and have been reviewed for the purpose of this assessment.

2.3.7 Table 4 presents the critical levels for the protection of vegetation for pollutants considered within this assessment.

Table 4: Critical Levels for the Protection of Vegetation

Pollutant	Critical Level	
	Concentration (µg/m^3)	Averaging Period
Oxides of nitrogen (NO_x)	30	Annual mean
	75	24-hour mean
SO_2	20	Annual mean for higher plants
	10	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystem's integrity
Hydrogen fluoride (HF)	0.5	Weekly mean
	5	Daily mean

2.3.8 It should be noted that the critical level for HF is provided in Environment Agency (EA) Guidance 'Air emissions risk assessment for your environmental permit'[4] and is not included within the Air Quality Standards Regulations (2010) or AQS.

2.4 LOCAL AIR QUALITY MANAGEMENT

2.4.1 Under Section 82 of the Environment Act (1995) (Part IV) Local Authorities are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves comparing present and likely future pollutant concentrations against the AQOs. If it is predicted that levels at locations of relevant exposure are likely to be exceeded, the Local Authority is required to declare an Air Quality Management Area (AQMA). For each AQMA the LA is required to produce an Air Quality Action Plan,

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

the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.5 INDUSTRIAL POLLUTION CONTROL LEGISLATION

2.5.1 Atmospheric emissions from industry are controlled in the UK through the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments. The operation of plant at Brownhills Skip Hire is included within the Regulations. As such, the facility is required to operate in accordance with an Environmental Permit. Amongst conditions of operation are stated Emission Limit Values (ELVs) for various pollutants produced by the processes. Compliance with these conditions must be demonstrated through periodic monitoring requirements, which have been set in order to limit potential impacts in the surrounding area.

2.6 ENVIRONMENTAL ASSESSMENT LEVELS

2.6.1 An Environmental Assessment Level (EAL) is the concentration of a substance, which, in a particular environmental medium, the regulators regard as an appropriate comparator value. This enables comparison between the environmental effects of different substances in that medium and between environmental effects in different media, enabling the summation of those effects.

2.6.2 Ideally EALs to fulfil this objective would be defined for each pollutant:

- Based on the sensitivity of particular habitats or receptors (in particular three main types of receptor should be considered, protection of human health, protection of natural ecosystems and protection of specific sensitive receptors, e.g. materials, commercial activities requiring a particular environmental quality);
- Be produced according to a standardised protocol to ensure that they are consistent, reproducible and readily understood;
- Provide similar measure of protection for different receptors both within and between media; and,
- Take account of habitat specific environmental factors such as pH, nutrient status, bioaccumulation, transfer and transformation processes where necessary.

2.6.3 EALs used in this assessment were obtained from EA guidance 'Air emissions risk assessment for your environmental permit'[5] and are summarised in Table 5.

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

Table 5: Environmental Assessment Levels

Pollutant	Environmental Assessment Level (µg/m^3)	
	Long Term (Annual)	**Short Term (1-hour)**
Hydrogen chloride (HCl)	-	750
HF	16	160
Mercury (Hg)	0.25	7.5
C_6H_6	-	30 (24-hour)
Antimony (Sb)	5	150
As	0.003	-
Chromium (Cr), Cr (II) and Cr (III)	5	150
Cr (VI)	0.0002	-
Copper (Cu)	10	200
Manganese (Mn)	0.15	1,500
Vanadium (V)	5	1

2.6.4 It should be noted that the EAL for As of 0.003µg/m^3 is lower than the AQTV of 0.006µg/m^3 and has therefore been used throughout this assessment.

3 BASELINE

3.1.1 Existing air quality conditions in the vicinity of the site were identified in order to provide a baseline for assessment. These are detailed in the following Sections.

3.2 LOCAL AIR QUALITY MANAGEMENT

3.2.1 As required by the Environment Act (1995), Walsall Council (WC) has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has indicated that annual mean and 1-hour NO_2 concentrations and 24-hour PM_{10} concentrations are above the AQOs within their jurisdiction. As such, two AQMAs have been declared. The closest of these to the site is described as follows:

"An area encompassing the whole borough"

3.2.2 The site is located within the AQMA. As such, there is the potential for emissions from the SWIP to cause air quality impacts within this sensitive area. This has been considered throughout the assessment.

3.2.3 WC has concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs. As such, no further AQMAs have been designated.

3.3 LOCAL AIR QUALITY MODELLING

3.3.1 WC has undertaken modelling of NO_2 concentrations throughout the borough to provide an indication of areas where there is the potential AQO exceedances.

3.3.2 A review of WC's ADMS Urban Nitrogen Dioxide Quality Model 2021[6] indicated that the nearest predicted exceedance of the annual mean AQO for NO_2 is approximately 6km south-west of the site. Due to the distance between the area and the site, it is not anticipated that the operation of the facility will contribute to exceedances of the AQO.

3.4 AIR QUALITY MONITORING

Local Authority Monitoring

3.4.1 A review of monitoring undertaken by WC and neighbouring Lichfield District Council indicated the nearest survey position to the development is situated approximately 4.0km north-east of the proposed development. Due to the distance between the two locations, it is not considered likely that similar pollution levels would occur at these positions. As such, this source of data has not been considered further in the context of the assessment.

Heavy Metals Monitoring

3.4.2 Monitoring of heavy metals is carried out by DEFRA at 24 locations throughout the UK. The closest monitoring location to the facility is Walsall Bilston Lane at NGR: 397197, 298370. The site is an 'urban industrial' location and is situated approximately 9.2km south-west of Brownhills Skip Hire. The most

[6] ADMS Urban Nitrogen Dioxide Quality Model, Walsall Council, 2021.

recent complete data available from Walsall Bilston Lane is from 2017, as summarised in Table 6.

Table 6: Metals Monitoring Results

Monitoring Site	Annual Mean Concentration (ng/m^3)
As	1.12
Cd	0.88
Cr	3.92
Cu	22.30
Hg	2.30
Mn	9.27
Ni	1.48
Pb	19.99
V	0.88

Note: (a) Monitoring for Hg ceased in 2014. As such, data provided is for 2013.

Acid Gas Monitoring

3.4.3 Concentrations of HCl and SO_2 are monitored in the UK through the UK Eutrophying and Acidifying Pollutants (UKEAP) network. The closest site to the facility is Sutton Boddington at NGR: 450540, 326822, approximately 51.9km north-east of the boundary. The most recent data available from Sutton Boddington is from 2020, as summarised in Table 7.

Table 7: UKEAP Monitoring Results

Monitoring Site	Annual Mean Concentration (µg/m^3)
HCl	0.16
SO_2	0.70

Note: (a) Monitoring for HCl ceased in 2016. As such, data provided is for 2016.

3.4.4 Baseline concentrations of HF are not measured locally or nationally, since these are not generally of concern in terms of local air quality. However, the Expert Panel on Air Quality Standards (EPAQS) report "Guidelines for halogens and hydrogen halides in ambient air for protecting human health against acute irritancy effects" contains some estimates of baseline levels. This indicates that measured concentrations have been in the range of 0.036µg/m^3 to 2.35µg/m^3.

3.4.5 In lieu of local monitoring, the maximum measured baseline HF concentration has been used for the purpose of this assessment.

Dioxins and Furans Monitoring

3.4.6 Monitoring of dioxins and furans is undertaken throughout the UK through the Toxic Organic Micro Pollutants (TOMPs) network. Throughout this report, the term 'dioxins' is taken to mean the family of 210 compounds or congeners comprising polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). If both PCDDs and PCDFs are present, these have been referred to as PCDD/Fs. The summation of the concentrations of 17 toxic PCDD and PCDF congeners,

weighted relative to the toxicity of 2,3,7,8-TCDD, is given in the form of Toxic Equivalents (TEQ).

3.4.7 The TOMPS monitoring site is Manchester Law Courts at NGR: 383375, 398260, approximately 95.2km north-north-west of the site boundary. The most recent data available from this site is from 2016 and is summarised in Table 8.

Table 8: Dioxins and Furans Monitoring Results

Pollutant	Annual Mean Concentration (TEQ fg/m^3)
PCDD/F	23

3.5 BACKGROUND POLLUTANT CONCENTRATIONS

3.5.1 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality. The facility is located in grid square NGR: 403500, 305500. Data for this location was downloaded from the DEFRA website for the purpose of this assessment and is summarised in Table 9.

Table 9: Background Pollutant Concentrations Predictions

Pollutant	Predicted Background Concentration (µg/m^3)
NO_2	11.16
PM_{10}	12.43
$PM_{2.5}$	8.12
SO_2	4.82
C_6H_6	0.374
CO	337

3.5.2 As shown in Table 9, predicted background concentrations are well below the relevant AQOs at the site.

3.5.3 It should be noted that background concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted for 2022 in order to reflect current conditions in the vicinity of the site. The background concentration of C_6H_6 was predicted for 2010, whilst SO_2 and CO were predicted for 2001. These are the most recent predictions available from DEFRA.

3.6 SENSITIVE RECEPTORS

3.6.1 A sensitive receptor is defined as any location which may be affected by changes in air quality. These have been defined for human and ecological receptors in the following Sections.

Sensitive Human Receptors

3.6.2 A desk-top study was undertaken in order to identify any sensitive human receptor locations in the vicinity of the site that required specific consideration during the assessment. These are summarised in Table 10.

Table 10: Sensitive Human Receptor Locations

Receptor		NGR (m)	
		X	Y
R1	Residential - Pelsall Road	403860.1	305320.9
R2	Residential - Pelsall Road	403706.0	305185.3
R3	Residential - Pelsall Road	403527.2	305062.4
R4	Residential - St Johns Road	402950.7	304586.5
R5	Residential - Albion Road	404040.9	305573.0

3.6.3 Reference should be made to Figure 2 for a map showing the sensitive human receptor locations.

Sensitive Ecological Receptors

3.6.4 Atmospheric emissions from the facility have the potential to impact on receptors of ecological sensitivity within the vicinity of the site. The Conservation of Habitats and Species Regulations (2010) and subsequent amendments require competent authorities to review applications and consents that have the potential to impact on ecological designations. A study was therefore undertaken to identify the following sites of ecological or nature conservation importance:

- Special Areas of Conservation (SACs), Special Protection Areas (SPAs) or Ramsar sites within 10km of the facility; and,
- Sites of Special Scientific Interest (SSSIs), Local Nature Reserves (LNRs), Ancient Woodland (AW), Local Wildlife Sites (LWSs), Sites of Importance to Nature Conservation (SINCs) and Sites of Local Importance to Nature Conservation (SLINCs) within 2km of the facility.

3.6.5 The study was completed using the Multi-Agency Geographic Information for the Countryside (MAGIC) web-based interactive mapping service which draws together information on key environmental schemes and designations, as well as publicly available information. This indicated the following ecological designations within the relevant distances:

- Unnamed AW;
- Chasewater and the Southern Staffordshire Coalfield Heaths SSSI and SINC;
- Shire Oak Park LNR;
- Jockey Fields SSSI;
- Clayhanger SSSI;
- Pelsall North Common LNR;
- Brownhills Common LWS;
- Wyrley Hayes Wood LWS;
- Cannock Extension Canal SSSI and SAC; and,
- A number of unnamed SINCs and SLINCs.

3.6.6 For the purpose of the modelling assessment, discrete receptors were placed at the closest points of each designation to the facility to ensure the maximum potential impact was predicted. These are summarised in Table 11.

Table 11: Sensitive Ecological Receptor Locations

Receptor		NGR (m)	
		X	Y
E1	Unnamed Ancient Woodland / SINC	404025.0	305545.5
E2	Chasewater and the Southern Staffordshire Coalfield Heaths SSSI / SINC	404358.7	305919.8
E3	Shire Oak Park LNR / SINC	405558.2	303964.6
E4	Jockey Fields SSSI / SINC / SLINC	404032.9	303565.1
E5	Clayhanger SSSI	403568.9	304946.1
E6	Clayhanger SSSI	403263.6	304844.3
E7	Pelsall North Common LNR / SINC	402280.9	304861.8
E8	SINC / SLINC	403317.1	305257.7
E9	Brownhills Common LWS / SINC	403331.6	305735.9
E10	SINC	404604.1	305835.3
E11	SLINC	404188.9	305195.9
E12	SLINC	402736.3	305706.7
E13	Wyrley Hayes Wood LWS	402180.2	305359.9
E14	Cannock Extension Canal SSSI and SAC	401995.8	305396.2
E15	SLINC	403568.7	305183.4

3.6.7 Reference should be made to Figure 3 for a map of the ecological receptor locations.

3.6.8 Critical loads have been designated within the UK based on the sensitivity and relevant features of the receiving habitat. Review of the APIS website[7] was undertaken to identify the habitat types most sensitive to nitrogen deposition within each designation. The relevant critical loads are presented in Table 12.

Table 12: Critical Loads - Nitrogen Deposition

Ecological Designation	Feature	APIS Habitat	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
E1	Broadleafed mixed and Yew woodland	Broadleaved deciduous woodland	10	20
E2	Bogs	Raised and blanket bogs	5	10
E3	Broadleafed mixed and Yew woodland	Broadleaved deciduous woodland	10	20
E4 - E6	Fen, marsh and swamp (Juncus effusus / acutiflorus	Moist and wet oligotrophic grasslands: Molinia caerulea meadows	15	25

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

Ecological Designation	Feature	APIS Habitat	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
	- Galium palustre rush pasture)			
E7 - E13	Broadleafed mixed and Yew woodland	Broadleaved deciduous woodland	10	20
E14	Luronium natans - Floating water-plantain	Permanent oligotrophic waters: Softwater lakes	3	10
E15	Broadleafed mixed and Yew woodland	Broadleaved deciduous woodland	10	20

3.6.9 The site features were also reviewed to identify the habitat types most sensitive to acid deposition. These are summarised in Table 13.

Table 13: Critical Loads - Acid Deposition

Ecological Designation	Feature	APIS Habitat	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
E1	Broadleafed mixed and Yew woodland	Broadleafed/Coniferous unmanaged woodland	0.357	1.063	1.42
E2	Fen, marsh and swamp	Bogs	0.321	0.268	0.589
E3	Broadleafed mixed and Yew woodland	Broadleafed/Coniferous unmanaged woodland	0.357	1.611	1.968
E4	Neutral grassland (Holcus Lanatus - Juncus Effusus)	Acid grassland	0.438	0.91	1.348
E5 and E6	Neutral grassland (Holcus Lanatus - Juncus Effusus)	Acid grassland	0.438	0.26	0.698
E7	Broadleafed mixed and Yew woodland	Broadleaved deciduous woodland	0.357	2.485	2.842
E8 - E11	Broadleafed mixed and Yew woodland	Broadleaved deciduous woodland	0.357	1.063	1.42
E12 and E13	Broadleafed mixed and Yew woodland	Broadleaved deciduous woodland	0.357	1.639	1.996
E14	Luronium natans - Floating water-plantain	Freshwater	_(a)	_(a)	_(a)
E15	Broadleafed mixed and Yew woodland	Broadleaved deciduous woodland	0.357	1.063	1.42

Note: No stated critical load.

3.6.10 Background pollutant concentrations and deposition rates at each ecological receptor location were obtained from the APIS website[8] and are summarised in Table 14.

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

Table 14: Baseline Pollution Levels

Receptor	Annual Mean NO_x Concentration ($\mu g/m^3$)	Annual Mean SO_2 Concentration ($\mu g/m^3$)	Annual Nitrogen Deposition (kgN/ha/yr)	Acid Critical Load (keq/ha/yr)	
				Nitrogen	Sulphur
E1	21.48	2.01	41.58	2.97	0.28
E2	21.48	1.82	24.8	1.8	0.2
E3	22.12	1.63	38.36	2.74	0.26
E4	21.17	1.87	25.5	1.8	0.2
E5	18.66	1.73	25.2	1.8	0.2
E6	18.66	1.73	25.2	1.8	0.2
E7	20.47	2.03	42.7	3.05	0.3
E8	18.87	2.01	41.58	2.97	0.28
E9	18.87	2.01	41.58	2.97	0.28
E10	21.48	2.01	41.58	2.97	0.28
E11	21.48	2.01	41.58	2.97	0.28
E12	18.35	2.01	41.58	2.97	0.28
E13	18.35	2.01	41.58	2.97	0.28
E14	18.16	2.57	24.8	1.8	0.2
E15	18.87	2.01	41.58	2.97	0.28

4 METHODOLOGY

4.1 INTRODUCTION

4.1.1 Emissions associated with the combustion of waste within the SWIP have the potential to cause impacts at sensitive locations in the vicinity of the site. These have been quantified through dispersion modelling in accordance with the methodology outlined in the following Sections.

4.2 DISPERSION MODEL

4.2.1 Dispersion modelling was undertaken using ADMS-5.2 (v5.2.4.0), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS-5 is a short-range dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere. It is a new generation model utilising boundary layer height and Monin-Obukhov length to describe the atmospheric boundary layer and a skewed Gaussian concentration distribution to calculate dispersion under convective conditions.

4.2.2 The model utilises hourly meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology and calculates user-selected long-term and short-term averages.

4.3 MODELLING SCENARIOS

4.3.1 Predicted pollutant concentrations were summarised in the following formats:

- Process contribution (PC) - Predicted pollutant concentration as a result of emissions from the facility only; and
- Predicted environmental concentration (PEC) - Total predicted pollutant concentration as a result of emissions from the facility and existing baseline levels.

4.3.2 Predicted ground level pollutant concentrations and deposition rates were compared with the relevant AQOs, AQLVs, EALs, critical loads and critical levels. These criteria are collectively referred to as Environmental Quality Standards (EQSs).

Human Receptors

4.3.3 The scenarios considered for human receptors in the modelling assessment are summarised in Table 16.

Table 15: Human Receptor Modelling Scenarios

Pollutant	Modelled As	
	Short Term	Long Term
NO_2	99.8th percentile (%ile) 1-hour mean	Annual mean
PM_{10}	90.4th %ile 24-hour mean	Annual mean
$PM_{2.5}$	-	Annual mean
SO_2	99.9th %ile 15-minute mean	-

Pollutant	Modelled As	
	Short Term	Long Term
	99.73rd %ile 1-hour mean	
	99.2nd %ile 24-hour mean	
Total Volatile Organic Compounds (VOCs) as C_6H_6	24-hour mean	Annual mean
HCl	1-hour mean	-
HF	1-hour mean	Annual mean
CO	8-hour rolling mean	-
Cd and Tl (as Cd)	-	Annual mean
Hg	1-hour mean	Annual mean
Metals total Sb, As, Pb, Cr, Cobalt (Co), Cu, Mn, Ni, V and their compounds)	1-hour mean	Annual mean
PCDD/F	-	Annual mean

4.3.4 Some short-term air quality criteria are framed in terms of the number of occasions in a calendar year on which the concentration should not be exceeded. As such, the %iles shown in Table 15 were selected to represent the relationship between the permitted number of exceedances of short-period concentrations and the number of periods within a calendar year.

Ecological Receptors

4.3.5 The scenarios considered for ecological receptors in the modelling assessment are summarised in Table 16.

Table 16: Ecological Receptor Modelling Scenarios

Pollutant	Modelled As	
	Short Term	Long Term
NO_x	24-hour mean	Annual mean
SO_2	-	Annual mean
HF	24-hour mean	-
	Weekly mean	
Nitrogen deposition	-	Annual deposition
Acid deposition	-	Annual deposition

4.4 ASSESSMENT AREA

4.4.1 The assessment area was defined based on the facility location, anticipated pollutant dispersion patterns and the positioning of sensitive receptors. Ambient concentrations were predicted over NGR: 402570, 304500 to 404070, 306000. One Cartesian grid with a resolution of 10m was used within the model to produce data suitable for contour plotting using the Surfer software package.

4.4.2 Reference should be made to Figure 4 for a graphical representation of the assessment grid extents.

4.5 PROCESS CONDITIONS

4.5.1 A summary of the inputs used to describe the existing gas boiler in the assessment is provided in Table 17. These were obtained from the Applicant.

Table 17: Process Conditions

Parameters	Value	Unit
Stack location	403326.0, 305247.5	NGR
Stack height	13	m
Stack diameter	0.5	m
Exhaust gas temperature	80	°C
Exhaust gas flow rate	6,117.3	Nm^3/s
Exhaust gas efflux velocity	14.13[(a)]	m/s

Note: (a) Calculated from total actual volumetric flow rate for the plant which includes an additional 2,000m^3 of make-up air.

4.6 EMISSIONS

4.6.1 The pollutants considered within the assessment and their associated ELVs are shown in Table 18.

Table 18: Pollutant Emissions Concentrations

Pollutant	ELV (mg/m^3)		
	½-hour Mean	24-hour Mean	30-minute to 8-hour mean
NO_x	400	200	-
Particulate matter (PM)	30	10	-
SO_2	200	50	-
Total VOCs	20	10	-
HCl	60	10	-
HF	4	1	-
CO	100	50	-
Cd and Tl (as Cd)	-	-	0.05
Hg	-	-	0.05
Metals total Sb, As, Pb, Cr, Cobalt (Co), Cu, Mn, Ni, V and their compounds)	-	-	0.5
PCDD/Fs	-	-	0.0000001

4.6.2 Mass emission rates for use in the assessment were derived from the concentrations shown in Table 18 and the flow rate shown in in Table 17. The results are summarised in Table 19. This represents a conservative assessment approach with emissions assumed to be the maximum permitted with the plant operating in accordance with the relevant authorisation limits.

Table 19: Pollutant Mass Emission Rates

Pollutant	Mass Emissions Rate (g/s)	
	8-hour, 1 hour and 15-minute Modelling Period	**Annual, 24-hour and Weekly Modelling Periods**
NO_x	0.3399	0.6797
PM	-	0.0170
SO_2	0.0850	0.3399
Total VOCs	-	0.0170
HCl	0.1020	-
HF	0.0017	0.0068
CO	0.1699	-
Cd and Tl (as Cd)	-	0.0001
Hg	0.0001	0.0001
Metals total Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V and their compounds)	0.0008	0.0008
PCDD/Fs	1.7×10^{-10}	1.7×10^{-10}

4.6.3 Emissions of NO_x from combustion processes are predominantly in the form of NO. Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO_2. Comparisons of ambient NO and NO_2 concentrations in the vicinity of point sources in recent years has indicated that it is unlikely that more than 30% of the NO_x is present at ground level as NO_2.

4.6.4 Ground level NO_x concentrations were predicted through dispersion modelling. NO_2 concentrations reported in the results section assume 70% conversion from NO_x to NO_2 for annual means and 35% conversion for 1-hour concentrations, based upon EA guidance[9].

4.6.5 The emission concentration provided for Cd and Tl is stated as the total permitted level for both species in combination. However, Tl does not have an associated EQS and was therefore not considered as part of the assessment. As such, the purpose of the dispersion modelling it was assumed that 50% of the emission consisted of Cd.

4.6.6 The emission concentration provided for PM is stated as total dust. However, for the purposes of dispersion modelling it was considered that the entire PM emission consisted of only PM_{10} or $PM_{2.5}$. This allowed the maximum ground level impacts, with respect to the relevant EQS, to be assessed. Actual plant emissions of PM are unlikely to only consist of only one PM fraction, resulting in a worst-case assessment.

4.6.7 The ELV for VOC is stated as total organic carbon (TOC). However, for the purposes of dispersion modelling it was considered that the entire TOC emission consisted of only C_6H_6. This allowed the maximum ground level impacts to be assessed with respect to the EQS. Actual plant emissions of TOC are unlikely to only consist of one species, resulting in a worst-case assessment. It should be noted that emissions were modelled as TOC and results factored to C_6H_6 using the relative atomic mass to

[9] Environmental permitting: air dispersion modelling reports, EA, 2018.

carbon ratio.

4.6.8 The ELV for Sb, As, Pb, Cr, Co, Cu, Mn, Ni and V is stated as total Group 3 metals. Due to the low EQSs that have been designated for Cr (VI), As and Ni, the EA have issued guidance on the modelling of Group 3 metals in support of energy recovery plants[10]. This was reviewed for the purpose of the assessment and the following staged approach adopted:

- Potential impacts on annual mean Cr (VI), As and Ni and 1-hour mean V concentrations were assessed as these represent the lowest EQSs;
- Stage 1 - The full metal emission was considered to consist of only one species. Any species with predicted exceedances of the EQSs or that could not be screened out in accordance with the EA criteria were progressed to Stage 2;
- Stage 2 - The emission was apportioned equally between the relevant species. This resulted in 11% of the ELV being apportioned to each metal. Any species with predicted exceedances of the EQSs or that could not be screened out in accordance with the EA criteria were progressed to Stage 3; and,
- Stage 3 - Review EA data for specific species.

4.6.9 Emissions were assumed to be constant, with the plant in operation for 24-hours per day, 365-days per year. This is considered to be a worst-case assessment scenario as plant shutdown or periods of reduced work load are not reflected in the modelled emissions.

4.7 BUILDING EFFECTS

4.7.1 The dispersion of substances released from elevated sources can be influenced by the presence of buildings close to the emission point. Structures can interrupt the wind flows and cause significantly higher ground-level concentrations close to the source than would arise in the absence of the buildings.

4.7.2 Analysis of the site layout indicated that a number of buildings should be included within the model in order to take account of effects on pollutant dispersion. Input geometries are shown in Table 20.

Table 20: Building Geometries

Building	NGR (m)		Height (m)	Length / Diameter (m)	Width (m)	Angle (^{O})
	X	Y				
Plant Room	403338.3	305244.9	10.0	31.8	8.0	106.4
North Building	403329.9	305260.4	10.0	17.5	8.0	192.4
Office	403363.1	305267.0	7.0	4.1	11.1	179.4

4.7.3 Reference should be made to Figure 4 for a graphical representation of the site layout.

[10] Guidance to Applicants on Impact Assessment for Group 3 Metals Stack, EA, 2012.

4.8 METEOROLOGICAL DATA

4.8.1 Meteorological data used in this assessment was taken from Birmingham Airport Meteorological Station over the period 1st January 2015 to 31st December 2019 (inclusive). Birmingham Airport is located at NGR: 418446, 283594, which is approximately 26.4km south-east of the site. It is anticipated that conditions would be reasonably similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature.

4.8.2 All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 5 for a wind rose of the utilised meteorological data.

4.9 ROUGHNESS LENGTH

4.9.1 Roughness length (z_0) is a modelling parameter applied to allow consideration of surface height roughness elements. A z0 of 0.5m was used within the model to describe the modelling extents and meteorological site. This is considered appropriate for the morphology of both areas and is suggested within ADMS-5 as being suitable for 'parkland, open suburbia'.

4.10 MONIN-OBUKHOV LENGTH

4.10.1 The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used to describe the modelling extents and meteorological site. This is considered appropriate for the nature of both areas and is suggested within ADMS-5 as being suitable for a 'cities and large towns'.

4.11 TERRAIN DATA

4.11.1 Ordnance Survey OS Terrain 50 data was included in the model for the site and surrounding area in order to take account of the specific flow field produced by variations in ground height throughout the assessment extents. This was pre-processed using the method suggested by CERC[11].

4.12 NITROGEN DEPOSITION

4.12.1 Nitrogen deposition occurs as a result of NO_2. Nitrogen deposition rates were calculated using the conversion factors provided within EA document 'Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06'[12]. Predicted pollutant concentrations were multiplied by the relevant deposition velocity and conversion factor to calculate the speciated dry deposition flux. The conversion factors used for the determination of nitrogen deposition are presented within Table 21.

11 Note 105: Setting up Terrain Data for Input to CERC Models, CERC, 2016.

12 Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06, EA, 2014.

Table 21: Conversion Factors to Determine Dry Deposition Flux for Nitrogen Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to kg/ha/yr of pollutant species)
	Grassland	Forest	
NO_2	0.0015	0.003	95.9

4.12.2 The relevant deposition velocity for each ecological receptor was selected from Table 21 based on the vegetation type present within the designation.

4.13 ACID DEPOSITION

4.13.1 Acid deposition occurs as a result of NO_2, SO_2 and HCl. Predicted ground level pollutant concentrations of all these species were converted to kilo-equivalent ion depositions (keq/ha/yr) for comparison with the critical load for acid deposition at each of the identified ecological receptors. The conversion to units of equivalents, a measure of the potential acidifying effect of a species, was undertaken using the standard conversion factors shown in Table 22.

Table 22: Conversion Factors to Determine Dry Deposition Flux for Acid Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to kg/ha/yr of pollutant species)
	Grassland	Forest	
NO_2	0.0015	0.003	6.84
SO_2	0.012	0.024	9.84
HCl	0.025	0.06	8.63

4.13.2 The HCl equivalent was added to the sulphur proportion, in accordance with the methodology outlined in AQTAG 06.

4.13.3 The contribution of wet HCl deposition was determined by multiplying the dry deposition rate by a factor of three, as suggested in EA guidance H1[13]. This was also added to the sulphur contribution.

4.13.4 The PC proportion of the EQS was calculated using the following formula obtained from the APIS website[14]:

PC as %CL function = ((PC of pollutant deposition)/CLmaxN)*100

4.14 BACKGROUND CONCENTRATIONS

4.14.1 Review of existing data in the vicinity of the site was undertaken in Section 3 in order to identify suitable background values for use in the assessment. These were subsequently utilised to represent existing concentrations in the vicinity of the site. A summary of the relevant values is provided in Table 23.

4.14.2 It should be noted that the closest NO_2 monitors to the site are positioned at roadside locations within an urban centre and results are therefore unlikely to be representative of conditions at the facility. As such, the background concentration predicted by DEFRA was utilised to represent existing

[13] Horizontal Guidance Note H1 - Annex (f), EA, 2010.
[14] http://www.apis.ac.uk/.

concentrations in the vicinity of the site.

Table 23: Background Pollutant Concentrations

Pollutant	Background Pollutant Concentration Used In Model	Unit	Source
NO_2	11.16	µg/m^3	DEFRA Mapping
SO_2	4.82	µg/m^3	DEFRA Mapping
C_6H_6	0.374	µg/m^3	DEFRA Mapping
CO	337	µg/m^3	DEFRA Mapping
PM_{10}	12.43	µg/m^3	DEFRA Mapping
$PM_{2.5}$	8.12	µg/m^3	DEFRA Mapping
HCl	0.16	µg/m^3	UKEAP
HF	2.35	µg/m^3	UKEAP
Cd	0.88	ng/m^3	EPAQS
Hg	2.3	ng/m^3	Heavy metals network
PCDD	23	fg/m^3	Heavy metals network
As	1.12	ng/m^3	TOMPS network
Cr (VI)	3.92	ng/m^3	Heavy metals network
Ni	1.48	ng/m^3	Heavy metals network
V	0.88	ng/m^3	Heavy metals network

4.14.3 Background levels at the ecological receptors were obtained from the APIS website, as summarised in Table 14.

4.14.4 It is not possible to add short-term peak baseline and process concentrations. This is because the conditions which give rise to peak ground-level concentrations of substances emitted from an elevated source at a particular location and time are likely to be different to the conditions which give rise to peak concentrations due to emissions from other sources. This point is addressed in EA guidance 'Air emissions risk assessment for your environmental permit'[15], which advises that an estimate of the maximum combined pollutant concentration can be obtained by adding the maximum predicted short-term concentration due to emissions from the source to twice the annual mean baseline concentration. This approach was adopted throughout the assessment.

4.15 ASSESSMENT CRITERIA

Human Receptors

4.15.1 EA guidance 'Air emissions risk assessment for your environmental permit'[16] states that PCs can be screened as insignificant if they meet the following criteria:

- The short-term PC is less than 10% of the short-term environmental standard; and,

15 https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.
16 https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

- The long-term PC is less than 1% of the long-term environmental standard.

4.15.2 If these criteria are exceeded the following guidance is provided on when PECs can be screened as insignificant:

- The short-term PC is less than 20% of the short-term environmental standards minus twice the long-term background concentration; and,
- The long-term PEC is less than 70% of the long-term environmental standards.

4.15.3 In addition, the following screening criteria are outlined in EA guidance[17] for metal concentrations:

- Long-term PC is less than 1% and short-term PC is less than 10%; or,
- Long-term and short-term PEC is less than 100% (taking likely modelling uncertainties into account).

4.15.4 For screening purposes only, the EA methodology assumes that Cr (VI) comprises 20% of the total background Cr.

4.15.5 Should the above criteria be exceeded then additional consideration to potential impacts should be provided.

Ecological Receptors

4.15.6 EA guidance 'Air emissions risk assessment for your environmental permit'[18] states that PCs at international designations can be screened as insignificant if they meet the following criteria:

- 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; and,
- The long-term PEC is less than 70% of the long-term environmental standards.

4.15.7 The guidance states that PCs at local nature sites can be screened as insignificant if they meet the following criteria:

- The short-term PC is less than 100% of the short-term environmental standard; and,
- The long-term PC is less than 100% of the long-term environmental standard.

4.15.8 Predicted PCs have been compared to the relevant EQSs and the criteria stated above.

4.16 MODEL UNCERTAINTY

4.16.1 Uncertainty in dispersion modelling predictions can be associated with a variety of factors including:

- Model uncertainty - due to model limitations;

17 Guidance to Applicants on Impact Assessment for Group 3 Metals Stack, EA, 2012.
18 https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

- Data uncertainty - due to errors in input data, including emission estimates, operational procedures, land use characteristics and meteorology; and,
- Variability - randomness of measurements used.

4.16.2 Potential uncertainties in the model results were minimised as far as practicable and worst-case inputs used in order to provide a robust assessment. This included the following:

- Choice of model - ADMS-5 is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;
- Meteorological data - Modelling was undertaken using five meteorological data sets from an observation site local to the facility to take account of inter-year variability. The assessment was based on the worst-case year for each averaging period to ensure maximum concentrations were considered;
- Surface characteristics - The z_0 and Monin-Obukhov length were determined for both the dispersion and meteorological sites based on the surrounding land uses and guidance provided by CERC;
- Plant operating conditions - Operational parameters for the plant were supplied by the applicant, based on the performance specifications. As such, these are considered to be representative of likely operating conditions;
- Emission rates - Emission rates were derived from information provided the applicant and the relevant ELVs for the plant. Emissions were assumed to be constant throughout the modelling period, which does not allow for operational shut down. These assumptions are likely to overestimate actual emissions and therefore result in a worst-case assessment;
- Background concentrations - Background pollutant levels were obtained from the DEFRA mapping study, APIS and national monitoring networks. As such, they are considered suitable for an assessment of this nature;
- Receptor locations - A Cartesian Grid was included in the model in order to provide suitable data for contour plotting. Receptor points were also included at sensitive locations to provide additional consideration of these areas; and,
- Variability - All model inputs were as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

4.16.3 Results were considered in the context of the relevant EQSs. It is considered that the use of the stated measures to reduce uncertainty and the use of worst-case assumptions when necessary has resulted in model accuracy of an acceptable level.

5 ASSESSMENT

5.1 INTRODUCTION

5.1.1 Dispersion modelling was undertaken with the inputs described in Section 4. The results are provided in the following Sections.

5.2 MAXIMUM POLLUTANT CONCENTRATIONS

5.2.1 Maximum predicted pollutant concentrations at any point within the assessment extents for any meteorological data set are summarised in Table 24.

Table 24: Maximum Predicted Pollutant Concentrations

Pollutant	Averaging Period	Unit	EQS	PC	PC Proportion of EQS (%)	PEC	PEC Proportion of EQS (%)
NO_2	Annual	µg/m^3	40	9.86	24.7	21.02	52.6
	99.8th %ile 1-hour mean	µg/m^3	200	48.98	24.5	71.30	35.7
SO_2	99.2nd %ile 24-hour mean	µg/m^3	125	11.72	9.4	21.36	17.1
	99.73rd %ile 1-hour mean	µg/m^3	350	68.35	19.5	77.99	22.3
	99.9th %ile 15-minute mean	µg/m^3	266	76.13	28.6	85.77	32.2
C_6H_6	Annual	µg/m^3	5	0.76	15.3	1.14	22.7
	24-hour	µg/m^3	30	2.95	9.8	3.70	12.3
CO	Rolling 8-hour	µg/m^3	10,000	46.81	0.5	720.81	7.2
PM_{10}	Annual	µg/m^3	40	0.70	1.8	13.13	32.8
	90.4th %ile 24-hour mean	µg/m^3	50	1.22	2.4	26.08	52.2
$PM_{2.5}$	Annual	µg/m^3	20	0.70	3.5	8.82	44.1
HCl	1-hour	µg/m^3	750	54.15	7.2	54.47	7.3
HF	Annual	µg/m^3	16	0.07	0.4	2.42	15.1
	1 hour	µg/m^3	160	3.61	2.3	8.31	5.2
Cd	Annual	ng/m^3	5	2.07	41.4	2.95	59.0
Hg	Annual	ng/m^3	250	4.14	1.7	6.44	2.6
	1-hour	ng/m^3	7,500	50.79	0.7	55.39	0.7
PCDD/Fs	Annual	fg/m^3	n/a	0.01	-	23.01	-
	1-hour	fg/m^3	n/a	0.09	-	46.09	-

5.2.2 As shown in shown in Table 24, there were no predicted exceedances of any EQS at any location for any pollutant or averaging period.

5.3 METAL CONCENTRATIONS

5.3.1 A staged assessment methodology was utilised for the prediction of grouped metal concentrations, as outlined previously. Potential impacts on annual mean Cr(VI), As and Ni and 1-hour mean V concentrations were assessed as these represent the lowest EQSs. The results are outlined below.

Stage 1

5.3.2 Predicted concentrations with the full metal emission considered to consist of only one species are summarised in Table 25.

Table 25: Predicted Metal Concentrations - Stage 1

Pollutant	Averaging Period	Unit	EQS	PC	PC Proportion of EQS (%)	PEC	PEC Proportion of EQS (%)
As	Annual	ng/m^3	3	33.16	1,105.3	34.28	1,142.6
Cr (VI)	Annual	ng/m^3	0.2	33.16	16,579.3	37.08	18,539.3
Ni	Annual	ng/m^3	20	33.16	165.8	34.64	173.2
V	1-hour	ng/m^3	1,000	424.69	42.5	426.45	42.6

5.3.3 As indicated in Table 25, the EA criteria was exceeded for the predicted PC of all metals. However, due to the low PEC of V it is considered unlikely that exceedances of the relevant EQSs would occur. As such, the second EA criteria was achieved and there was no requirement to proceed to a Stage 2 Assessment for this species.

5.3.4 As, Cr (VI) and Ni were progressed to a Stage 2 Assessment.

Stage 2

5.3.5 Predicted concentrations with the metal emission distributed equally between all species are summarised in Table 26.

Table 26: Predicted Metal Concentrations - Stage 2

Pollutant	Averaging Period	Unit	EQS	PC	PC Proportion of EQS (%)	PEC	PEC Proportion of EQS (%)
As	Annual	ng/m^3	3	3.65	121.6	4.77	158.9
Cr (VI)	Annual	ng/m^3	0.2	3.65	1,823.7	7.57	3,783.7
Ni	Annual	ng/m^3	20	3.65	18.2	5.13	25.6

5.3.6 As indicated in Table 26, the EA criteria was exceeded for the predicted PC of all metals. However, due to the low PEC of Ni it is considered unlikely that exceedances of the relevant EQSs would occur. As such, the second EA criteria was achieved and there was no requirement to proceed to a Stage 3 Assessment for this species.

5.3.7 Cr (VI) and As were progressed to a Stage 3 Assessment.

Stage 3

5.3.8 The EA metals guidance[19] provides a range of emission concentrations (corresponding fractions of the total metals emission) measured at twenty municipal waste incineration facilities in the UK. The data suggests that, on average, Cr comprises 1.7% of the total metals emission and provides a mean Cr(VI) emission rate of 3.5 x 10^{-5}mg/Nm^3, whilst As comprises 0.2% of the total metals emission and provides a mean emission rate of 0.001mg/Nm^3. The predicted maximum PCs and PECs utilising this data is summarised in Table 27.

Table 27: Predicted Metal Concentrations - Stage 3

Pollutant	Averaging Period	Unit	EQS	PC	PC Proportion of EQS (%)	PEC	PEC Proportion of EQS (%)
As	Annual	ng/m^3	3	0.066	2.2	1.186	39.5
Cr (VI)	Annual	ng/m^3	0.2	0.002	1.2	0.786	393.2

5.3.9 As shown in Table 27, the As PEC is less than the relevant EQS. As such, impacts are not predicted to be significant. The Cr (VI) PEC is greater than the EQS. However, the PC is only slightly above 1% of the EQS and the point of maximum impact is not considered a location of relevant exposure, as outlined in Table 2 and shown on Figure 25. As such, the impact is not considered to be significant.

5.4 HUMAN RECEPTORS

Nitrogen Dioxide

5.4.1 Predicted annual mean NO_2 PECs, inclusive of background levels, are summarised in Table 28.

Table 28: Predicted Annual Mean NO_2 Concentrations

Receptor	Predicted Annual Mean NO_2 PEC (µg/m^3)				
	2015	2016	2017	2018	2019
R1	11.46	11.45	11.55	11.45	11.45
R2	11.54	11.52	11.64	11.49	11.52
R3	11.89	11.88	12.03	11.79	11.91
R4	11.23	11.26	11.20	11.25	11.21
R5	11.33	11.32	11.37	11.33	11.33

5.4.2 As indicated in Table 28, predicted NO_2 concentrations were below the annual mean EQS of 40µg/m^3 at all sensitive receptor locations for all meteorological data sets.

5.4.3 Maximum predicted annual mean NO_2 concentrations at the receptor locations are summarised in Table 29.

[19] Guidance to Applicants on Impact Assessment for Group 3 Metals Stack, EA, 2012.

Table 29: Maximum Predicted Annual Mean NO_2 Concentrations

Receptor		Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	0.39	11.55	1.0	28.9
R2	Residential - Pelsall Road	0.48	11.64	1.2	29.1
R3	Residential - Pelsall Road	0.87	12.03	2.2	30.1
R4	Residential - St Johns Road	0.10	11.26	0.2	28.1
R5	Residential - Albion Road	0.21	11.37	0.5	28.4

5.4.4 As indicated in Table 29, all PECs were below 70% of the EQS. As such, predicted effects on annual mean NO_2 concentrations are not considered to be significant, in accordance with the stated criteria.

5.4.5 Predicted 99.8th %ile 1-hour mean NO2 PECs, inclusive of background levels, are summarised in Table 30.

Table 30: Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations

Receptor	Predicted 99.8th %ile 1-hour Mean NO_2 PEC ($\mu g/m^3$)				
	2015	2016	2017	2018	2019
R1	29.11	29.43	29.43	29.06	29.15
R2	30.11	30.22	29.82	29.48	29.82
R3	33.26	33.04	33.90	33.83	33.97
R4	25.68	26.39	25.54	26.06	25.52
R5	26.89	27.08	27.61	27.20	27.06

5.4.6 As indicated in Table 30, predicted NO_2 concentrations were below the 1-hour mean EQS of 200$\mu g/m^3$ at all sensitive receptor locations for all meteorological data sets.

5.4.7 Maximum predicted 1-hour mean NO_2 concentrations at the receptor locations are summarised in Table 31.

Table 31: Maximum Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations

Receptor		Predicted 99.8th %ile 1-hour NO_2 Concentration ($\mu g/m^3$)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Residential - Pelsall Road	7.11	29.43	3.6	4.0
R2	Residential - Pelsall Road	7.90	30.22	4.0	4.4
R3	Residential - Pelsall Road	11.65	33.97	5.8	6.6
R4	Residential - St Johns Road	4.07	26.39	2.0	2.3
R5	Residential - Albion Road	5.29	27.61	2.6	3.0

Note: (a) PC proportion of EQS minus twice the long-term background concentration.

5.4.8 As indicated in Table 31, all PCs were below 10% of the EQS at all sensitive locations. As such,

predicted effects on 1-hour mean NO_2 concentrations are not considered to be significant, in accordance with the stated criteria.

Sulphur Dioxide

5.4.9 Predicted 99.2nd %ile 24-hour mean SO_2 PECs, inclusive of background levels, are summarised in Table 32.

Table 32: Predicted 99.2nd %ile 24-hour Mean SO_2 Concentrations

Receptor	Predicted 99.2nd %ile 24-hour Mean SO_2 PEC (µg/m^3)				
	2015	2016	2017	2018	2019
R1	10.25	10.29	10.38	10.43	10.34
R2	10.40	10.41	10.60	10.51	10.34
R3	11.22	11.21	11.40	11.31	11.39
R4	9.93	9.93	9.87	10.00	9.87
R5	10.00	9.97	10.03	10.00	9.97

5.4.10 As indicated in Table 32, predicted SO_2 concentrations were below the 24-hour mean EQS of 125µg/m^3 at all sensitive receptor locations for all meteorological data sets.

5.4.11 Maximum predicted 24-hour mean SO_2 concentrations at the receptor locations are summarised in Table 33.

Table 33: Maximum Predicted 99.2nd %ile 24-hour Mean SO_2 Concentrations

Receptor		Predicted 99.2nd %ile 24-hour SO_2 Concentration (µg/m^3)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Residential - Pelsall Road	0.79	10.43	0.6	0.7
R2	Residential - Pelsall Road	0.96	10.60	0.8	0.8
R3	Residential - Pelsall Road	1.76	11.40	1.4	1.5
R4	Residential - St Johns Road	0.36	10.00	0.3	0.3
R5	Residential - Albion Road	0.39	10.03	0.3	0.3

Note: (a) PC proportion of EQS minus twice the long-term background concentration.

5.4.12 As indicated in Table 33, all PCs were below 10% of the EQS at all sensitive locations. As such, predicted effects on 24-hour mean SO_2 concentrations are not considered to be significant, in accordance with the stated criteria.

5.4.13 Predicted 99.73rd %ile 1-hour mean SO_2 PECs, inclusive of background levels, are summarised in Table 34.

Table 34: Predicted 99.73rd %ile 1-hour Mean SO_2 Concentrations

Receptor	Predicted 99.73rd %ile 1-hour Mean SO_2 PEC (µg/m³)				
	2015	2016	2017	2018	2019
R1	18.12	19.37	19.39	18.06	18.36
R2	20.09	19.91	19.79	19.37	19.37
R3	24.06	24.22	25.65	24.57	25.27
R4	13.92	14.46	12.84	14.26	12.98
R5	16.02	16.25	16.49	16.34	16.21

5.4.14 As indicated in Table 34, predicted SO_2 concentrations were below the 1-hour mean EQS of 350µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.4.15 Maximum predicted 1-hour mean SO_2 concentrations at the receptor locations are summarised in Table 35.

Table 35: Maximum Predicted 99.73rd %ile 1-hour Mean SO_2 Concentrations

Receptor		Predicted 99.73rd %ile 1-hour SO_2 Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Residential - Pelsall Road	9.75	19.39	2.8	2.9
R2	Residential - Pelsall Road	10.45	20.09	3.0	3.1
R3	Residential - Pelsall Road	16.01	25.65	4.6	4.7
R4	Residential - St Johns Road	4.82	14.46	1.4	1.4
R5	Residential - Albion Road	6.85	16.49	2.0	2.0

Note: (a) PC proportion of EQS minus twice the long-term background concentration.

5.4.16 As indicated in Table 35, all PCs were below 10% of the EQS at all sensitive locations. As such, predicted effects on 1-hour mean SO_2 concentrations are not considered to be significant, in accordance with the stated criteria.

5.4.17 Predicted 99.9th %ile 15-minute mean SO_2 PECs, inclusive of background levels, are summarised in Table 36.

Table 36: Predicted 99.9th %ile 15-minute Mean SO_2 Concentrations

Receptor	Predicted 99.9th %ile 15-minute Mean SO_2 PEC (µg/m³)				
	2015	2016	2017	2018	2019
R1	25.60	27.02	26.86	26.33	26.01
R2	25.64	25.50	25.50	24.74	25.52
R3	30.13	30.04	31.34	30.26	30.85
R4	18.56	19.61	17.51	19.65	15.94
R5	21.33	21.32	21.40	21.37	21.27

5.4.18 As indicated in Table 36, predicted SO_2 concentrations were below the 15-minute mean EQS of

266µg/m^3 at all sensitive receptor locations for all meteorological data sets.

5.4.19 Maximum predicted 15-minute mean SO_2 concentrations at the receptor locations are summarised in Table 37.

Table 37: Maximum Predicted 99.9th %ile 15-minute Mean SO_2 Concentrations

Receptor		Predicted 99.9th %ile 15-minute Mean SO_2 Concentration (µg/m^3)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Residential - Pelsall Road	17.38	27.02	6.5	6.8
R2	Residential - Pelsall Road	16.00	25.64	6.0	6.2
R3	Residential - Pelsall Road	21.70	31.34	8.2	8.5
R4	Residential - St Johns Road	10.01	19.65	3.8	3.9
R5	Residential - Albion Road	11.76	21.40	4.4	4.6

Note: (a) PC proportion of EQS minus twice the long-term background concentration.

5.4.20 As indicated in Table 37, all PCs were below 10% of the EQS at all sensitive locations. As such, predicted effects on 15-minute mean SO_2 concentrations are not considered to be significant, in accordance with the stated criteria.

Volatile Organic Compounds

5.4.21 Predicted annual mean VOC (as C_6H_6) PECs, inclusive of background levels, are summarised in Table 38.

Table 38: Predicted Annual Mean VOC (as C_6H_6) Concentrations

Receptor	Predicted Annual Mean VOC (as C_6H_6) PEC (µg/m^3)				
	2015	2016	2017	2018	2019
R1	0.40	0.40	0.40	0.40	0.40
R2	0.40	0.40	0.41	0.40	0.40
R3	0.43	0.43	0.44	0.42	0.43
R4	0.38	0.38	0.38	0.38	0.38
R5	0.39	0.39	0.39	0.39	0.39

5.4.22 As indicated in Table 38, predicted VOC (as C_6H_6) concentrations were below the annual mean EQS of 5µg/m^3 at all sensitive receptor locations for all meteorological data sets.

Maximum predicted annual mean VOC (as C_6H_6) concentrations at the receptor locations are summarised in

5.4.23 Table 39.

Table 39: Maximum Annual Mean VOC (as C_6H_6) Concentrations

Receptor		Predicted Annual Mean VOC (as C_6H_6) Concentration ($\mu g/m^3$)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	0.03	0.40	0.6	8.1
R2	Residential - Pelsall Road	0.04	0.41	0.7	8.2
R3	Residential - Pelsall Road	0.07	0.44	1.4	8.8
R4	Residential - St Johns Road	0.01	0.38	0.1	7.6
R5	Residential - Albion Road	0.02	0.39	0.3	7.8

As indicated in

5.4.24 Table 39, all PECs were below 70% of the EQS. As such, predicted effects on annual mean C_6H_6 concentrations are not considered to be significant, in accordance with the stated criteria.

5.4.25 Predicted 24-hour mean VOC (as C_6H_6) PECs, inclusive of background levels, are summarised in Table 40.

Table 40: Predicted 24-hour Mean VOC (as C_6H_6) Concentrations

Receptor	Predicted 24-hour Mean VOC (as C_6H_6) PEC ($\mu g/m^3$)				
	2015	2016	2017	2018	2019
R1	0.91	0.91	0.91	0.91	0.89
R2	0.91	0.94	0.94	1.01	0.94
R3	1.15	1.14	1.12	1.11	1.30
R4	0.82	0.81	0.80	0.83	0.82
R5	0.84	0.82	0.84	0.83	0.82

5.4.26 As indicated in Table 40, predicted VOC (as C_6H_6) concentrations were below the 24-hour mean EQS of 30$\mu g/m^3$ at all sensitive receptor locations for all meteorological data sets.

5.4.27 Maximum predicted 24-hour mean VOC (as C_6H_6) concentrations at the receptor locations are summarised in Table 41.

Table 41: Maximum Predicted 24-hour Mean VOC (as C_6H_6) Concentrations

Receptor		Predicted 24-hour Mean VOC (as C_6H_6) Concentration ($\mu g/m^3$)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Residential - Pelsall Road	0.17	0.91	0.1	0.1
R2	Residential - Pelsall Road	0.27	1.01	0.1	0.1
R3	Residential - Pelsall Road	0.56	1.30	0.3	0.3
R4	Residential - St Johns Road	0.09	0.83	0.0	0.0
R5	Residential - Albion Road	0.10	0.84	0.0	0.0

Note: (a) PC proportion of EQS minus twice the long-term background concentration.

5.4.28 As indicated in Table 41, all PCs were below 10% of the EQS at all sensitive receptor locations. As such, predicted effects on 24-hour mean C_6H_6 concentrations are not considered to be significant, in accordance with the stated criteria.

Carbon Monoxide

5.4.29 Predicted 8-hour rolling mean CO PECs, inclusive of background levels, are summarised in Table 42.

Table 42: Predicted 8-hour Rolling Mean CO Concentrations

Receptor	Predicted 8-hour Rolling Mean CO PEC ($\mu g/m^3$)				
	2015	2016	2017	2018	2019
R1	677.30	677.14	678.01	677.09	677.37
R2	677.95	678.09	677.60	677.77	677.28
R3	680.94	679.86	680.20	680.39	680.35
R4	677.34	675.53	675.18	675.53	676.10
R5	675.94	676.02	675.97	676.04	675.87

5.4.30 As indicated in Table 42, predicted CO concentrations were below the 8-hour rolling mean EQS of 10,000$\mu g/m^3$ at all sensitive receptor locations for all meteorological data sets.

5.4.31 Maximum predicted 8-hour rolling mean CO concentrations at the receptor locations are summarised in Table 43.

Table 43: Maximum Predicted 8-hour Rolling Mean CO Concentrations

Receptor		Predicted 8-hour Rolling Mean CO Concentration ($\mu g/m^3$)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Residential - Pelsall Road	4.01	678.01	0.0	0.0
R2	Residential - Pelsall Road	4.09	678.09	0.0	0.0
R3	Residential - Pelsall Road	6.94	680.94	0.1	0.1
R4	Residential - St Johns Road	3.34	677.34	0.0	0.0

Receptor		Predicted 8-hour Rolling Mean CO Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R5	Residential - Albion Road	2.04	676.04	0.0	0.0

Note: (a) PC proportion of EQS minus twice the long-term background concentration.

5.4.32 As indicated in Table 43, all PCs were below 10% of the EQS at all sensitive receptor locations. As such, predicted effects on 8-hour rolling mean CO concentrations are not considered to be significant, in accordance with the stated criteria.

Particulate Matter

5.4.33 Predicted annual mean PM_{10} PECs, inclusive of background levels, are summarised in Table 44.

Table 44: Predicted Annual Mean PM_{10} Concentrations

Receptor	Predicted Annual Mean PM_{10} PEC (µg/m³)				
	2015	2016	2017	2018	2019
R1	12.45	12.45	12.46	12.45	12.45
R2	12.46	12.46	12.46	12.45	12.46
R3	12.48	12.48	12.49	12.47	12.48
R4	12.43	12.44	12.43	12.44	12.43
R5	12.44	12.44	12.45	12.44	12.44

5.4.34 As indicated in Table 44, predicted PM_{10} concentrations were below the annual mean EQS of 40µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.4.35 Maximum predicted annual mean PM_{10} concentrations at the receptor locations are summarised in Table 45.

Table 45: Maximum Annual Mean PM_{10} Concentrations

Receptor		Predicted Annual Mean PM_{10} Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	0.03	12.46	0.1	31.1
R2	Residential - Pelsall Road	0.03	12.46	0.1	31.2
R3	Residential - Pelsall Road	0.06	12.49	0.2	31.2
R4	Residential - St Johns Road	0.01	12.44	0.0	31.1
R5	Residential - Albion Road	0.02	12.45	0.0	31.1

5.4.36 As indicated in Table 45, all PCs were below 1% of the EQS at all sensitive receptor locations. As such, predicted effects on annual mean PM_{10} concentrations are not considered to be significant, in accordance with the stated criteria.

5.4.37 Predicted 90.4th %ile 24-hour mean PM_{10} PECs, inclusive of background levels, are summarised in

Table 46.

Table 46: Predicted 90.4th %ile 24-hour Mean PM_{10} Concentrations

Receptor	Predicted 90.4th %ile 24-hour Mean PM_{10} PEC (µg/m³)				
	2015	2016	2017	2018	2019
R1	24.92	24.93	24.94	24.93	24.92
R2	24.95	24.95	24.96	24.93	24.95
R3	25.04	25.05	25.07	25.03	25.06
R4	24.88	24.89	24.87	24.89	24.87
R5	24.89	24.90	24.90	24.90	24.90

5.4.38 As indicated in Table 46, predicted PM_{10} concentrations were below the 24-hour mean EQS of 50µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.4.39 Maximum predicted 24-hour mean PM_{10} concentrations at the receptor locations are summarised in Table 47.

Table 47: Maximum Predicted 90.4th %ile 24-hour Mean PM_{10} Concentrations

Receptor		Predicted 90.4th %ile 24-hour Mean PM_{10} Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Residential - Pelsall Road	0.08	24.94	0.2	0.3
R2	Residential - Pelsall Road	0.10	24.96	0.2	0.4
R3	Residential - Pelsall Road	0.21	25.07	0.4	0.8
R4	Residential - St Johns Road	0.03	24.89	0.1	0.1
R5	Residential - Albion Road	0.04	24.90	0.1	0.2

Note: (a) PC proportion of EQS minus twice the long-term background concentration.

5.4.40 As indicated in Table 47, all PCs were below 10% of the EQS at all sensitive receptor locations. As such, predicted effects on 24-hour mean PM_{10} concentrations are not considered to be significant, in accordance with the stated criteria.

5.4.41 Predicted annual mean $PM_{2.5}$ PECs, inclusive of background levels, are summarised in Table 48.

Table 48: Predicted Annual Mean PM_{10} Concentrations

Receptor	Predicted Annual Mean $PM_{2.5}$ PEC (µg/m³)				
	2015	2016	2017	2018	2019
R1	8.14	8.14	8.15	8.14	8.14
R2	8.15	8.15	8.15	8.14	8.15
R3	8.17	8.17	8.18	8.16	8.17
R4	8.12	8.13	8.12	8.13	8.12
R5	8.13	8.13	8.14	8.13	8.13

5.4.42 As indicated in Table 48, predicted $PM_{2.5}$ concentrations were below the annual mean EQS of 20µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.4.43 Maximum predicted annual mean $PM_{2.5}$ concentrations at the receptor locations are summarised in Table 49.

Table 49: Maximum Annual Mean $PM_{2.5}$ Concentrations

Receptor		Predicted Annual Mean $PM_{2.5}$ Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	0.03	8.15	0.1	40.7
R2	Residential - Pelsall Road	0.03	8.15	0.2	40.8
R3	Residential - Pelsall Road	0.06	8.18	0.3	40.9
R4	Residential - St Johns Road	0.01	8.13	0.0	40.6
R5	Residential - Albion Road	0.02	8.14	0.1	40.7

5.4.44 As indicated in Table 49, PCs were below 1% of the EQS at all sensitive receptor locations. As such, predicted effects on annual mean $PM_{2.5}$ concentrations are not considered to be significant, in accordance with the stated criteria.

Hydrogen Chloride

5.4.45 Predicted 1-hour mean HCl PECs, inclusive of background levels, are summarised in Table 50.

Table 50: Predicted 1-hour Mean HCl Concentrations

Receptor	Predicted 1-hour Mean HCl PEC (µg/m³)				
	2015	2016	2017	2018	2019
R1	3.93	3.91	3.90	3.94	3.95
R2	4.03	4.01	4.01	4.22	3.99
R3	5.65	5.64	5.67	5.65	5.66
R4	2.51	2.54	2.52	2.54	2.54
R5	2.66	2.65	2.65	2.69	2.69

5.4.46 As indicated in Table 50, predicted HCl concentrations were below the 1-hour mean EQS of 750µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.4.47 Maximum predicted 1-hour mean HCl concentrations at the receptor locations are summarised in Table 51.

Table 51: Maximum Predicted 1-hour Mean HCl Concentrations

Receptor		Predicted 1-hour Mean HCl Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	3.63	3.95	0.5	0.5
R2	Residential - Pelsall Road	3.90	4.22	0.5	0.5
R3	Residential - Pelsall Road	5.35	5.67	0.7	0.7
R4	Residential - St Johns Road	2.22	2.54	0.3	0.3
R5	Residential - Albion Road	2.37	2.69	0.3	0.3

5.4.48 As indicated in Table 51, all PCs were below 10% of the EQS. As such, predicted effects on 1-hour mean HCl concentrations are not considered to be significant, in accordance with the stated criteria.

Hydrogen Fluoride

5.4.49 Predicted annual mean HF PECs, inclusive of background levels, are summarised in Table 52.

Table 52: Predicted Annual Mean HF Concentrations

Receptor	Predicted Annual Mean HF PEC (µg/m³)				
	2015	2016	2017	2018	2019
R1	2.352	2.352	2.353	2.352	2.352
R2	2.353	2.353	2.353	2.352	2.353
R3	2.355	2.355	2.356	2.354	2.355
R4	2.350	2.351	2.350	2.351	2.350
R5	2.351	2.351	2.352	2.351	2.351

5.4.50 As indicated in Table 52, predicted HF concentrations were below the long-term EQS of 16µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.4.51 Maximum predicted annual mean HF concentrations at the receptor locations are summarised in Table 53.

Table 53: Maximum Predicted Annual Mean HF Concentrations

Receptor		Predicted Annual Mean HF Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	0.003	2.353	0.02	14.70
R2	Residential - Pelsall Road	0.003	2.353	0.02	14.71
R3	Residential - Pelsall Road	0.006	2.356	0.04	14.73
R4	Residential - St Johns Road	0.001	2.351	0.00	14.69

Receptor		Predicted Annual Mean HF Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R5	Residential - Albion Road	0.002	2.352	0.01	14.70

5.4.52 As indicated in Table 53, PCs were below 1% of the EQS at all sensitive receptor locations. As such, predicted effects on annual mean HF concentrations are not considered to be significant, in accordance with the stated criteria.

5.4.53 Predicted 1-hour mean HF PECs, inclusive of background levels, are summarised in Table 54.

Table 54: Predicted 1-hour Mean HF Concentrations

Receptor	Predicted 1-hour Mean HF PEC (µg/m³)				
	2015	2016	2017	2018	2019
R1	4.941	4.939	4.938	4.941	4.942
R2	4.947	4.946	4.946	4.960	4.945
R3	5.055	5.054	5.057	5.055	5.056
R4	4.846	4.848	4.846	4.848	4.848
R5	4.856	4.855	4.855	4.858	4.858

5.4.54 As indicated in Table 54, predicted HF concentrations were below the 1-hour mean EQS of 160µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.4.55 Maximum predicted 1-hour mean HF concentrations at the receptor locations are summarised in Table 55.

Table 55: Maximum Predicted 1-hour Mean HF Concentrations

Receptor		Predicted 1-hour HF Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	0.24	4.94	0.15	0.16
R2	Residential - Pelsall Road	0.26	4.96	0.16	0.17
R3	Residential - Pelsall Road	0.36	5.06	0.22	0.23
R4	Residential - St Johns Road	0.15	4.85	0.09	0.10
R5	Residential - Albion Road	0.16	4.86	0.10	0.10

5.4.56 As indicated in Table 55, PCs were below 10% of the EQS at all sensitive receptor locations. As such, predicted effects on 1-hour mean HF concentrations are not considered to be significant, in accordance with the stated criteria.

Cadmium

5.4.57 Predicted annual mean Cd PECs, inclusive of background levels, are summarised in Table 56.

Table 56: Predicted Annual Mean Cd Concentrations

Receptor	Predicted Annual Mean Cd PEC (ng/m^3)				
	2015	2016	2017	2018	2019
R1	0.94	0.94	0.96	0.94	0.94
R2	0.96	0.96	0.98	0.95	0.95
R3	1.03	1.03	1.06	1.01	1.04
R4	0.89	0.90	0.89	0.90	0.89
R5	0.92	0.91	0.92	0.92	0.92

5.4.58 As indicated in Table 56, predicted Cd concentrations were below the annual mean EQS of 5ng/m^3 at all sensitive receptor locations for all meteorological data sets.

5.4.59 Maximum predicted annual mean Cd concentrations at the receptor locations are summarised in Table 57.

Table 57: Maximum Predicted Annual Mean Cd Concentrations

Receptor		Predicted Annual Mean Cd Concentration (ng/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	0.08	0.96	1.6	19.2
R2	Residential - Pelsall Road	0.10	0.98	2.0	19.6
R3	Residential - Pelsall Road	0.18	1.06	3.7	21.3
R4	Residential - St Johns Road	0.02	0.90	0.4	18.0
R5	Residential - Albion Road	0.04	0.92	0.9	18.5

5.4.60 As indicated in Table 57, all PECs were below 70% of the EQS. As such, predicted effects on annual mean Cd concentrations are not considered to be significant, in accordance with the stated criteria.

Mercury

5.4.61 Predicted annual mean Hg PECs, inclusive of background levels, are summarised in Table 58.

Table 58: Predicted Annual Mean Hg Concentrations

Receptor	Predicted Annual Mean Hg PEC (ng/m^3)				
	2015	2016	2017	2018	2019
R1	2.43	2.42	2.46	2.42	2.42
R2	2.46	2.45	2.50	2.44	2.45
R3	2.61	2.60	2.67	2.56	2.62
R4	2.33	2.34	2.32	2.34	2.32
R5	2.37	2.37	2.39	2.37	2.37

5.4.62 As indicated in Table 58, predicted Hg concentrations were below the annual mean EQS of 250ng/m^3 at all sensitive receptor locations for all meteorological data sets.

5.4.63 Maximum predicted annual mean Hg concentrations at the receptor locations are summarised in Table 59.

Table 59: Maximum Predicted Annual Mean Hg Concentrations

Receptor		Predicted Annual Mean Hg Concentration (ng/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	0.16	2.46	0.07	0.99
R2	Residential - Pelsall Road	0.20	2.50	0.08	1.00
R3	Residential - Pelsall Road	0.37	2.67	0.15	1.07
R4	Residential - St Johns Road	0.04	2.34	0.02	0.94
R5	Residential - Albion Road	0.09	2.39	0.04	0.96

5.4.64 As indicated in Table 59, all PECs were below 70% of the EQS. As such, predicted effects on annual mean Hg concentrations are not considered to be significant, in accordance with the stated criteria.

5.4.65 Predicted 1-hour mean Hg PECs, inclusive of background levels, are summarised in Table 60.

Table 60: Predicted 1-hour Mean Hg Concentrations

Receptor	Predicted 1-hour Mean Hg PEC (ng/m^3)				
	2015	2016	2017	2018	2019
R1	8.14	8.12	8.11	8.15	8.16
R2	8.24	8.22	8.22	8.42	8.20
R3	9.82	9.81	9.85	9.82	9.84
R4	6.74	6.77	6.75	6.77	6.77
R5	6.89	6.88	6.88	6.92	6.93

5.4.66 As indicated in Table 60, predicted Hg concentrations were below the 1-hour mean EQS of 7,500ng/m^3 at all sensitive receptor locations for all meteorological data sets.

5.4.67 Maximum predicted 1-hour mean Hg concentrations at the receptor locations are summarised in Table 61.

Table 61: Maximum Predicted 1-hour Mean Hg Concentrations

Receptor		Predicted 1-hour Mean Hg Concentration (ng/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	3.56	8.16	0.05	0.05
R2	Residential - Pelsall Road	3.82	8.42	0.05	0.05
R3	Residential - Pelsall Road	5.25	9.85	0.07	0.07
R4	Residential - St Johns Road	2.17	6.77	0.03	0.03
R5	Residential - Albion Road	2.33	6.93	0.03	0.03

5.4.68 As indicated in Table 61, PCs were below 10% of the EQS at all sensitive receptor locations. As such,

predicted effects on 1-hour mean Hg concentrations are not considered to be significant, in accordance with the stated criteria.

Dioxins and Furans

5.4.69 Predicted annual mean PCDD/Fs PECs, inclusive of background levels, are summarised in Table 62.

Table 62: Predicted Annual Mean PCDD/F Concentrations

Receptor	Predicted Annual Mean PCDD/F PEC (ng/m^3)				
	2015	2016	2017	2018	2019
R1	23.000	23.000	23.000	23.000	23.000
R2	23.000	23.000	23.000	23.000	23.000
R3	23.001	23.001	23.001	23.000	23.001
R4	23.000	23.000	23.000	23.000	23.000
R5	23.000	23.000	23.000	23.000	23.000

Heavy Metals

5.4.70 As shown in Table 27, maximum annual mean heavy metal impacts were predicted as a result of Cr (VI) and As emissions. As such, pollutant concentrations of these species have been predicted at the relevant receptor locations.

5.4.71 Predicted annual mean Cr (VI) PECs, inclusive of background levels, are summarised in Table 63.

Table 63: Predicted Annual Mean Cr (VI) Concentrations

Receptor	Predicted Annual Mean Cr (VI) PEC (ng/m^3)				
	2015	2016	2017	2018	2019
R1	0.78407	0.78407	0.78409	0.78407	0.78407
R2	0.78409	0.78408	0.78411	0.78408	0.78408
R3	0.78417	0.78417	0.78421	0.78415	0.78418
R4	0.78402	0.78402	0.78401	0.78402	0.78401
R5	0.78404	0.78404	0.78405	0.78404	0.78404

5.4.72 As indicated in Table 63, predicted Cr (VI) concentrations were above the annual mean EQS of 0.2ng/m^3 at all sensitive receptor locations for all meteorological data sets. It should be noted that the EQS is exceeded as a baseline condition.

5.4.73 Maximum predicted annual mean Cr (VI) concentrations at the receptor locations are summarised in Table 64.

Table 64: Maximum Predicted Annual Mean Cr (VI) Concentrations

Receptor		Predicted Annual Mean Cr (VI) Concentration (ng/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	0.00009	0.78409	0.05	392.05
R2	Residential - Pelsall Road	0.00011	0.78411	0.06	392.06
R3	Residential - Pelsall Road	0.00021	0.78421	0.10	392.10
R4	Residential - St Johns Road	0.00002	0.78402	0.01	392.01
R5	Residential - Albion Road	0.00005	0.78405	0.02	392.02

5.4.74 As indicated in Table 64, PCs were below 1% of the EQS at all sensitive receptor locations. As such, effects on annual mean Cr (VI) concentrations are not considered to be significant, in accordance with the stated criteria.

5.4.75 Predicted annual mean As PECs, inclusive of background levels, are summarised in Table 65.

Table 65: Predicted Annual Mean As Concentrations

Receptor	Predicted Annual Mean As PEC (ng/m^3)				
	2015	2016	2017	2018	2019
R1	1.122	1.122	1.123	1.122	1.122
R2	1.123	1.122	1.123	1.122	1.122
R3	1.125	1.125	1.126	1.124	1.125
R4	1.120	1.121	1.120	1.121	1.120
R5	1.121	1.121	1.121	1.121	1.121

5.4.76 As indicated in Table 65, predicted As concentrations were below the annual mean EQS of 3ng/m^3 at all sensitive receptor locations for all meteorological data sets.

5.4.77 Maximum predicted annual mean As concentrations at the receptor locations are summarised in Table 66.

Table 66: Maximum Predicted Annual Mean As Concentrations

Receptor		Predicted Annual Mean As Concentration (ng/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - Pelsall Road	0.003	1.123	0.09	37.42
R2	Residential - Pelsall Road	0.003	1.123	0.11	37.44
R3	Residential - Pelsall Road	0.006	1.126	0.20	37.53
R4	Residential - St Johns Road	0.001	1.121	0.02	37.35
R5	Residential - Albion Road	0.001	1.121	0.05	37.38

5.4.78 As indicated in Table 66, PCs were below 1% of the EQS at all sensitive receptor locations. As such, predicted effects on annual mean As concentrations are not considered to be significant, in accordance with the stated criteria.

WHO Guidelines

5.4.79 A comparison of the maximum predicted pollutant concentrations, as shown in Table 24, to the WHO AQG is as follows:

- Annual NO_2 complies with the Interim Target 2;
- Annual PM_{10} complies with the AQG level;
- Annual $PM_{2.5}$ complies with the Interim Target 4; and,
- 24-hour SO_2 complies with the AQG level.

5.4.80 As shown above, the site complies with the Interim Target 2 or above for NO_2, PM_{10}, $PM_{2.5}$ and SO_2.

5.4.81 As stated previously, the WHO values are guidelines only and there is no legislative or planning requirement to consider these criteria within the UK. It should be noted that the WHO AQG for Annual Mean NO_2 and $PM_{2.5}$ is below the DEFRA background concentration for the site. Any implementation of the WHO AQG are likely to include the interim targets in the immediate future due the a large proportion of the country exceeding the AQG as a baseline.

5.5 ECOLOGICAL RECEPTORS

Oxides of Nitrogen

5.5.1 Predicted annual mean NO_x PCs at the ecological receptors are summarised in Table 67.

Table 67: Predicted Annual Mean NO_x Concentrations

Receptor	Predicted Annual Mean NO_x PC (µg/m^3)				
	2015	2016	2017	2018	2019
E1	0.26	0.25	0.33	0.26	0.26
E2	0.12	0.12	0.13	0.12	0.12
E3	0.03	0.03	0.04	0.02	0.04
E4	0.04	0.05	0.03	0.04	0.04
E5	0.60	0.63	0.67	0.56	0.62
E6	0.30	0.38	0.17	0.38	0.25
E7	0.03	0.05	0.03	0.05	0.04
E8	1.89	1.95	1.75	1.77	1.83
E9	0.56	0.52	0.59	0.54	0.59
E10	0.09	0.09	0.11	0.09	0.09
E11	0.17	0.16	0.21	0.15	0.16
E12	0.12	0.12	0.11	0.14	0.16
E13	0.03	0.04	0.03	0.04	0.04
E14	0.03	0.03	0.02	0.03	0.03
E15	0.97	0.88	1.21	0.79	0.92

5.5.2 Maximum predicted annual mean NO_x concentrations at the receptor locations are summarised in Table 68.

Table 68: Maximum Predicted Annual Mean NO_x Concentrations

Receptor		Predicted Annual Mean NO_x Concentration (µg/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Unnamed Ancient Woodland / SINC	0.33	21.81	1.1	72.7
E2	Chasewater and the Southern Staffordshire Coalfield Heaths SSSI / SINC	0.13	21.61	0.4	72.0
E3	Shire Oak Park LNR / SINC	0.04	22.16	0.1	73.9
E4	Jockey Fields SSSI / SINC / SLINC	0.05	21.22	0.2	70.7
E5	Clayhanger SSSI	0.67	19.33	2.2	64.4
E6	Clayhanger SSSI	0.38	19.04	1.3	63.5
E7	Pelsall North Common LNR / SINC	0.05	20.52	0.2	68.4
E8	SINC / SLINC	1.95	20.82	6.5	69.4

Receptor		Predicted Annual Mean NO_x Concentration (µg/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E9	Brownhills Common LWS / SINC	0.59	19.46	2.0	64.9
E10	SINC	0.11	21.59	0.4	72.0
E11	SLINC	0.21	21.69	0.7	72.3
E12	SLINC	0.16	18.51	0.5	61.7
E13	Wyrley Hayes Wood LWS	0.04	18.39	0.1	61.3
E14	Cannock Extension Canal SSSI and SAC	0.03	18.19	0.1	60.6
E15	SLINC	1.21	20.08	4.0	66.9

5.5.3 As indicated in Table 68, PCs were below 1% of the EQS at all SSSIs and SACs with the exception of E6 - Clayhanger SSSI. However PECs were below 100% of the EQS at the receptor. PCs were also less than 100% at all local sites. As such, predicted effects on annual mean NO_x concentrations at all designations are not considered to be significant, in accordance with the stated criteria.

5.5.4 Predicted 24-hour mean NO_x PCs at the ecological receptors are summarised in Table 69.

Table 69: Predicted 24-hour Mean NO_x Concentrations

Receptor	Predicted 24-hour Mean NO_x PC (µg/m^3)				
	2015	2016	2017	2018	2019
E1	2.02	1.69	2.14	1.85	1.61
E2	0.78	0.94	0.81	0.82	0.83
E3	0.26	0.35	0.35	0.78	0.49
E4	0.45	0.40	0.30	0.47	0.59
E5	4.71	4.61	4.49	4.56	9.60
E6	4.41	5.02	2.69	4.40	2.69
E7	0.51	0.90	0.65	1.13	0.86
E8	10.98	16.24	10.67	11.46	10.90
E9	3.37	3.57	3.65	3.42	2.90
E10	0.76	0.59	0.76	0.69	0.56
E11	1.15	1.19	1.91	1.36	1.74
E12	2.05	1.77	1.43	2.00	1.88
E13	0.88	1.00	0.75	1.10	0.75
E14	0.70	0.82	0.60	0.87	0.59
E15	6.11	6.29	7.33	9.78	5.59

5.5.5 Maximum predicted 24-hour mean NO_x concentrations at the receptor locations are summarised in Table 70.

Table 70: Maximum Predicted 24-hour Mean NO_x Concentrations

Receptor		Predicted 24-hour Mean NO_x Concentration (µg/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Unnamed Ancient Woodland / SINC	2.14	45.10	2.9	60.1
E2	Chasewater and the Southern Staffordshire Coalfield Heaths SSSI / SINC	0.94	43.90	1.3	58.5
E3	Shire Oak Park LNR / SINC	0.78	45.02	1.0	60.0
E4	Jockey Fields SSSI / SINC / SLINC	0.59	42.93	0.8	57.2
E5	Clayhanger SSSI	9.60	46.92	12.8	62.6
E6	Clayhanger SSSI	5.02	42.34	6.7	56.4
E7	Pelsall North Common LNR / SINC	1.13	42.07	1.5	56.1
E8	SINC / SLINC	16.24	53.98	21.6	72.0
E9	Brownhills Common LWS / SINC	3.65	41.39	4.9	55.2
E10	SINC	0.76	43.72	1.0	58.3
E11	SLINC	1.91	44.87	2.5	59.8
E12	SLINC	2.05	38.75	2.7	51.7
E13	Wyrley Hayes Wood LWS	1.10	37.80	1.5	50.4
E14	Cannock Extension Canal SSSI and SAC	0.87	37.19	1.2	49.6
E15	SLINC	9.78	47.52	13.0	63.4

5.5.6 As indicated in Table 70, PCs were below 10% of the EQS at all SSSIs and SACs with the exception of E5 - Clayhanger SSSI. However PECs were below 100% of the EQS at the receptor. PCs were also less than 100% at all local sites. As such, predicted effects on 24-hour mean NO_x concentrations are not considered to be significant, in accordance with the stated criteria.

Sulphur Dioxide

5.5.7 Predicted annual mean SO_2 PCs at the ecological receptors are summarised in Table 71.

Table 71: Predicted Annual Mean SO_2 Concentrations

Receptor	Predicted Annual Mean SO_2 PC (µg/m^3)				
	2015	2016	2017	2018	2019
E1	0.06	0.06	0.08	0.07	0.07
E2	0.03	0.03	0.03	0.03	0.03
E3	0.01	0.01	0.01	0.01	0.01
E4	0.01	0.01	0.01	0.01	0.01
E5	0.15	0.16	0.17	0.14	0.15
E6	0.07	0.10	0.04	0.10	0.06
E7	0.01	0.01	0.01	0.01	0.01
E8	0.47	0.49	0.44	0.44	0.46
E9	0.14	0.13	0.15	0.14	0.15

Receptor	Predicted Annual Mean SO_2 PC (µg/m^3)				
	2015	2016	2017	2018	2019
E10	0.02	0.02	0.03	0.02	0.02
E11	0.04	0.04	0.05	0.04	0.04
E12	0.03	0.03	0.03	0.03	0.04
E13	0.01	0.01	0.01	0.01	0.01
E14	0.01	0.01	0.01	0.01	0.01
E15	0.24	0.22	0.30	0.20	0.23

5.5.8 Maximum predicted annual mean SO_2 concentrations at the receptor locations are summarised in Table 72.

Table 72: Maximum Predicted Annual Mean SO_2 Concentrations

Receptor		Predicted Annual Mean SO_2 Concentration (µg/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Unnamed Ancient Woodland / SINC	0.08	2.09	0.814	10.5
E2	Chasewater and the Southern Staffordshire Coalfield Heaths SSSI / SINC	0.03	1.85	0.320	9.3
E3	Shire Oak Park LNR / SINC	0.01	1.64	0.099	8.2
E4	Jockey Fields SSSI / SINC / SLINC	0.01	1.88	0.117	9.4
E5	Clayhanger SSSI	0.17	1.90	1.677	9.5
E6	Clayhanger SSSI	0.10	1.83	0.956	9.1
E7	Pelsall North Common LNR / SINC	0.01	2.04	0.127	10.2
E8	SINC / SLINC	0.49	2.50	4.868	12.5
E9	Brownhills Common LWS / SINC	0.15	2.16	1.483	10.8
E10	SINC	0.03	2.04	0.283	10.2
E11	SLINC	0.05	2.06	0.525	10.3
E12	SLINC	0.04	2.05	0.408	10.3
E13	Wyrley Hayes Wood LWS	0.01	2.02	0.101	10.1
E14	Cannock Extension Canal SSSI and SAC	0.01	2.58	0.080	12.9
E15	SLINC	0.30	2.31	3.031	11.6

5.5.9 As indicated in Table 72, PCs were below 1% of the EQS at all SSSIs and SACs and less than 100% at all local sites with the exception of E5. However, PECs were below 100% of the EQS at the receptor. As such, predicted effects on annual mean SO_2 concentrations are not considered to be significant, in accordance with the stated criteria.

Hydrogen Fluoride

5.5.10 Predicted weekly mean HF PCs at the ecological receptors are summarised in Table 73.

Table 73: Predicted Weekly Mean HF Concentrations

Receptor	Predicted Weekly Mean HF PC (µg/m³)				
	2015	2016	2017	2018	2019
E1	0.003	0.003	0.004	0.004	0.003
E2	0.001	0.002	0.002	0.002	0.001
E3	0.001	0.000	0.001	0.000	0.001
E4	0.001	0.001	0.001	0.001	0.001
E5	0.011	0.010	0.012	0.010	0.012
E6	0.011	0.012	0.003	0.007	0.005
E7	0.001	0.001	0.001	0.002	0.001
E8	0.024	0.024	0.019	0.021	0.021
E9	0.008	0.007	0.007	0.008	0.010
E10	0.001	0.001	0.002	0.001	0.001
E11	0.003	0.003	0.003	0.002	0.003
E12	0.003	0.003	0.003	0.003	0.004
E13	0.001	0.001	0.001	0.002	0.002
E14	0.001	0.001	0.001	0.001	0.001
E15	0.014	0.015	0.016	0.011	0.016

5.5.11 Maximum predicted weekly mean HF concentrations at the receptor locations are summarised in Table 74.

Table 74: Maximum Predicted Weekly Mean HF Concentrations

Receptor		Predicted Weekly Mean HF Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Unnamed Ancient Woodland / SINC	0.004	0.004	0.8	0.8
E2	Chasewater and the Southern Staffordshire Coalfield Heaths SSSI / SINC	0.002	0.002	0.4	0.4
E3	Shire Oak Park LNR / SINC	0.001	0.001	0.2	0.2
E4	Jockey Fields SSSI / SINC / SLINC	0.001	0.001	0.2	0.2
E5	Clayhanger SSSI	0.012	0.012	2.4	2.4
E6	Clayhanger SSSI	0.012	0.012	2.3	2.3
E7	Pelsall North Common LNR / SINC	0.002	0.002	0.4	0.4
E8	SINC / SLINC	0.024	0.024	4.8	4.8
E9	Brownhills Common LWS / SINC	0.010	0.010	2.0	2.0
E10	SINC	0.002	0.002	0.3	0.3
E11	SLINC	0.003	0.003	0.6	0.6
E12	SLINC	0.004	0.004	0.7	0.7
E13	Wyrley Hayes Wood LWS	0.002	0.002	0.4	0.4

Receptor		Predicted Weekly Mean HF Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E14	Cannock Extension Canal SSSI and SAC	0.001	0.001	0.3	0.3
E15	SLINC	0.016	0.016	3.2	3.2

5.5.12 As indicated in Table 74, PCs were below 10% of the EQS at all SSSIs and SACs and less than 100% at all local sites. As such, predicted effects on weekly mean HF concentrations are not considered to be significant, in accordance with the stated criteria.

5.5.13 Predicted 24-hour mean HF PCs at the ecological receptors are summarised in Table 75.

Table 75: Predicted 24-hour Mean HF Concentrations

Receptor	Predicted 24-hour Mean HF PC (µg/m³)				
	2015	2016	2017	2018	2019
E1	0.010	0.008	0.011	0.009	0.008
E2	0.004	0.005	0.004	0.004	0.004
E3	0.001	0.002	0.002	0.004	0.002
E4	0.002	0.002	0.002	0.002	0.003
E5	0.024	0.023	0.022	0.023	0.048
E6	0.022	0.025	0.013	0.022	0.013
E7	0.003	0.004	0.003	0.006	0.004
E8	0.055	0.081	0.053	0.057	0.055
E9	0.017	0.018	0.018	0.017	0.014
E10	0.004	0.003	0.004	0.003	0.003
E11	0.006	0.006	0.010	0.007	0.009
E12	0.010	0.009	0.007	0.010	0.009
E13	0.004	0.005	0.004	0.006	0.004
E14	0.004	0.004	0.003	0.004	0.003
E15	0.031	0.031	0.037	0.049	0.028

5.5.14 Maximum predicted 24-hour mean HF concentrations at the receptor locations are summarised in Table 77.

Table 76: Maximum Predicted 24-hour Mean HF Concentrations

Receptor		Predicted 24-hour Mean HF Concentration (ng/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Unnamed Ancient Woodland / SINC	0.011	0.011	0.2	0.2
E2	Chasewater and the Southern Staffordshire Coalfield Heaths SSSI / SINC	0.005	0.005	0.1	0.1

Receptor		Predicted 24-hour Mean HF Concentration (ng/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E3	Shire Oak Park LNR / SINC	0.004	0.004	0.1	0.1
E4	Jockey Fields SSSI / SINC / SLINC	0.003	0.003	0.1	0.1
E5	Clayhanger SSSI	0.048	0.048	1.0	1.0
E6	Clayhanger SSSI	0.025	0.025	0.5	0.5
E7	Pelsall North Common LNR / SINC	0.006	0.006	0.1	0.1
E8	SINC / SLINC	0.081	0.081	1.6	1.6
E9	Brownhills Common LWS / SINC	0.018	0.018	0.4	0.4
E10	SINC	0.004	0.004	0.1	0.1
E11	SLINC	0.010	0.010	0.2	0.2
E12	SLINC	0.010	0.010	0.2	0.2
E13	Wyrley Hayes Wood LWS	0.006	0.006	0.1	0.1
E14	Cannock Extension Canal SSSI and SAC	0.004	0.004	0.1	0.1
E15	SLINC	0.049	0.049	1.0	1.0

5.5.15 As indicated in Table 77, PCs were below 10% of the EQS at all SSSIs and SACs and less than 100% at all local sites. As such, predicted effects on 24-hour mean HF concentrations are not considered to be significant, in accordance with the stated criteria.

Nitrogen Deposition

5.5.16 Predicted annual nitrogen deposition PCs at the ecological receptors are summarised in Table 77.

Table 77: Predicted Annual Nitrogen Deposition

Receptor	Predicted Annual Nitrogen Deposition PC (kgN/ha/yr)				
	2015	2016	2017	2018	2019
E1	0.052	0.050	0.066	0.053	0.053
E2	0.012	0.012	0.013	0.012	0.012
E3	0.006	0.007	0.008	0.005	0.008
E4	0.004	0.005	0.003	0.004	0.004
E5	0.060	0.064	0.068	0.057	0.062
E6	0.030	0.039	0.017	0.038	0.025
E7	0.006	0.010	0.006	0.010	0.008
E8	0.380	0.392	0.352	0.357	0.369
E9	0.113	0.105	0.119	0.109	0.119
E10	0.019	0.018	0.023	0.019	0.019
E11	0.034	0.033	0.042	0.030	0.032
E12	0.024	0.023	0.022	0.027	0.033
E13	0.007	0.008	0.006	0.008	0.008

Receptor	Predicted Annual Nitrogen Deposition PC (kgN/ha/yr)				
	2015	2016	2017	2018	2019
E14	0.003	0.003	0.002	0.003	0.003
E15	0.194	0.178	0.244	0.160	0.185

5.5.17 Maximum predicted annual nitrogen deposition rates at the receptor locations are summarised in Table 78.

Table 78: Maximum Predicted Annual Nitrogen Deposition

Receptor		Maximum Predicted Annual PC Nitrogen Deposition (kgN/ha/yr)	Proportion of EQS (%)	
			Low	High
E1	Unnamed Ancient Woodland / SINC	0.066	0.66	0.33
E2	Chasewater and the Southern Staffordshire Coalfield Heaths SSSI / SINC	0.013	0.26	0.13
E3	Shire Oak Park LNR / SINC	0.008	0.08	0.04
E4	Jockey Fields SSSI / SINC / SLINC	0.005	0.03	0.02
E5	Clayhanger SSSI	0.068	0.45	0.27
E6	Clayhanger SSSI	0.039	0.26	0.15
E7	Pelsall North Common LNR / SINC	0.010	0.10	0.05
E8	SINC / SLINC	0.392	3.92	1.96
E9	Brownhills Common LWS / SINC	0.119	1.19	0.60
E10	SINC	0.023	0.23	0.11
E11	SLINC	0.042	0.42	0.21
E12	SLINC	0.033	0.33	0.16
E13	Wyrley Hayes Wood LWS	0.008	0.08	0.04
E14	Cannock Extension Canal SSSI and SAC	0.003	0.11	0.03
E15	SLINC	0.244	2.44	1.22

5.5.18 As indicated in Table 78, PCs were below 1% of the EQS at all SSSIs and SACs and less than 100% at all local sites. As such, predicted effects on annual mean nitrogen deposition at the designations are not considered to be significant, in accordance with the stated criteria.

Acid Deposition

5.5.19 Maximum predicted annual acid deposition rates at the ecological receptors are summarised in Table 79.

Table 79: Maximum Predicted Annual Acid Deposition

Receptor		Maximum Predicted Annual PC Acid Deposition (kgN/ha/yr)	Proportion of EQS (%)
E1	Unnamed Ancient Woodland / SINC	0.049	3.46
E2	Chasewater and the Southern Staffordshire Coalfield Heaths SSSI / SINC	0.009	1.50
E3	Shire Oak Park LNR / SINC	0.006	0.30
E4	Jockey Fields SSSI / SINC / SLINC	0.003	0.24
E5	Clayhanger SSSI	0.046	6.64
E6	Clayhanger SSSI	0.026	3.78
E7	Pelsall North Common LNR / SINC	0.008	0.27
E8	SINC / SLINC	0.294	20.71
E9	Brownhills Common LWS / SINC	0.090	6.31
E10	SINC	0.017	1.21
E11	SLINC	0.032	2.24
E12	SLINC	0.025	1.24
E13	Wyrley Hayes Wood LWS	0.006	0.31
E14	Cannock Extension Canal SSSI and SAC	0.002	-
E15	SLINC	0.183	12.90

5.5.20 As indicated in Table 79, PCs were below 100% of the EQS at all local designations. As such, predicted effects on annual mean acid deposition at the designations are not considered to be significant, in accordance with the stated criteria.

5.5.21 Predicted PCs exceeded 1% of the EQS at a number of SSSIs. As such, additional modelling was undertaken in order to further assess potential impacts at the designations.

5.5.22 Information provided by the Applicant indicated a wet flue gas scrubber will be installed at the facility. This will reduce pollutant concentrations in the exhaust air from the plant prior to discharge to atmosphere. Monitoring data from a similar facility which uses the same abatement system was provided by the applicant. This indicated the following residual pollutant concentrations for exhaust air:

- SO_2 - 0.35mg/m^3;
- NO_2 - 0.2mg/m^3 ; and,
- HCl - 0.75 mg/m^3.

5.5.23 Further modelling was undertaken utilising the emission concentrations stated above in evaluate potential impacts as a result of acid deposition at the relevant ecological designations. The results are stated in Table 80.

Table 80: Predicted Annual Acid Deposition

Receptor		Maximum Predicted Annual PC Acid Deposition (kgN/ha/yr)	Proportion of EQS (%)
E1	Unnamed Ancient Woodland / SINC	0.0021	0.15
E2	Chasewater and the Southern Staffordshire Coalfield Heaths SSSI / SINC	0.0003	0.06
E3	Shire Oak Park LNR / SINC	0.0003	0.01
E4	Jockey Fields SSSI / SINC / SLINC	0.0001	0.01
E5	Clayhanger SSSI	0.0018	0.26
E6	Clayhanger SSSI	0.0010	0.15
E7	Pelsall North Common LNR / SINC	0.0003	0.01
E8	SINC / SLINC	0.0124	0.87
E9	Brownhills Common LWS / SINC	0.0038	0.27
E10	SINC	0.0007	0.05
E11	SLINC	0.0013	0.09
E12	SLINC	0.0010	0.05
E13	Wyrley Hayes Wood LWS	0.0003	0.01
E14	Cannock Extension Canal SSSI and SAC	0.0001	-
E15	SLINC	0.0077	0.54

5.5.24 As indicated in Table 80, PCs were below 1% of the EQS at all SSSIs and SACs and less than 100% at all local sites. As such, predicted effects on annual mean acid deposition at the designations are not considered to be significant, in accordance with the stated criteria.

6 CONCLUSION

6.1.1 Waste and Industry Compliance Ltd was instructed by Brownhills Skip Hire Ltd to commission an Air Quality Assessment in support of the operation of a SWIP at Collier Close, Walsall.

6.1.2 The plant has the potential to cause air quality impacts as a result of atmospheric emissions during normal operation. As such, an Air Quality Assessment was required in order to determine baseline conditions and assess potential changes in pollution levels as a result of the installation.

6.1.3 Dispersion modelling was undertaken in order to predict pollutant concentrations at sensitive locations as a result of emissions from the facility. The results of the dispersion modelling indicated impacts on existing pollutant concentrations were not predicted to be significant at any sensitive human receptor location.

6.1.4 Impacts were also predicted at relevant ecological sites. The results indicated that emissions from the plant are not predicted to significantly affect existing conditions at any designation.

6.1.5 Based on the assessment results, air quality issues are not considered a constraint to planning consent for the proposals.

APPENDIX 1

Legend

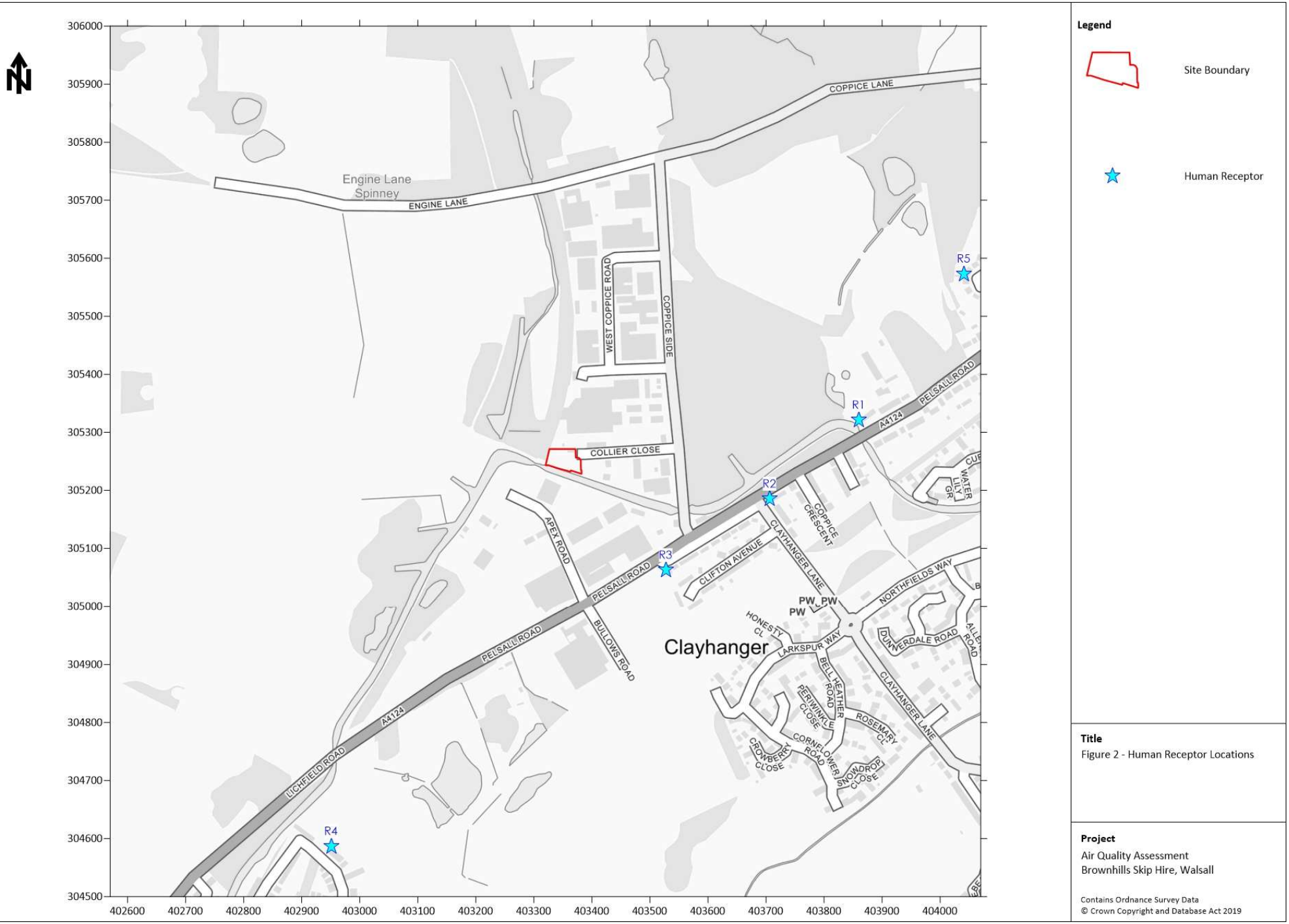
Site Boundary

Title

Figure 1 - Site Location Plan

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

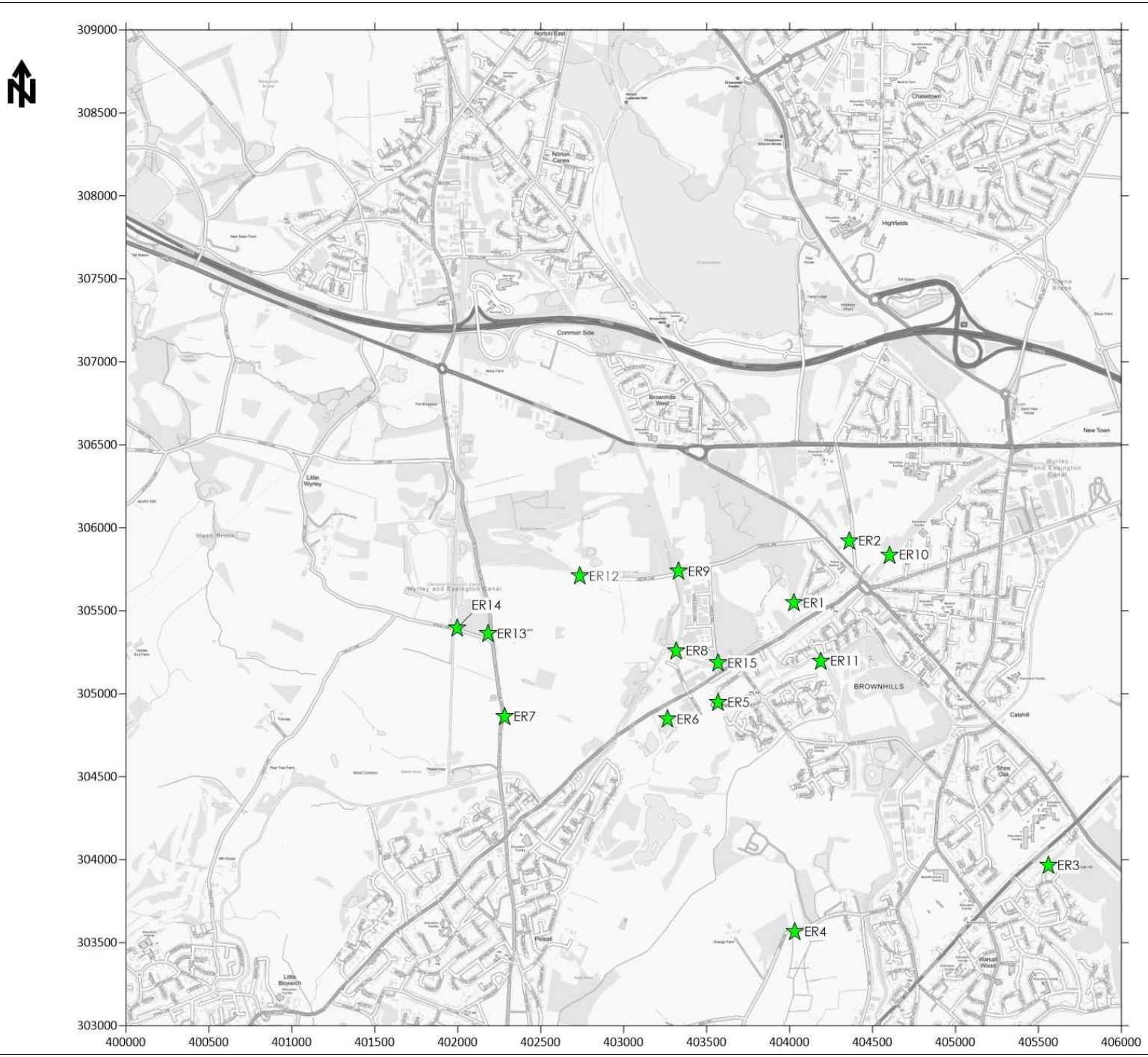
Human Receptor

Title

Figure 2 - Human Receptor Locations

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

Ecological Receptor

Title

Figure 3 - Ecological Receptor Locations

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall

Legend

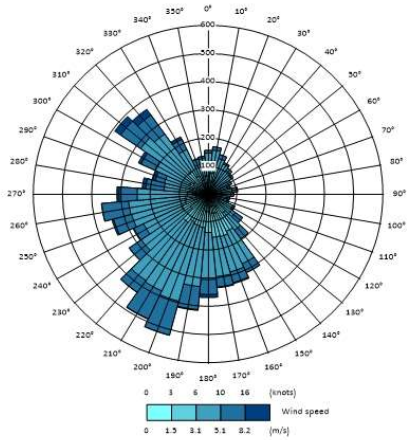
- Site Boundary
- Source
- Output Grid
- Building

Title

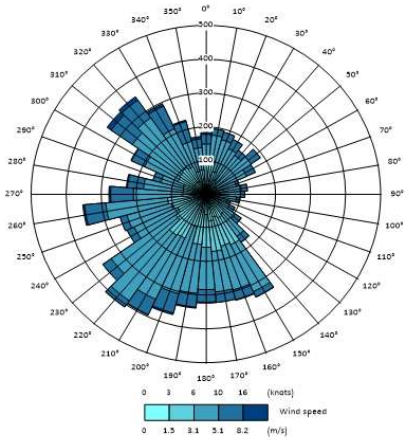
Figure 4 - ADMS-5 Inputs

Project

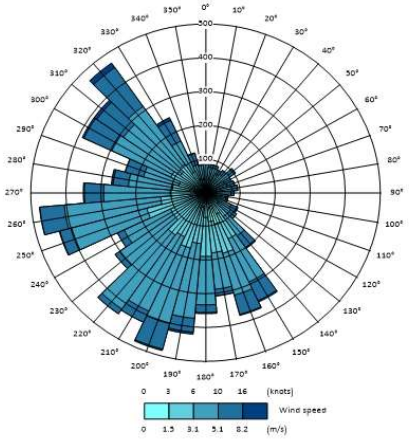
Air Quality Assessment
Brownhills Skip Hire, Walsall



2015 Meteorological Data



2016 Meteorological Data



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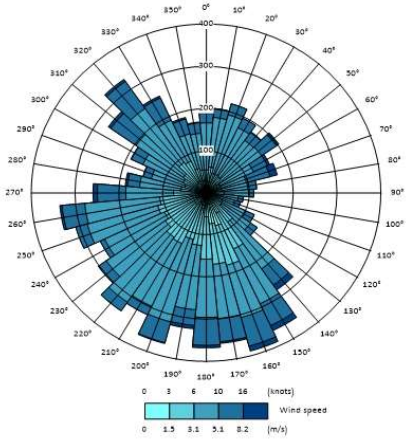
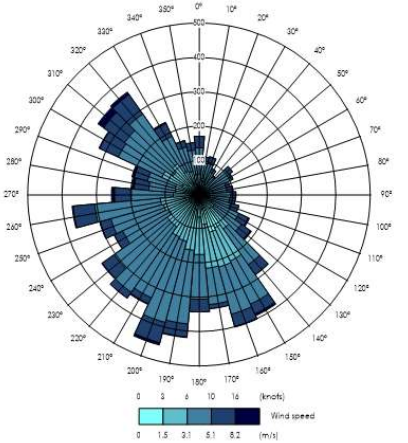


2018 Meteorological Data



2019 Meteorological Data

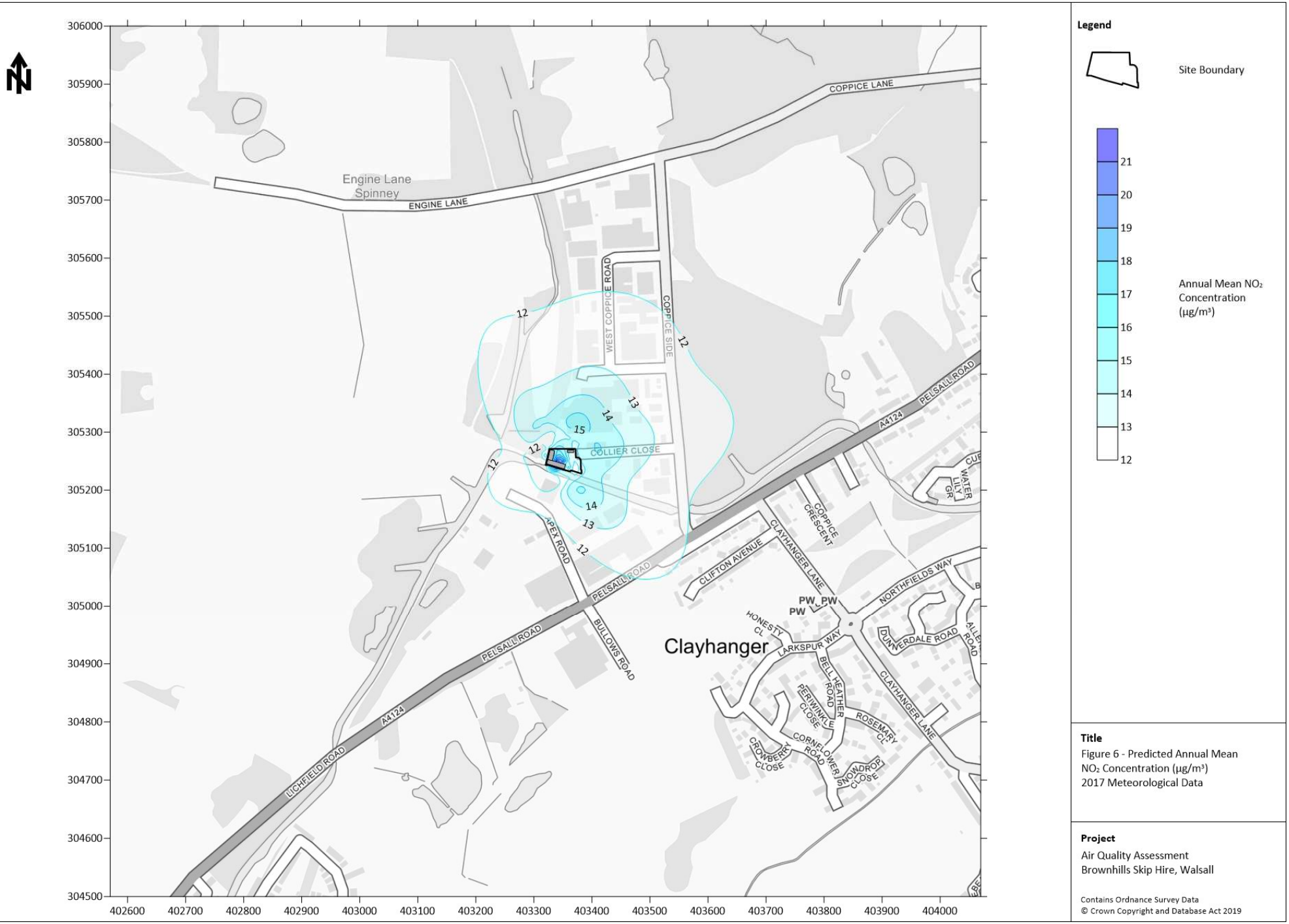
Legend

Title

Figure 5 - Wind Roses of 2015 to 2019
Birmingham Airport Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

Annual Mean NO_2 Concentration ($\mu g/m^3$)

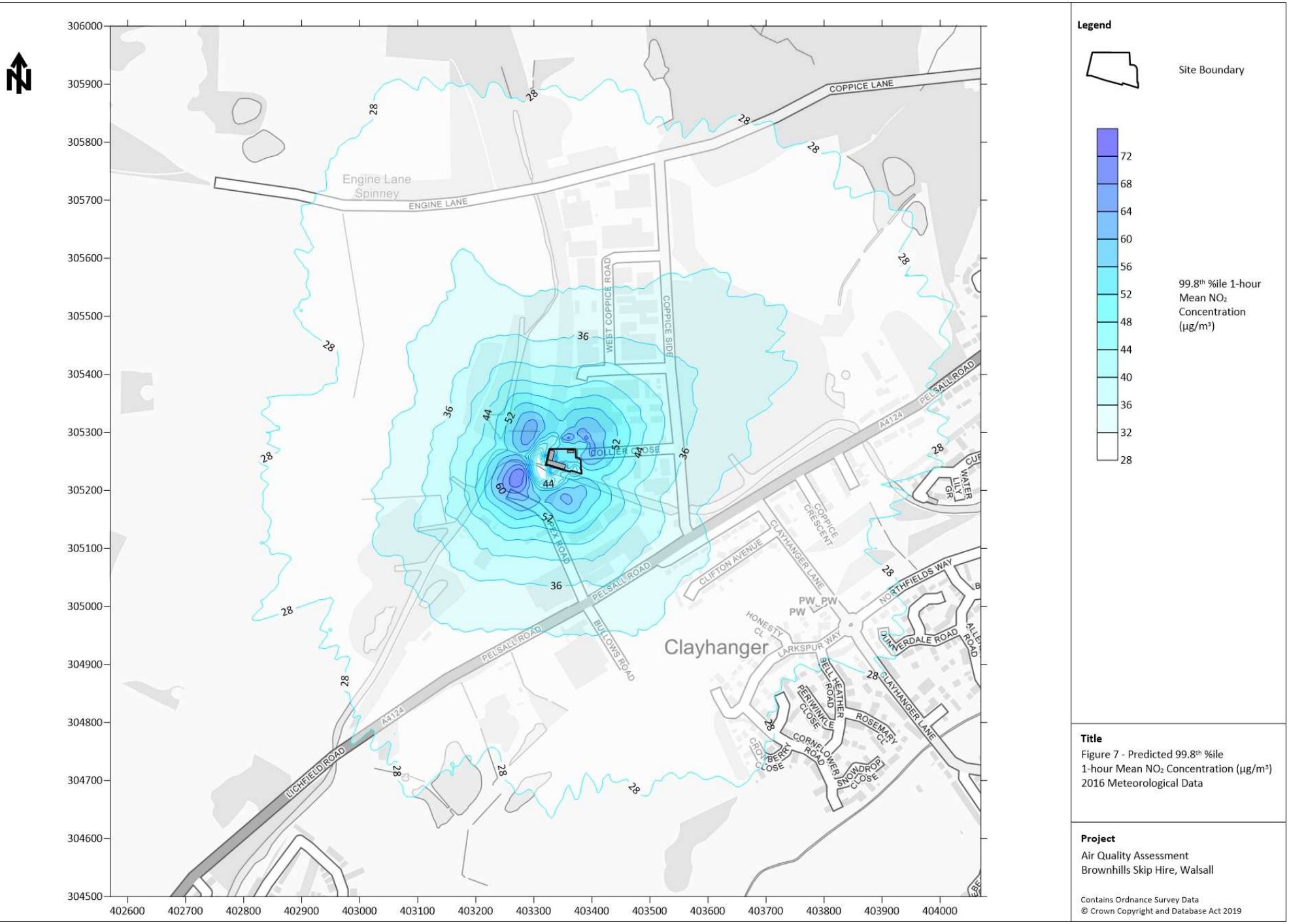
21
20
19
18
17
16
15
14
13
12

Title

Figure 6 - Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$)
2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

72
68
64
60
56
52
48
44
40
36
32
28

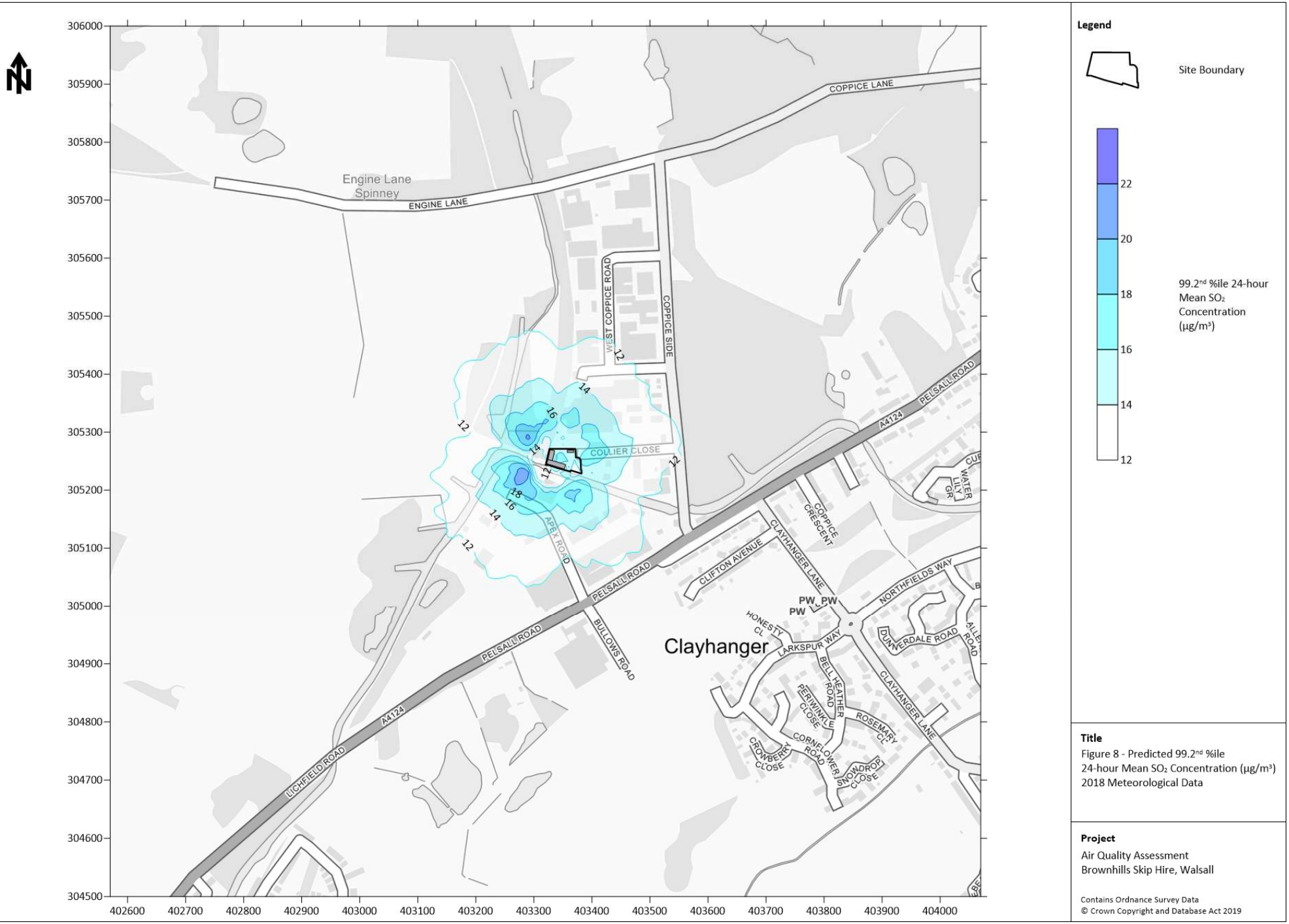
99.8th %ile 1-hour Mean NO_2 Concentration (µg/m³)

Title

Figure 7 - Predicted 99.8th %ile 1-hour Mean NO_2 Concentration (µg/m³) 2016 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

22
20
18
16
14
12

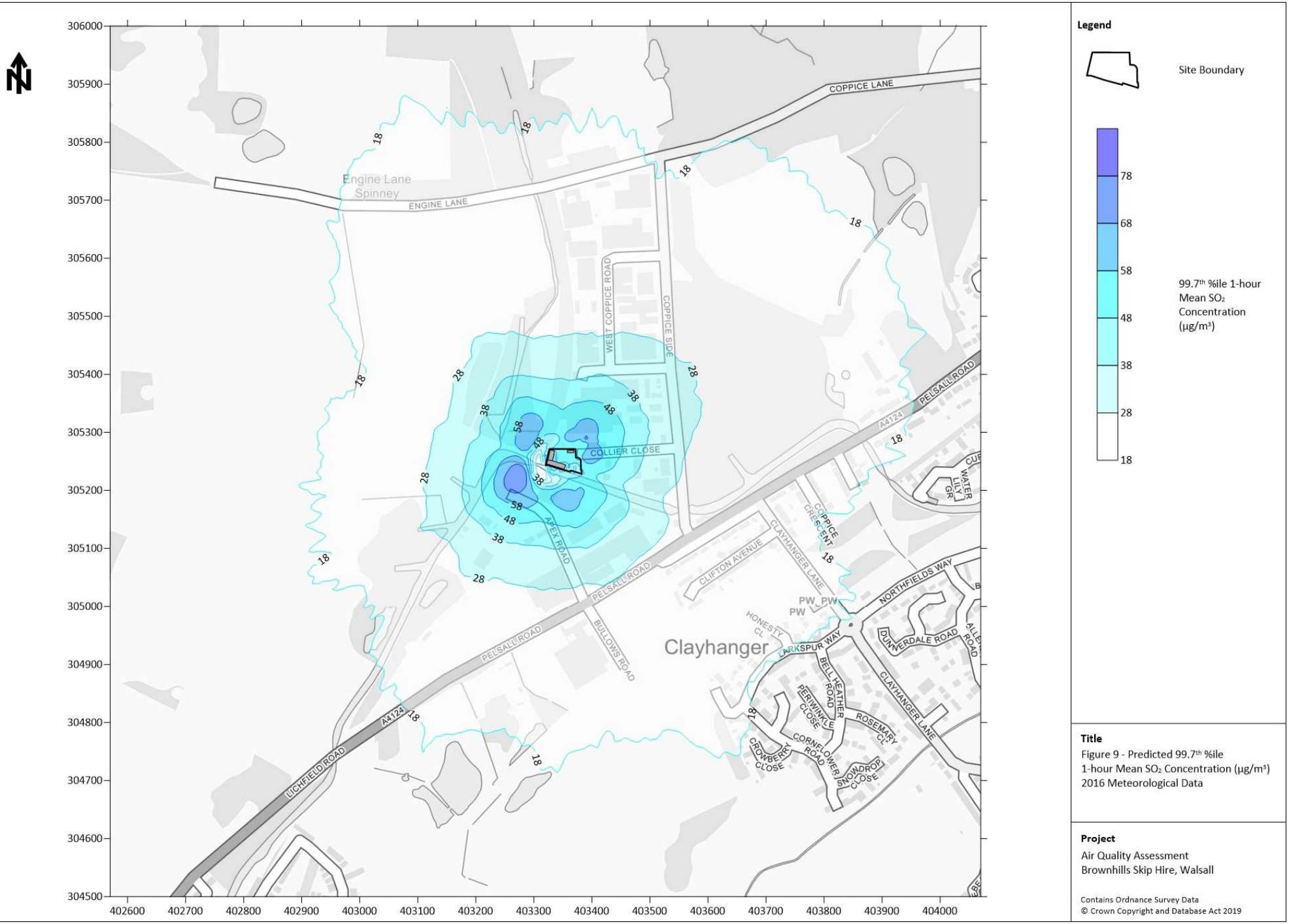
99.2nd %ile 24-hour Mean SO_2 Concentration ($\mu g/m^3$)

Title

Figure 8 - Predicted 99.2nd %ile 24-hour Mean SO_2 Concentration ($\mu g/m^3$) 2018 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

78
68
58
48
38
28
18

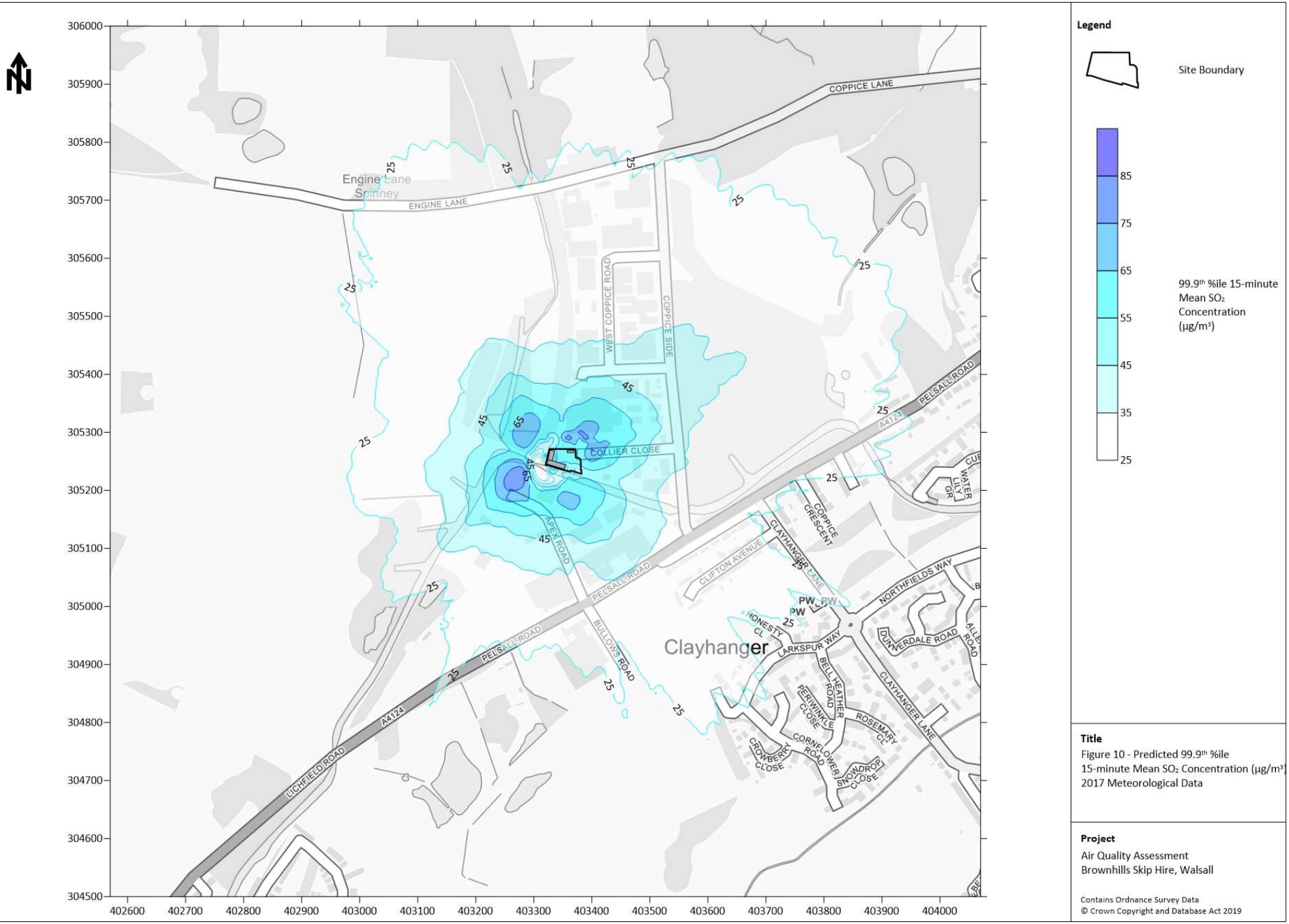
99.7th %ile 1-hour Mean SO_2 Concentration (µg/m³)

Title

Figure 9 - Predicted 99.7th %ile 1-hour Mean SO_2 Concentration (µg/m³) 2016 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

85
75
65
55
45
35
25

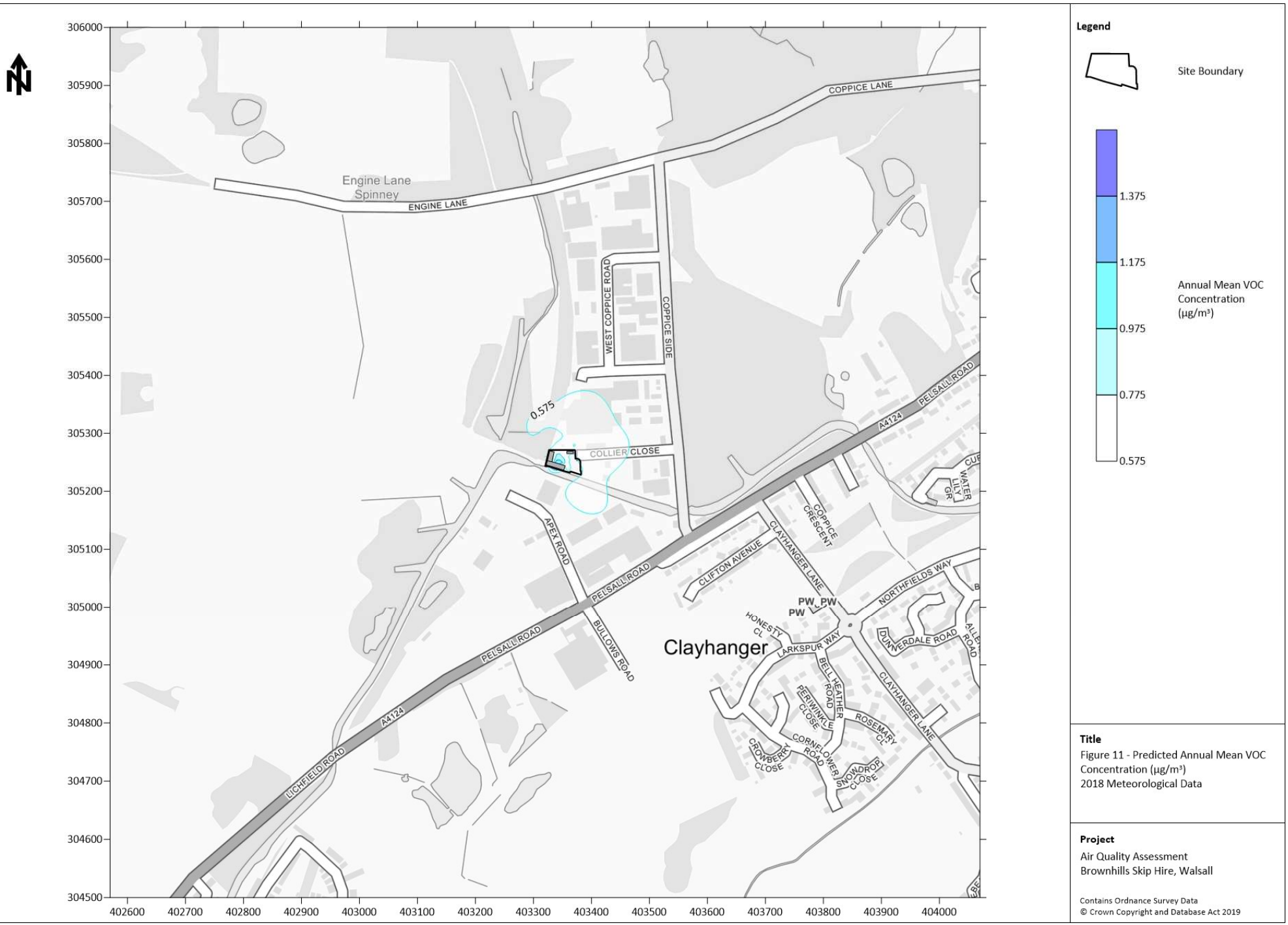
99.9th %ile 15-minute Mean SO_2 Concentration ($\mu g/m^3$)

Title

Figure 10 - Predicted 99.9th %ile 15-minute Mean SO_2 Concentration ($\mu g/m^3$) 2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall


306000
305900
305800
305700
305600
305500
305400
305300
305200
305100
305000
304900
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304600
304500
402600
402700
402800
402900
403000
403100
403200
403300
403400
403500
403600
403700
403800
403900
404000
COPPICE LANE
Engine Lane
Spinney
ENGINE LANE
WEST COPPICE ROAD
COPPICE SIDE
0.575
COLLIER CLOSE
A4124
PELSALL ROAD
APEX ROAD
CLIFTON AVENUE
CLAYHANGER LANE
COPPICE CRESCENT
NORTHFIELDS WAY
DUNNERDALE ROAD
Clayhanger
HONESTY CL
LARKSPUR WAY
BELL HEATHER ROAD
PERIWINKLE CLOSE
ROSEMARY CL
CORNFLOWER ROAD
CROWBERRY CLOSE
SNOWDROP CLOSE
BULLOWS ROAD
LICHFIELD ROAD
WATER LILY GR
Legend
Site Boundary
1.375
1.175
0.975
0.775
0.575
Annual Mean VOC Concentration (µg/m³)
Title
Figure 11 - Predicted Annual Mean VOC Concentration (µg/m³)
2018 Meteorological Data
Project
Air Quality Assessment
Brownhills Skip Hire, Walsall
Contains Ordnance Survey Data
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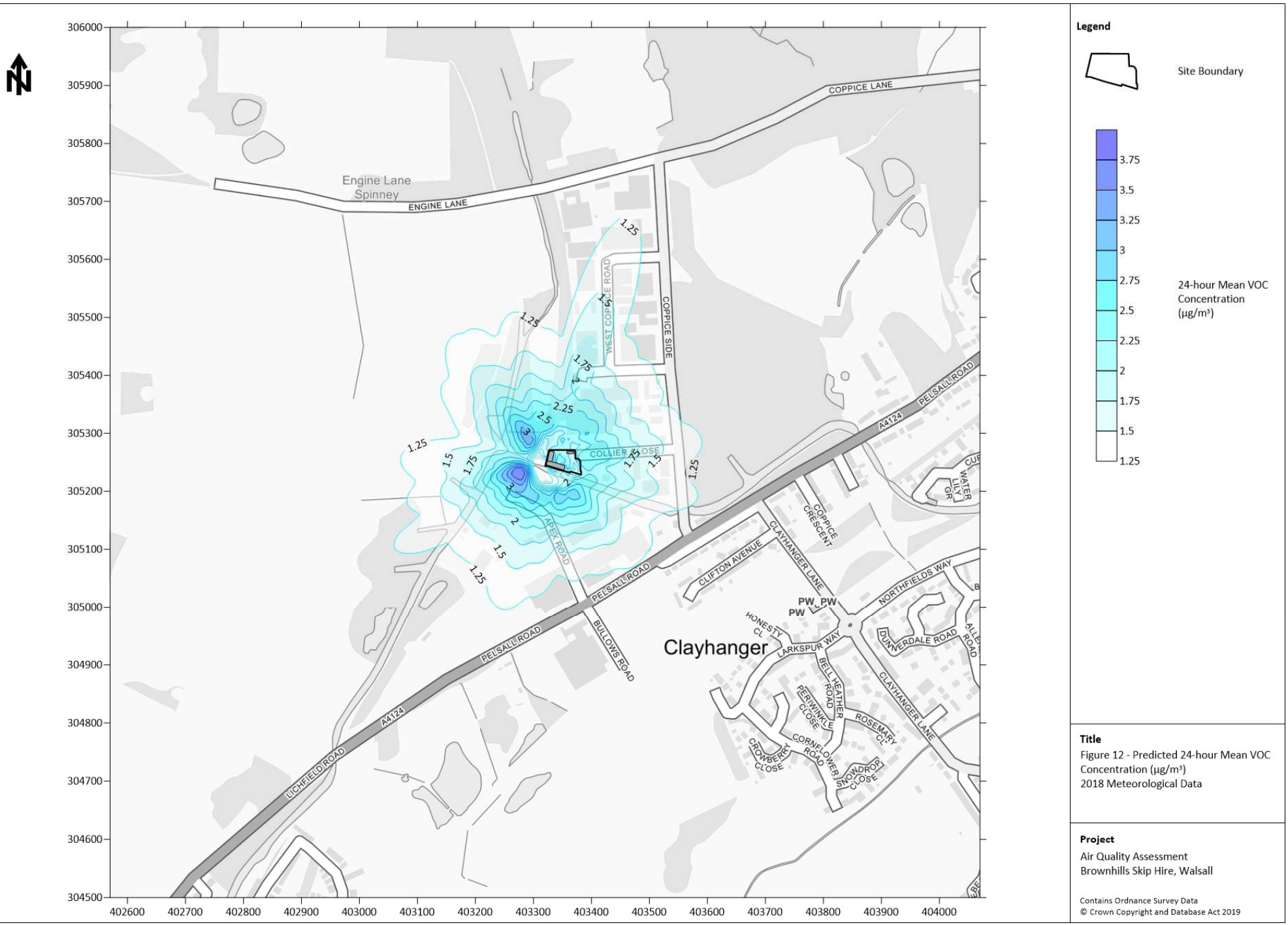
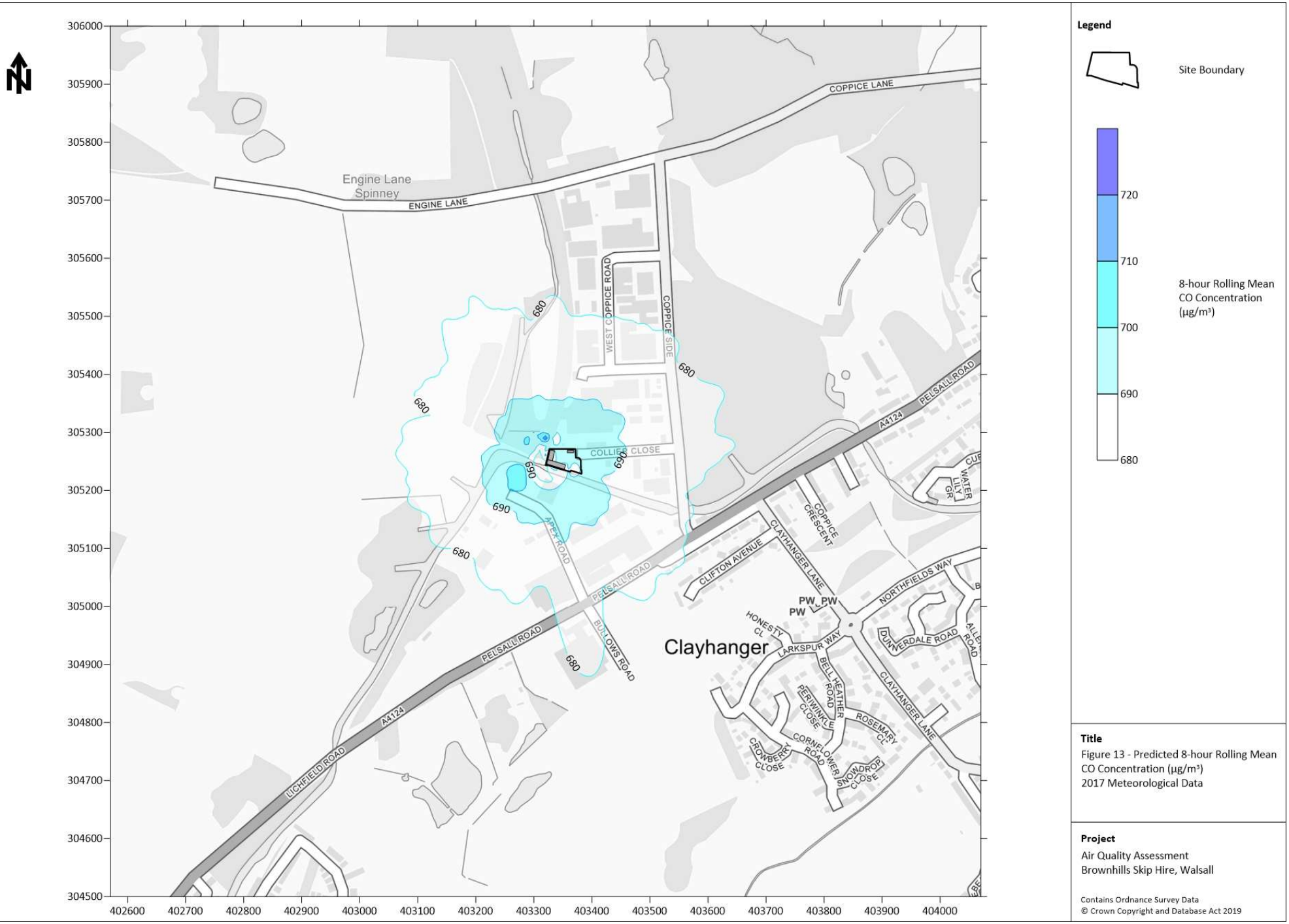


Title

Figure 12 - Predicted 24-hour Mean VOC Concentration (µg/m³)
2018 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

720
710
700
690
680

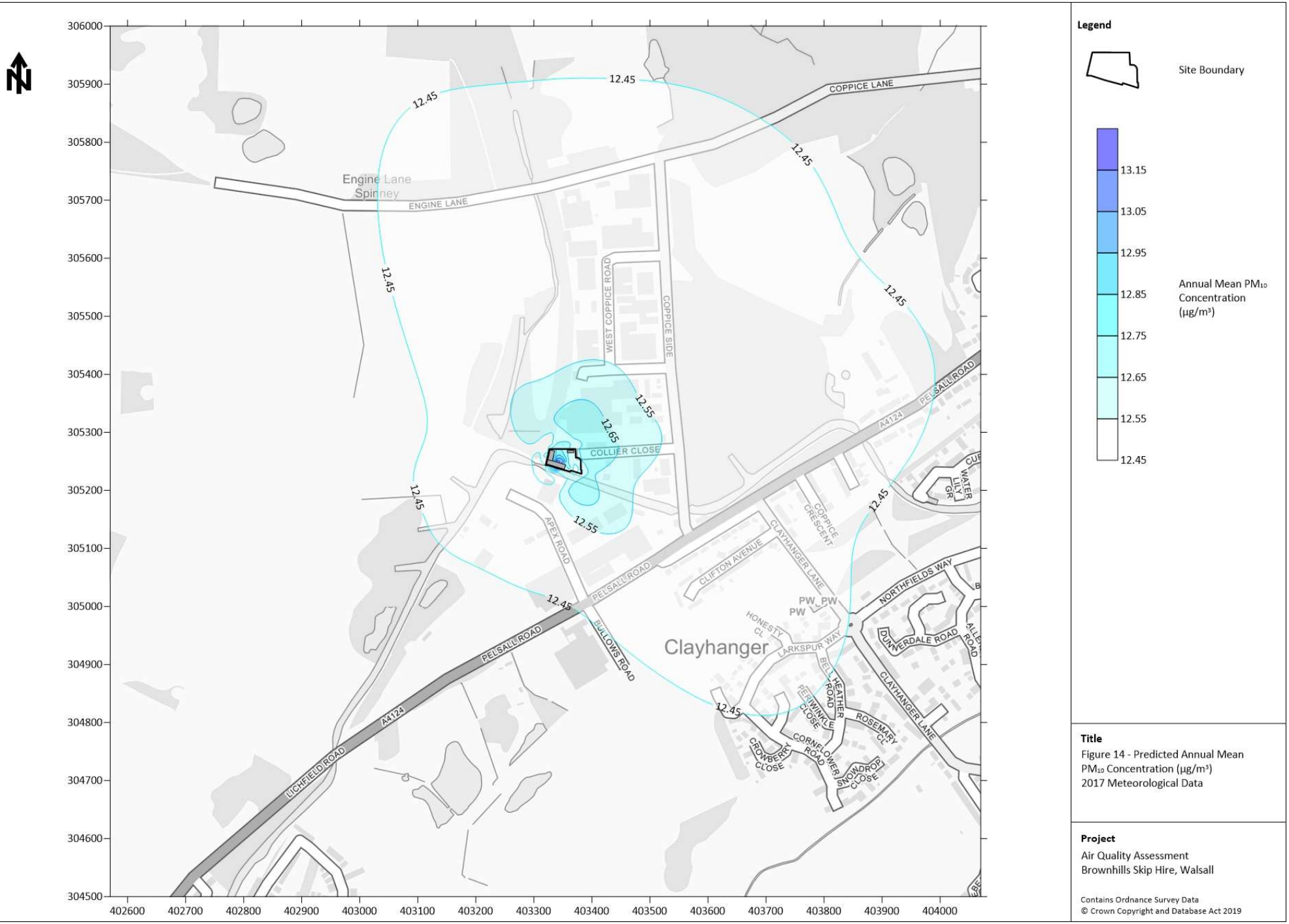
8-hour Rolling Mean CO Concentration (µg/m³)

Title

Figure 13 - Predicted 8-hour Rolling Mean CO Concentration (µg/m³)
2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

Annual Mean PM_{10} Concentration ($\mu g/m^3$)

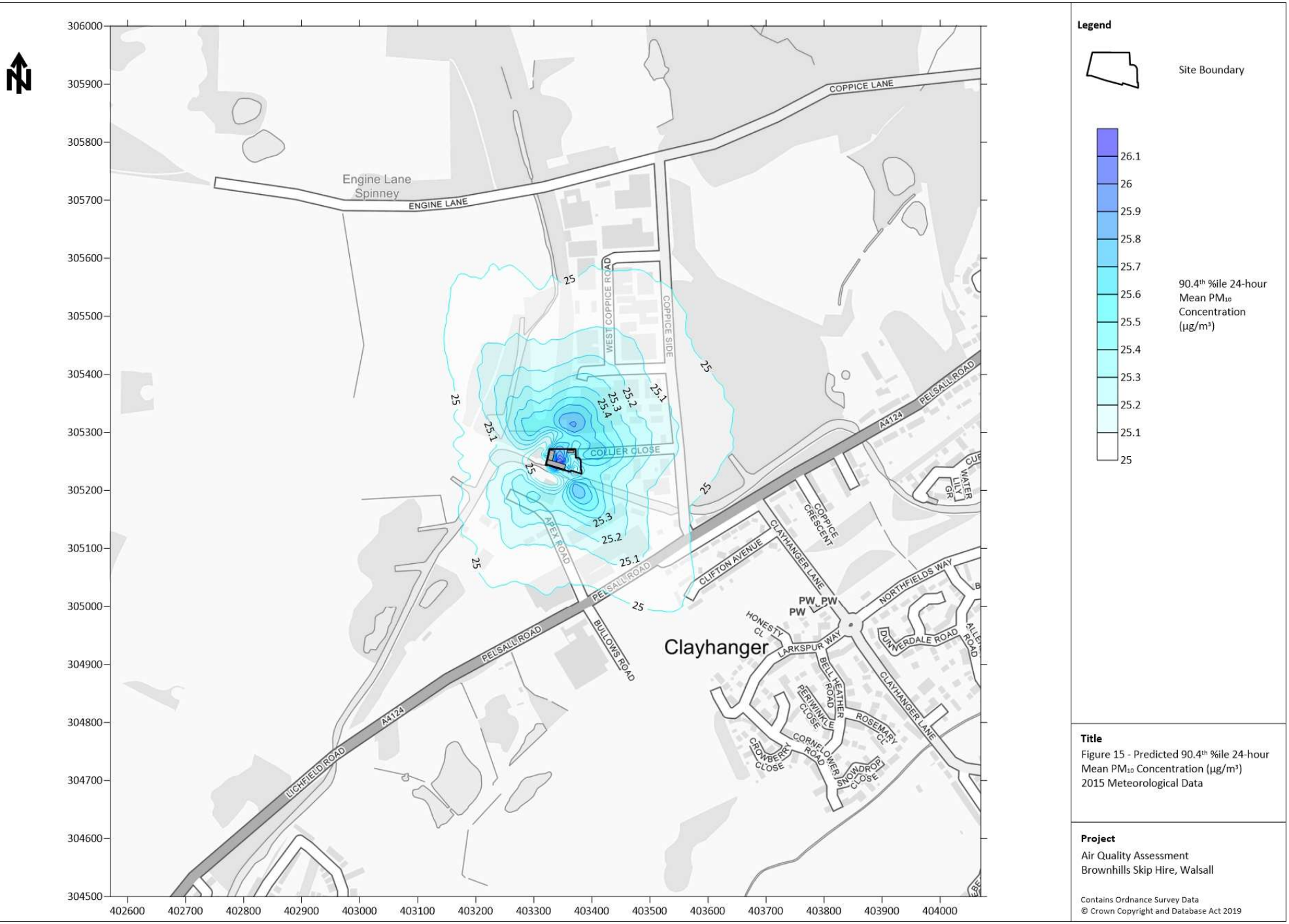
- 13.15
- 13.05
- 12.95
- 12.85
- 12.75
- 12.65
- 12.55
- 12.45

Title

Figure 14 - Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$) 2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

26.1
26
25.9
25.8
25.7
25.6
25.5
25.4
25.3
25.2
25.1
25

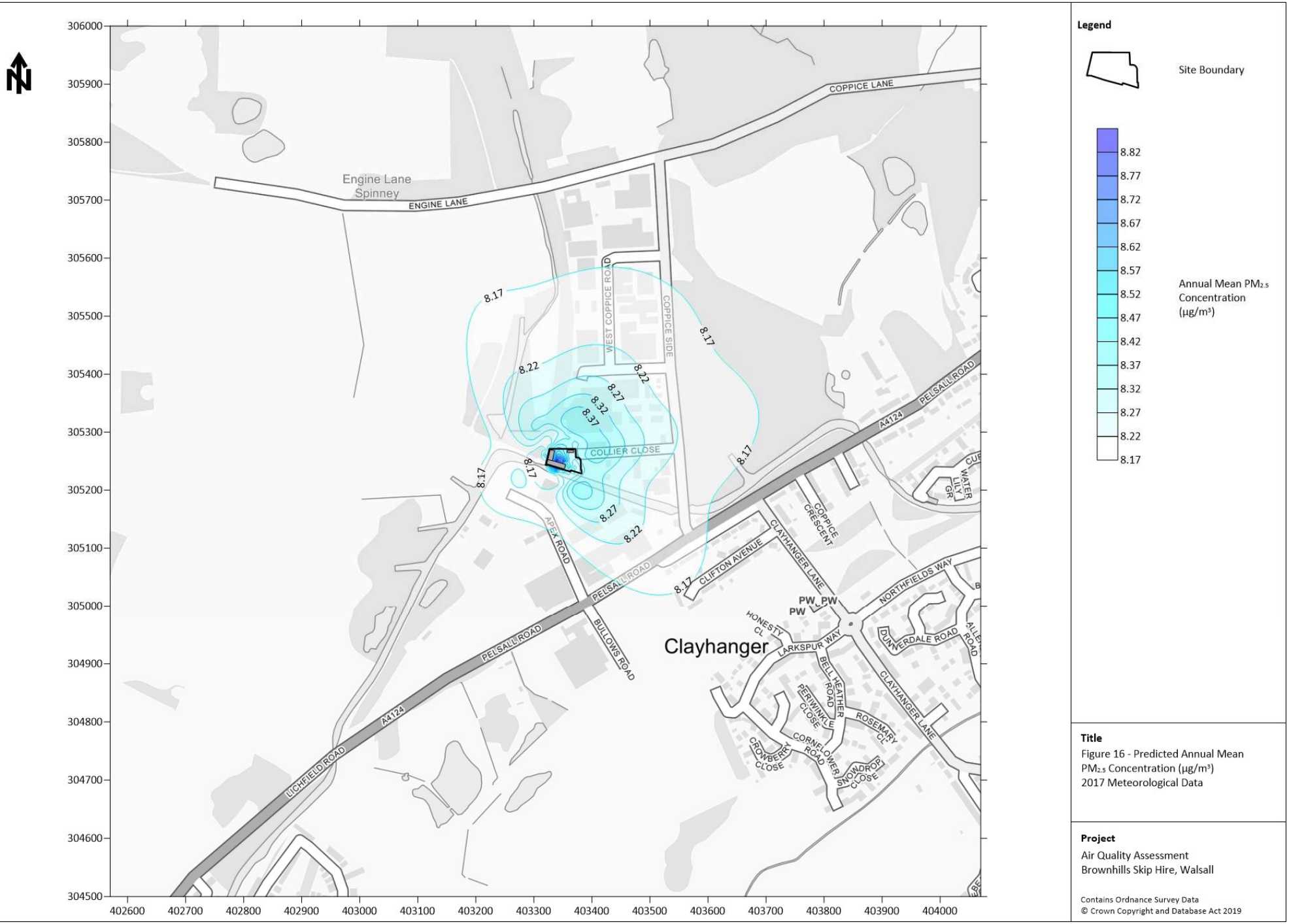
90.4th %ile 24-hour Mean PM_{10} Concentration ($\mu g/m^3$)

Title

Figure 15 - Predicted 90.4th %ile 24-hour Mean PM_{10} Concentration ($\mu g/m^3$) 2015 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)

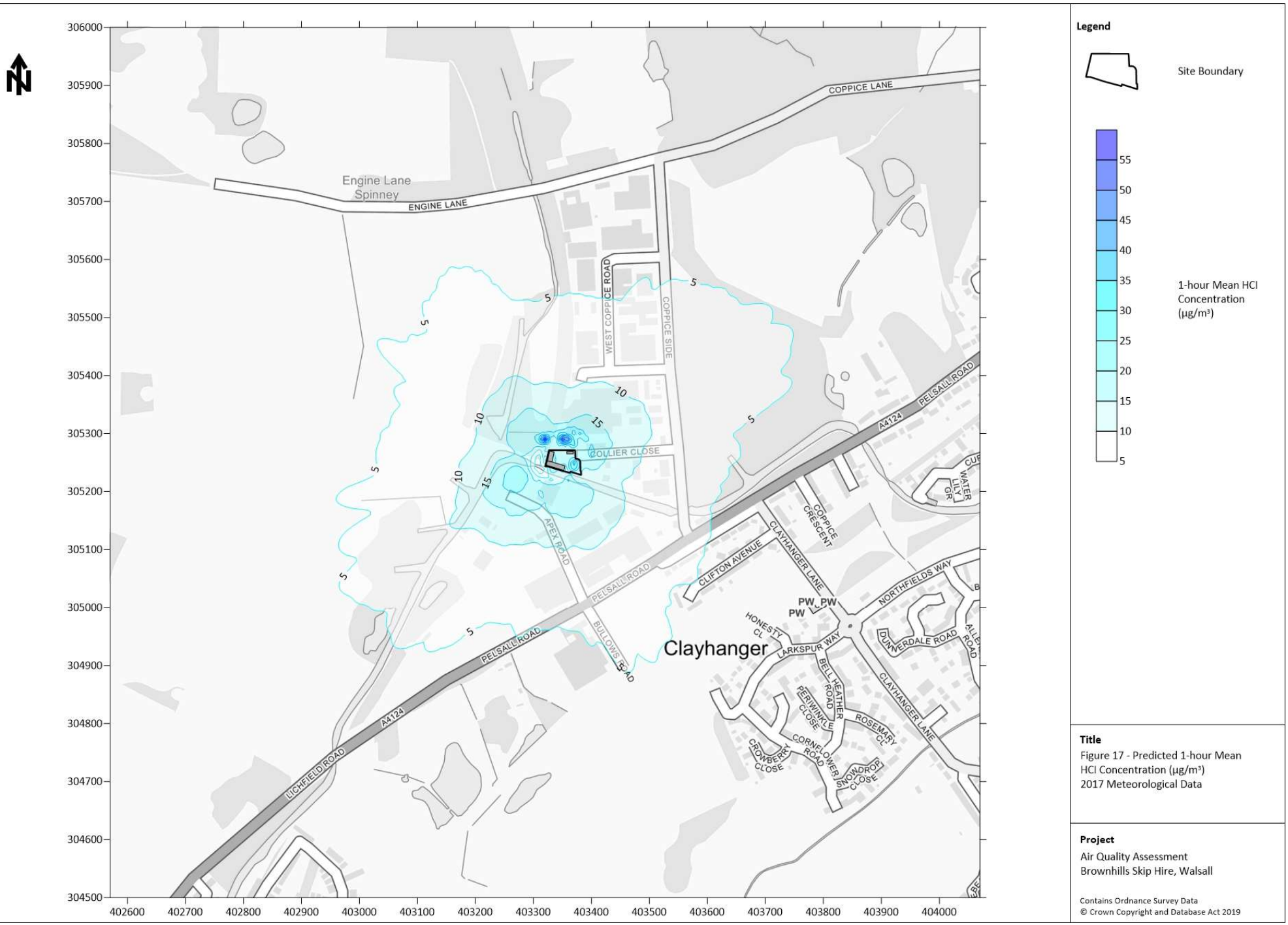
8.82
8.77
8.72
8.67
8.62
8.57
8.52
8.47
8.42
8.37
8.32
8.27
8.22
8.17

Title

Figure 16 - Predicted Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)
2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

1-hour Mean HCl Concentration (µg/m³)

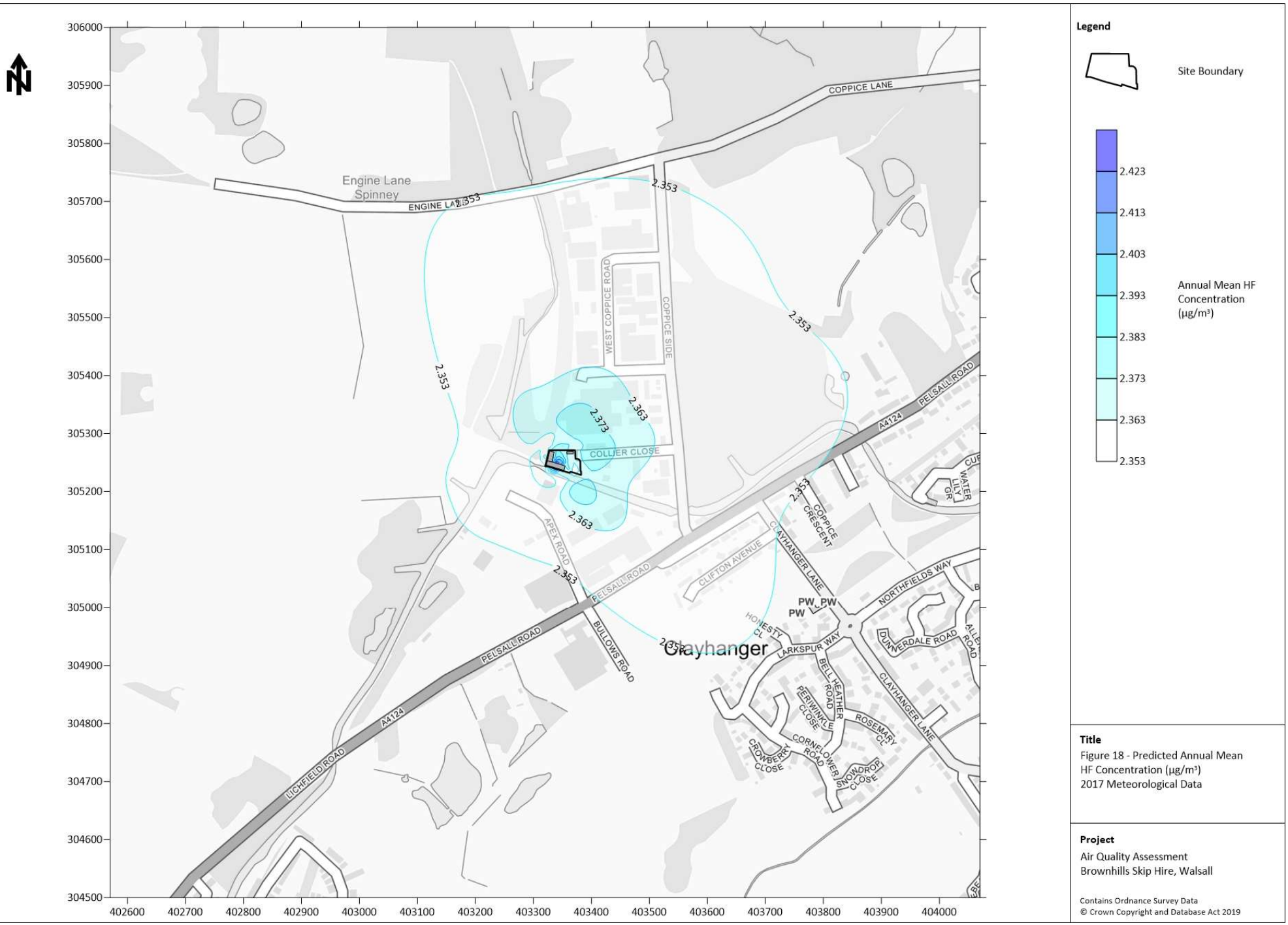
55
50
45
40
35
30
25
20
15
10
5

Title

Figure 17 - Predicted 1-hour Mean HCl Concentration (µg/m³)
2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

Annual Mean HF Concentration (µg/m³)

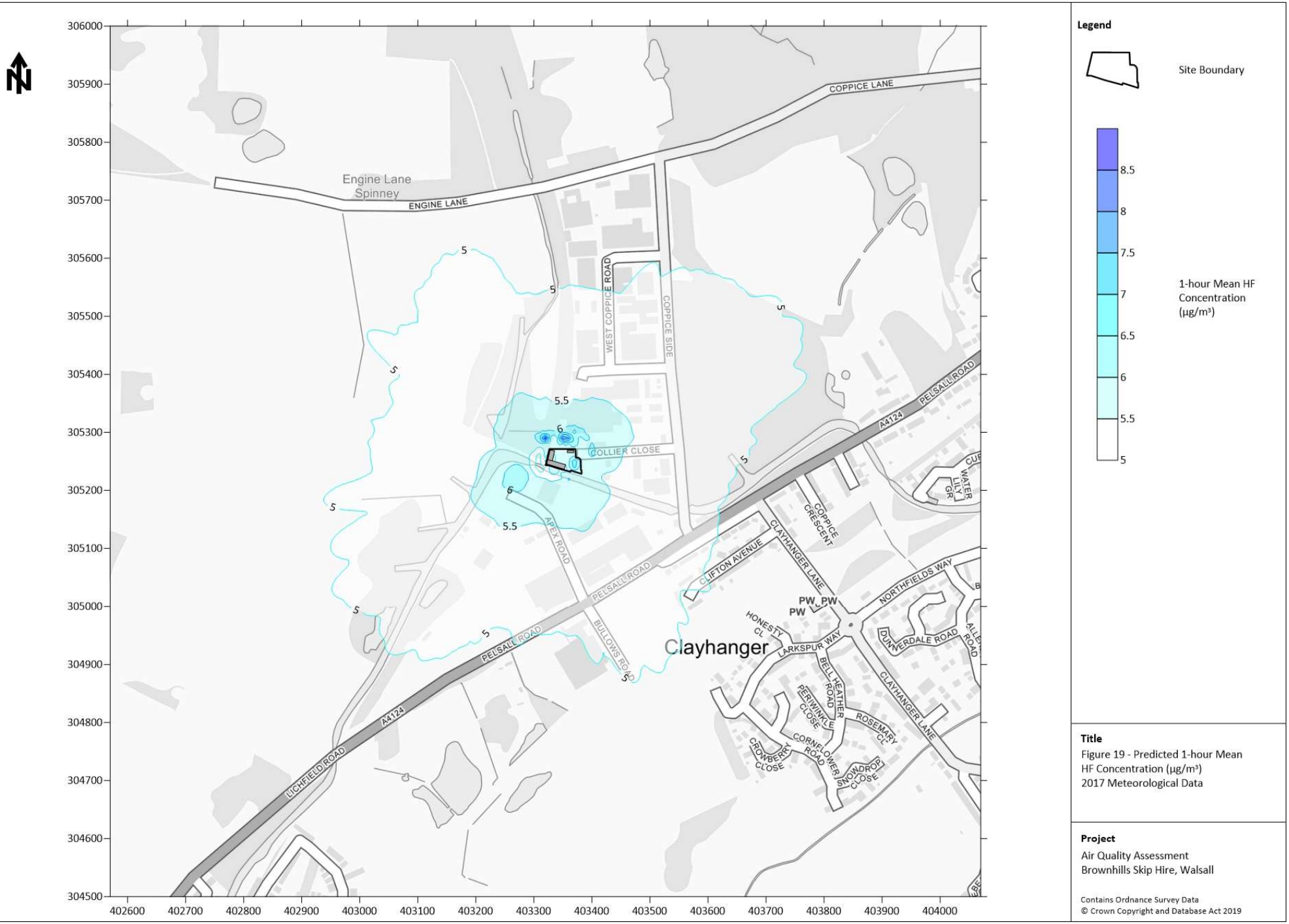
- 2.423
- 2.413
- 2.403
- 2.393
- 2.383
- 2.373
- 2.363
- 2.353

Title

Figure 18 - Predicted Annual Mean HF Concentration (µg/m³) 2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

1-hour Mean HF Concentration (µg/m³)

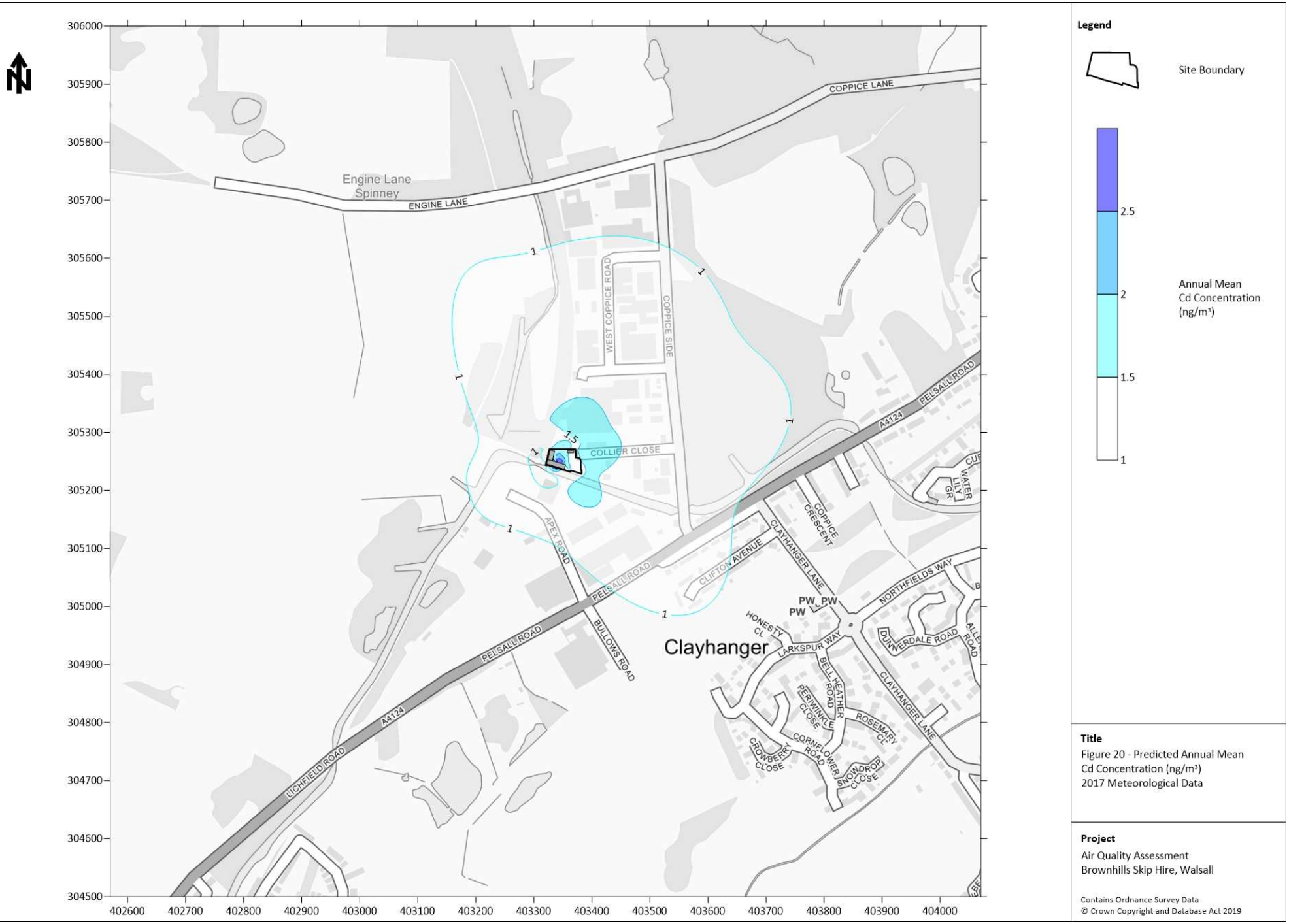
8.5
8
7.5
7
6.5
6
5.5
5

Title

Figure 19 - Predicted 1-hour Mean HF Concentration (µg/m³) 2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

Annual Mean Cd Concentration (ng/m³)

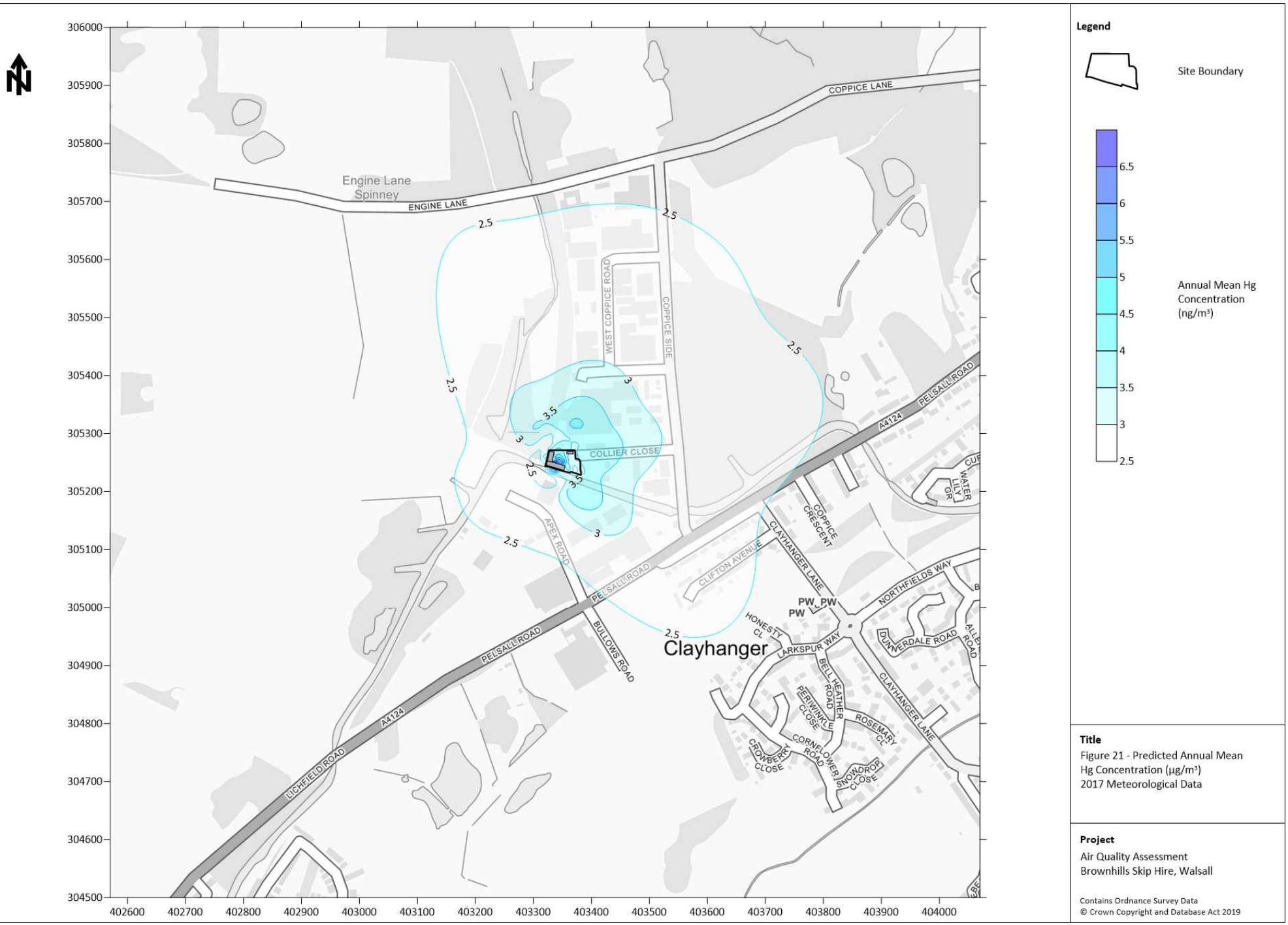
2.5
2
1.5
1

Title

Figure 20 - Predicted Annual Mean Cd Concentration (ng/m³)
2017 Meteorological Data

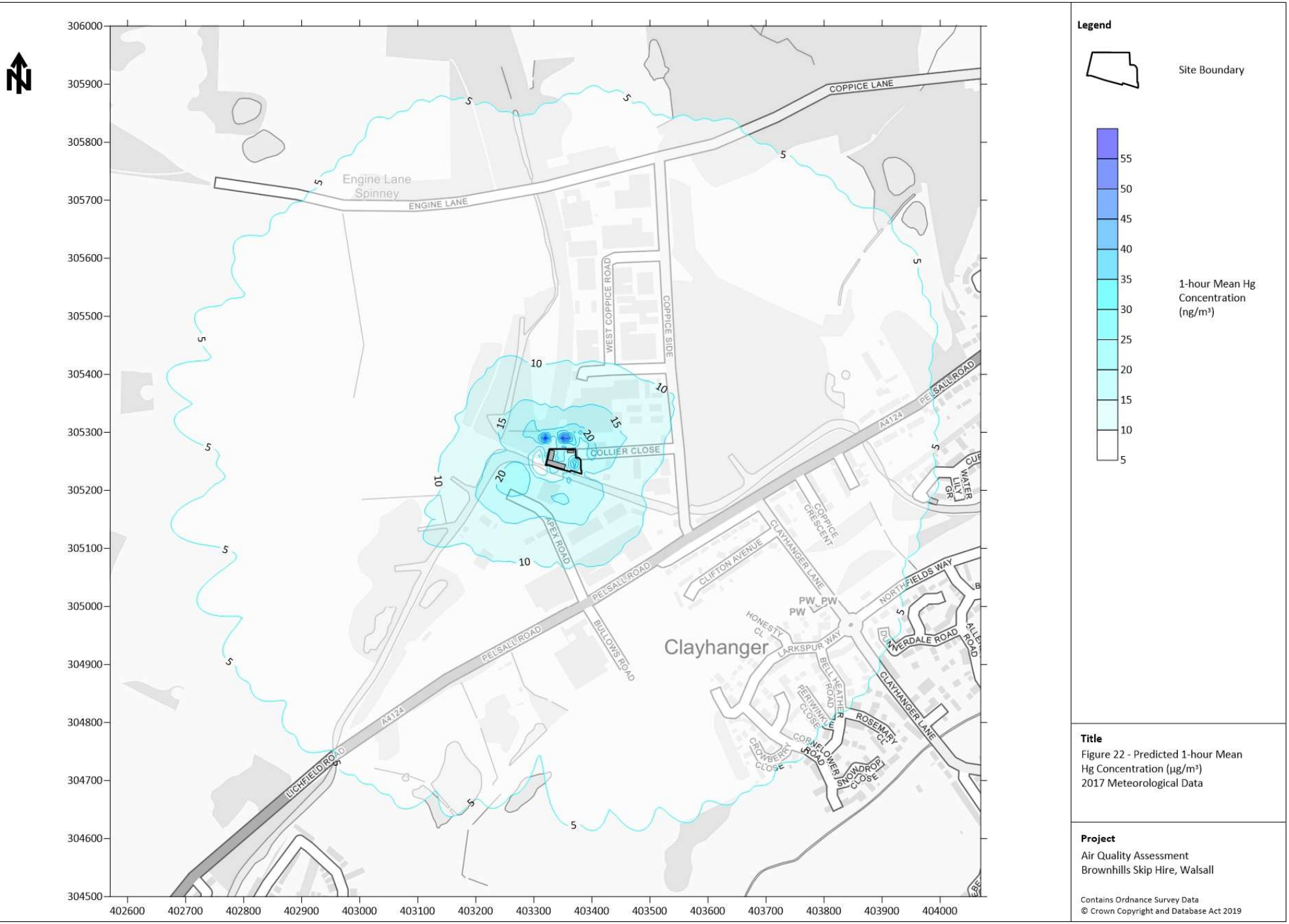
Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Title
Figure 21 - Predicted Annual Mean Hg Concentration (µg/m³)
2017 Meteorological Data

Project
Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

1-hour Mean Hg Concentration (ng/m³)

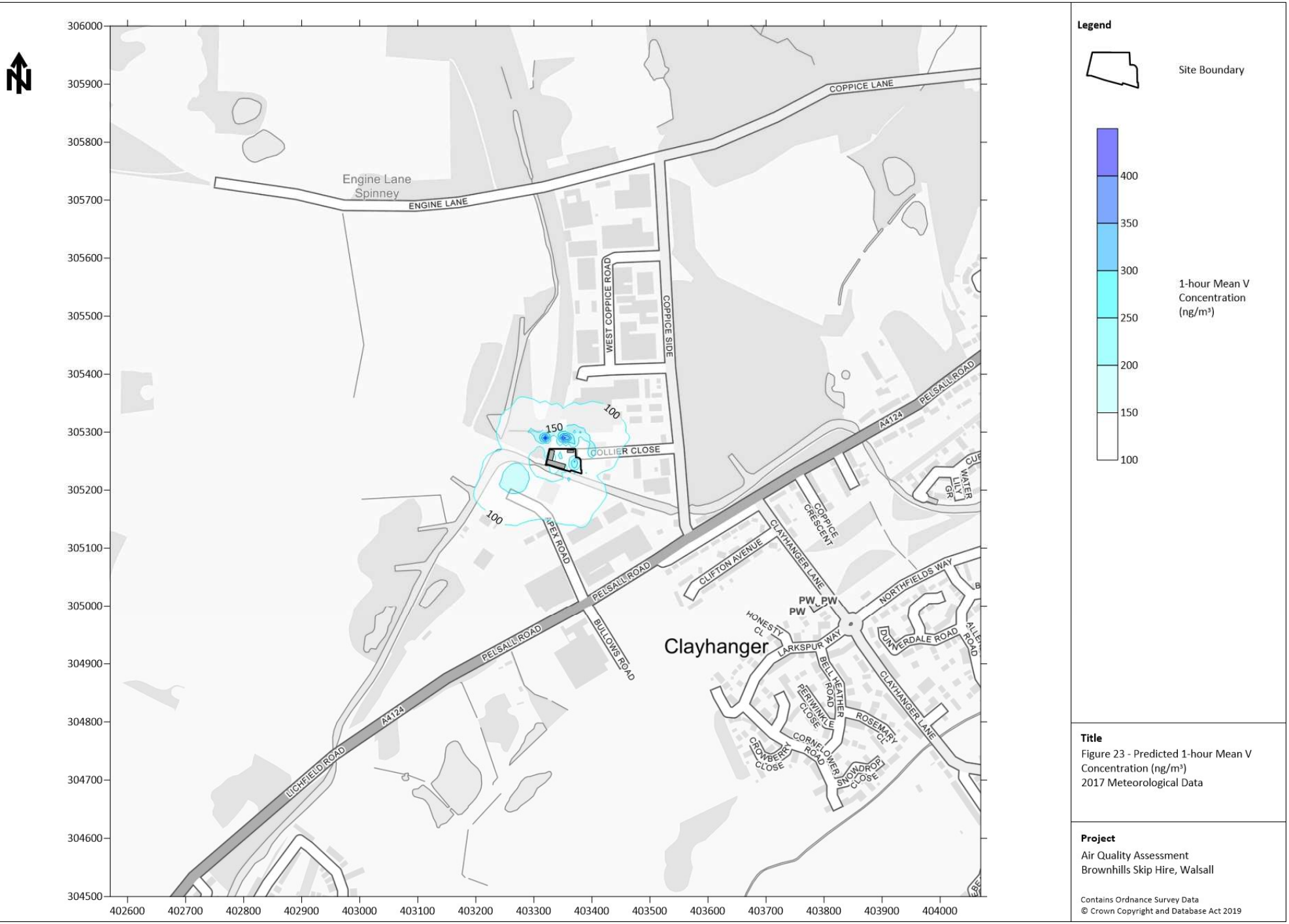
55
50
45
40
35
30
25
20
15
10
5

Title

Figure 22 - Predicted 1-hour Mean Hg Concentration (µg/m³)
2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall

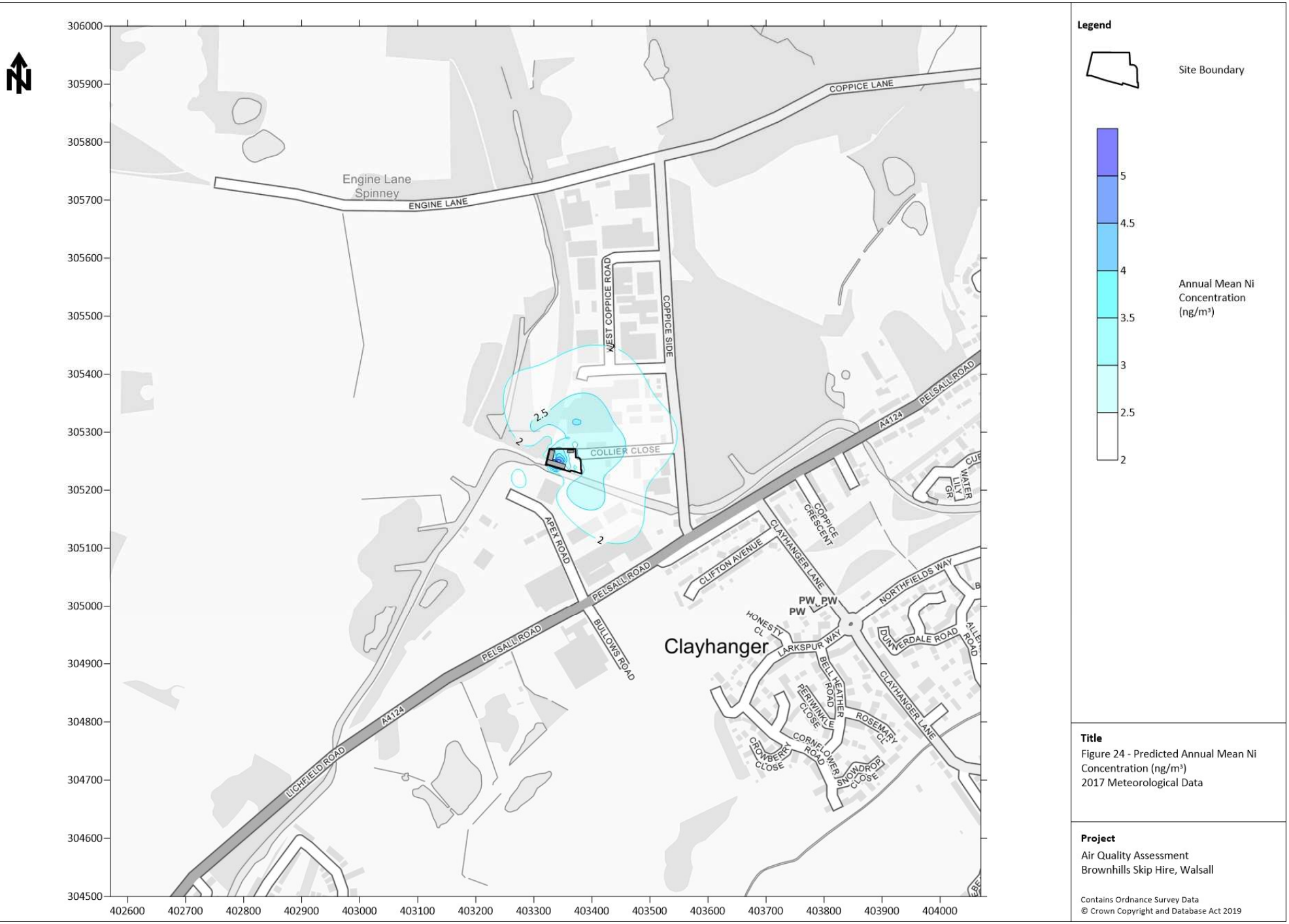


Title

Figure 23 - Predicted 1-hour Mean V Concentration (ng/m³)
2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall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403000
403100
403200
403300
403400
403500
403600
403700
403800
403900
404000
COPPICE LANE
Engine Lane
Spinney
ENGINE LANE
WEST COPPICE ROAD
COPPICE SIDE
2.5
2
COLLIER CLOSE
A4124
PELSALL ROAD
APEX ROAD
CLIFTON AVENUE
CLAYHANGER LANE
COPPICE CRESCENT
WATER LILY GR
PELSALL ROAD
BULLOWS ROAD
Clayhanger
NORTHFIELDS WAY
HONESTY CL
LARKSPUR WAY
DUNNERDALE ROAD
BELL HEATHER ROAD
PERIWINKLE CLOSE
ROSEMARY CL
CLAYHANGER LANE
CORNFLOWER ROAD
CROWBERRY CLOSE
SNOWDROP CLOSE
A4124
LICHFIELD ROAD
Legend
Site Boundary
5
4.5
4
3.5
3
2.5
2
Annual Mean Ni Concentration (ng/m³)
Title
Figure 24 - Predicted Annual Mean Ni Concentration (ng/m³)
2017 Meteorological Data
Project
Air Quality Assessment
Brownhills Skip Hire, Walsall
Contains Ordnance Survey Data
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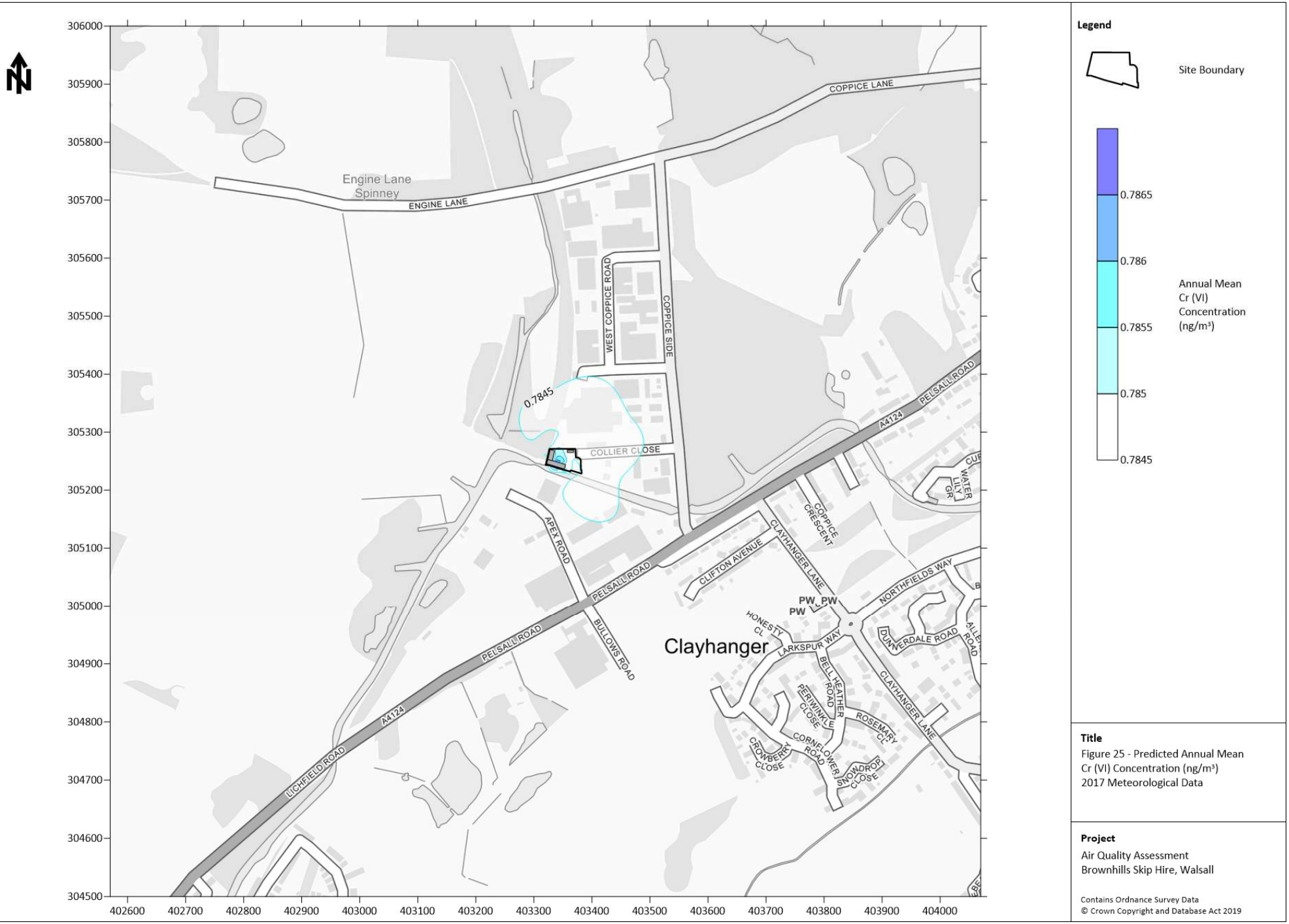
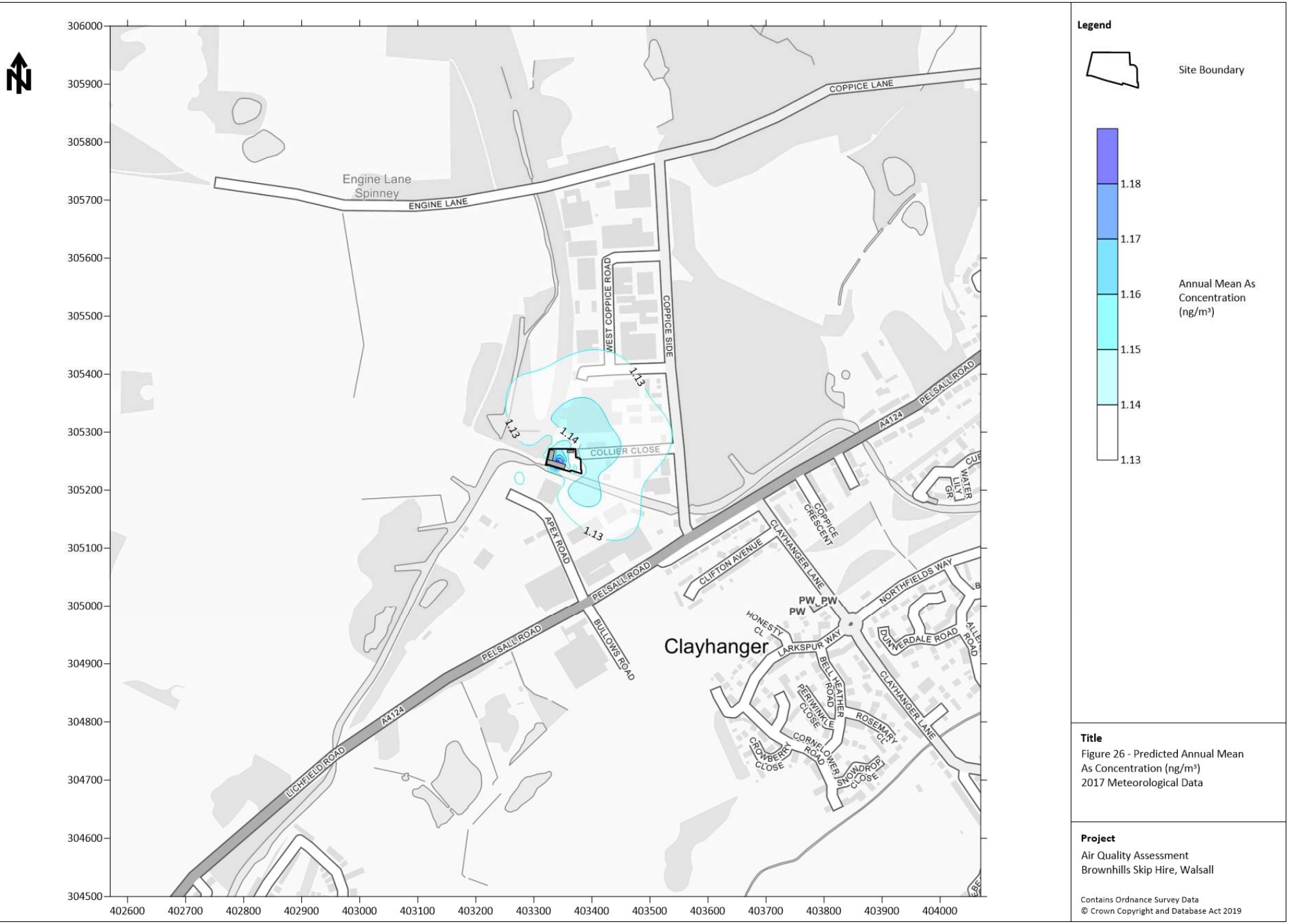


Title

Figure 25 - Predicted Annual Mean Cr (VI) Concentration (ng/m³) 2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall



Legend

Site Boundary

Annual Mean As Concentration (ng/m³)

1.18
1.17
1.16
1.15
1.14
1.13

Title

Figure 26 - Predicted Annual Mean As Concentration (ng/m³)
2017 Meteorological Data

Project

Air Quality Assessment
Brownhills Skip Hire, Walsall