ES Appendix VII

Human Health Risk Assessment

MEDICAL WASTE INCINERATION PLANT, STOPGATE LANE - HUMAN HEALTH RISK ASSESSMENT

Culzean W2E Limited

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1 Introduction

1.1 A Human Health Risk Assessment (HHRA) has been undertaken in support of a permit and planning application for a proposed Medical Waste Incinerator at Stopgate Lane, Simonswood. The purpose of this HHRA is to quantify potential risk to population exposed to residual emissions of polychlorinated dibenzo-dibenzo-dioxins (PCDD) (“dioxins) and polychlorinated dibenzofurans (PCDF) (“furans) from the proposed plant.

1.2 Risk to the population from inhalation of gaseous pollutants, particulate matter and metals has been addressed through undertaking dispersion modelling of emissions and comparing the resulting ground level pollutant concentrations with the various health based Air Quality Limit Values and Environmental Assessment Levels (EALs). These standards have been set based on known intake mechanisms, such as inhalation and ingestion. There are no ambient Air Quality Standards for dioxins and furans and health effects from these compounds can occur at very low inhalation and ingestion levels. Inhalation presents a direct exposure pathway, whilst ingestion can arise via indirect pathways, following the deposition of dioxins and furans from air to various media, including land and water, with subsequent uptake by humans via consumption of produce, drinking water and livestock which is subsequently consumed. In order to evaluate the potential health impacts from intake of dioxins/furans, a human health risk assessment model needs to be used, which takes account of exposure via all potential forms of intake.

1.3 The approach used by the Environment Agency (EA) when assessing potential health impacts from incinerators, is to use the H1 assessment methodology to assess impacts from most pollutants (including metals) against established Air Quality Standards and EALs and established dioxin intake models to assess potential health impacts from dioxins and furans. The principal models that can be used to assess dioxin intake are discussed later in this document.

2 Background on Dioxin and Furans, Exposure Routes and Tolerable Daily Intake

2.1 Description of Dioxins and Furans

2.1.1 The term 'dioxin' is normally used to refer to the family of 210 compounds known as PCDDs and PCDFs. There are 75 PCDDs and 135 PCDFs which make up the 'dioxin' family of compounds. Each dioxin compound comprises two benzene rings, interconnected by oxygen atoms and the various compounds have differing toxicity and physical properties. It is therefore important when assessing atmospheric transport and exposure to these toxic compounds to consider them on a congener specific basis. Out of the 210 dioxin compounds, there are 17 dioxin congeners which are thought to be the most toxic to human health, due to them possessing a specific structure of chlorines. These 17 congeners are presented in Table 2.1. Dioxins and furans are formed as by-products from combustion and incineration processes at low to mid temperatures (<850C). Dioxins and furans can be destroyed when incinerated at sufficiently high temperature, with adequate residence time and sufficient mixing during the combustion process. Therefore, legislation requires incineration processes to operate at a minimum temperature of 850C for at least 2 seconds before the last intake of combustion air, to destroy dioxins and furans. In the case of incineration of hazardous wastes, this required temperature rises to 1,100C.

2.1.2 The Industrial Emissions Directive (IED) requires dioxins and furans to be reported using the International Toxic Equivalence Quotient (I-TEQ) reporting convention in order to assess compliance against an Emission Limit Value (ELV) of 0.1ng I-TEQ.Nm^{-3}. The relative contribution of individual dioxin and furan congeners to the overall toxicity of a mixture is calculated by multiplying the individual congener emission concentration by the TEF. The most potent and widely studied congener is 2,3,7,8-TCDD, which is assigned a TEF of 1. Other congeners are assigned TEFs which define the relative toxicity of each congener, compared to 2,3,7,8-TCDD. The overall TEQ emission concentration is calculated by summing individual TEQ quotient concentrations. As the proposed plant is not yet operational, it is not possible to present a site specific emission profile for the 17 dioxin and furan congeners. However, reference has been made to a previous United States (US)

Environmental Protection Agency (EPA) inventory report on dioxin and furan releases in the United States for the years 1987, 1995 and 2000. The table below contains the average dioxin emissions concentrations reported across 104 Municipal Waste Incinerators. It is considered that in the absence of site specific information, this data will provide a suitable estimation of potential dioxin emission profile, given the large dataset used. The dioxin concentrations have been multiplied by the World Health Organisation (WHO) Toxic Equivalency Factors to determine TEQ emission concentrations, and then subsequently factored relative to the IED ELV to estimate a TEQ dioxin emission profile for the proposed plant.

Table 2.1 – Typical Dioxin Congener Emission Profile for Incineration Plants

Congener	Average Dioxin and Furan Emission Concentrations Across 104 MWI in the United States During Year 2000 (ng.Nm^{-3})	WHO TEQ Factors	Emission Concentrations Factored to WHO TEQ (ng.Nm^{-3})	TEQ Emission Concentrations Factored Relative to IED ELV (ng.Nm^{-3})
2,3,7,8-TCDD	0.005	1	0.005	0.005881
1,2,3,7,8-PeCDD	0.016	1	0.016	0.018819
1,2,3,4,7,8-HxCDD	0.016	0.1	0.0016	0.001882
1,2,3,6,7,8-HxCDD	0.037	0.1	0.0037	0.004352
1,2,3,7,8,9-HxCDD	0.032	0.1	0.0032	0.003764
1,2,3,4,6,7,8-HpCDD	0.219	0.01	0.00219	0.002576
OCDD	0.345	0.0003	0.000104	0.000122
2,3,7,8-TCDF	0.072	0.1	0.0072	0.008469
1,2,3,7,8-PeCDF	0.05	0.03	0.0015	0.001764
2,3,4,7,8-PeCDF	0.069	0.3	0.0207	0.024347
1,2,3,4,7,8-HxCDF	0.082	0.1	0.0082	0.009645
1,2,3,6,7,8-HxCDF	0.059	0.1	0.0059	0.00694
2,3,4,6,7,8-HxCDF	0.066	0.1	0.0066	0.007763
1,2,3,7,8,9-HxCDF	0.013	0.1	0.0013	0.001529

Congener	Average Dioxin and Furan Emission Concentrations Across 104 MWI in the United States During Year 2000 (ng.Nm^{-3})	WHO TEQ Factors	Emission Concentrations Factored to WHO TEQ (ng.Nm^{-3})	TEQ Emission Concentrations Factored Relative to IED ELV (ng.Nm^{-3})
1,2,3,4,6,7,8-HpCDF	0.156	0.01	0.00156	0.001835
1,2,3,4,7,8,9-HpCDF	0.024	0.01	0.00024	0.000282
OCDF	0.090	0.0003	0.000027	3.18E-05
			TOTAL	**0.1ng.Nm^{-3}**

2.2 Dioxin and Furan Exposure Routes

2.2.1 In general, levels of dioxins and furans in air are very low, except in the vicinity of inefficient incinerators and since these compounds are poorly soluble, concentrations are also very low in drinking water and surface water[1]. Dioxins and furans released from processes, such as combustion and incineration, are deposited to land, leading to bioaccumulation and bioconcentration through food chains. Therefore, the principal human exposure route for dioxins and furans is through ingestion of contaminated food products, such as meat, fish, eggs and dairy products. However, other parts of the human diet, can also contribute significantly to the total dioxin and furan intake, such as cereals, fats and oils.[1,2] Indeed, the WHO have estimated that 90% of human exposure to dioxins is through the food chain.[3]

1 Exposure to Dioxins and Dioxin-Like Substances: A Major Public Health Concern, WHO, 2010
2 Statement on the Tolerable Daily Intake for Dioxins and Dioxin-Like Polychlorinated Biphenyls, Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment, 2001.
3 Dioxins and Their Effects on Human Health, Fact Sheet No 225, WHO, June 1999.

2.3 Potential Dioxin and Furan Health Impacts and Tolerable Daily Intake

2.3.1 The WHO report that long term exposure to dioxins is linked to impairment of the immune system, the developing nervous system, the endoxrine system and reproductive functions. Chronic exposure of animals to dioxins has resulted in several types of cancer.[3]

2.3.2 The Tolerable Daily Intake (TDI) is the amount of a substance that can be ingested daily over a human lifetime without causing appreciable health risk, and is expressed in relation to bodyweight. The Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) previously recommended a TDI level for dioxins, furans and dioxin like PCBs of 2 picograms (pg) I-TEQ/Kg body weight/day.[2] They considered this to protect against effects on the male reproductive system and other possible effects such as cancer and cardiovascular effects. However, the COT have recently revised advice, resulting in a change from a TDI to a Tolerable Weekly Intake (TWI) of 2pg I-TEQ/Kg body weight/day, equivalent to approximately 0.29 pg I-TEQ/Kg body weight/day . As such exposure levels from the proposed plant have been compared to the lower TDI level to provide a worst case assessment.

2.3.3 For infant exposure via breast milk, there are no target levels for exposure. In order to evaluate potential health impacts as a result of exposure of infants to dioxins via breast milk, calculated exposure levels have been compared to national average background levels. The previous COT report[2] estimated an average consumer intake of 1.8pg.kg^{-1}.day^{-1} for dioxins/furans and 3.1 pg.kg^{-1}.day^{-1} for the 97.5 percentile consumer. As such, exposure levels via breast milk have been compared to the estimated background exposure level of 1.8 pg.kg^{-1}.day^{-1}.

2.4 Dioxin and Furan Intake Models

2.4.1 Two models have been recommended by COT to predict dioxin and furan uptake for comparison with the TDI, either of which the EA accept can be used when undertaking health impact assessments in support of permit applications. One of these models is the

Human Health Risk Assessment Protocol (HHRAP)[4] developed by the USEPA, the other being a model previously developed by HMIP[5]. Whilst the HMIP model is restricted to assessment of dioxins and furans only, the USEPA model contains algorithms which can also be applied to metals. However, the potential health impacts from metal emissions can be assessed through comparison with heath based Air Quality Standards/Environmental Assessment Levels and the EA position, based on the approach taken in recent permit decision documents, is that it is not therefore necessary to model the human body intake of metals. For the purpose of this assessment, the HHRAP has been used.

3 Assessment Methodology

3.1 HHRAP Model

3.1.1 In order to assess potential human health impacts from residual dioxins and furans arising from the proposed plant, the USEPA HHRAP model[4] has been used. The HHRAP comprises a multitude of equations to predict the concentration of dioxins and furans in soil, water and air and subsequent uptake by animals and humans. The HHRAP is freely available on the USEPA website. However, in order to simplify the process, Lakes Environmental have developed software, known as IRAP-h View, which is an interface which automatically undertakes the multitude of calculations within the HHRAP, based on defined input values by the user, which greatly simplifies the risk assessment process. IRAP-h View version 5.1.0 has been used to undertake this assessment.

3.1.2 The HHRAP model incorporates the following stages:

- Facility Characterisation;
- Air Dispersion and Deposition Modelling;
- Exposure Scenario Identification;

4 Human Health Risk Assessment protocol for Hazardous Waste Combustion Facilities, USEPA, 2005.
5 Risk Assessment of Dioxin Releases from Municipal Waste Incineration Processes, HMIP, 1996.

- Estimation of Media Concentrations; and,
- Quantifying Exposure.

3.1.3 The following sections discuss the above stages in more detail and outlines the methodology used to undertake the assessment.

3.2 Facility Characterisation

3.2.1 The first stage in the HHRAP is to characterise the facility, in terms of the nature and magnitude of emissions. As outlined previously, this assessment has been undertaken to assess potential health impacts from dioxins and furans. The following table outlines expected stack process parameters. Parameters for stack internal diameter, exhaust flow rate, temperature, oxygen and moisture content were provided by the plant manufacturer.

Table 3.1 - Expected Emission Source Process Parameters

Process Parameter	Value
Exhaust Flue (A1)	343239.29, 400693.02
Stack internal diameter (m)	0.5
Stack height (m)	14
Expected stack efflux velocity ($m.s^{-1}$)	14.92
Expected actual stack volumetric flowrate ($m^3.s^{-1}$)	2.93
Flow rate expressed at reference conditions of 273.15K, 11% oxygen, dry gas, 101.3kPa ($Nm^3.s^{-1}$)	1.36
Expected stack efflux temperature (K)	393
Expected oxygen content of exhaust gas, (v/v, %)	13.5
Expected moisture content of exhaust gas (v/v, %)	4
Expected absolute stack pressure (KPa)	Assumed to be Standard Atmospheric Pressure (101.3kPa)

3.2.2 The following table outlines dioxin and furan congener emission rates assigned within the assessment. Emission concentrations for each dioxin congener were calculated based on a maximum dioxin emission concentration of $0.1ng.Nm^{-3}$, which was then split across the 17 dioxin and furan congeners, based on the expected relative contribution of each to the total dioxin and furan emission concentration, based on the HMIP emission profile for waste incineration plants, as described previously. Equivalent emission rates were then subsequently determined.

Table 3.2 – Dioxin and Furan Congener Emission Rates

Congener	Dioxin Congener Emission Concentrations I-TEQ ($ng.Nm^{-3}$)[(a)]	Dioxin Congener Emission Rates (TEQ $ng.s^{-1}$)
2,3,7,8-TCDD	0.005881	0.007979178
1,2,3,7,8-PeCDD	0.018819	0.025533098
1,2,3,4,7,8-HxCDD	0.001882	0.002553446
1,2,3,6,7,8-HxCDD	0.004352	0.005904673
1,2,3,7,8,9-HxCDD	0.003764	0.005106891
1,2,3,4,6,7,8-HpCDD	0.002576	0.003495046
OCDD	0.000122	0.000165526
2,3,7,8-TCDF	0.008469	0.011490505
1,2,3,7,8-PeCDF	0.001764	0.002393346
2,3,4,7,8-PeCDF	0.024347	0.033033336
1,2,3,4,7,8-HxCDF	0.009645	0.013086069
1,2,3,6,7,8-HxCDF	0.00694	0.009416
2,3,4,6,7,8-HxCDF	0.007763	0.010532624
1,2,3,7,8,9-HxCDF	0.001529	0.002074505
1,2,3,4,6,7,8-HpCDF	0.001835	0.002489677
1,2,3,4,7,8,9-HpCDF	0.000282	0.00038261
OCDF	3.18E-05	4.31454E-05

3.3 Modelling of Dioxin and Furan Deposition

3.3.1 Emission Rates

3.3.1.1 Dispersion modelling was undertaken to determine dioxin and furan deposition surrounding the plant. This was undertaken using AERMOD and was in accordance with USEPA guidance.[4] The AERMOD model output is directly proportional to the emission rate for any given compound. As such, the HHRAP recommends calculation of deposition rates based on a unitised emission rate of 1.0 $g.s^{-1}$. The unitised air concentrations and deposition values are then adjusted to the individual dioxin congener specific air concentrations and deposition rates in IRAP-h. This provides a significant time saving as otherwise the model would have to be run multiple times.

3.3.2 Dioxin Deposition

3.3.2.1 Dioxins have a low volatility and dispersion in the atmosphere is likely to be via particulate aerosols[6]. As such, dioxins were assumed to particle phase/bound within the assessment.

3.3.2.2 In order to model deposition rates for particle bound congeners, AERMOD provides two options as follows, as stated within the AERMOD View guidance:

- Method 1 – This method is used when a significant fraction (greater than 10 percent) of the total particulate mass has a diameter of 10 microns or larger. The particle size distribution must be known reasonably well in order to use Method 1; and,
- Method 2 – This method is used when the particle size fraction is not well known and a small fraction (less than 10 percent) of the total particulate mass ha a diameter of 10 microns or larger

[6] WHO Air Quality Guidelines for Europe, 2nd Edition, 2000.

3.3.2.3 Given that the plant is not yet operational, there is no data on particle size distribution. Furthermore, the plant will be using ceramic filtration for particulate matter control and therefore it is reasonable to assume that the majority of particulate matter exiting the system will be less than 10 microns. In order to use Method 2, the user must provide values for mean particle diameter and fine particle fraction. For the purpose of this assessment, a fine particle fraction of 0.9 was assumed, given that the majority of particulate matter is expected to be less than 10 microns in diameter. A mean particle diameter of 0.1µm was assumed based on the value previously recommended by the USEPA[7].

3.3.3 Meteorological Data

3.3.3.1 Meteorological data used in this assessment was from Liverpool John Lennon Airport. Liverpool John Lennon Airport is located approximately 18km to the South of the proposed site and it is considered that it provides suitable data for use in this assessment. Previous DEFRA guidance stated met stations within 30km of a study site to be suitable for use in dispersion modelling assessments. Although Crosby meteorological station (14km to West) is marginally closer, it is considered to be in a more exposed coastal location than Liverpool Airport and therefore is not considered to be as representative of the application site, which is much further inland. There are no other observing stations within 30km of the application site with sufficient date capture. As such, Liverpool John Lennon Airport is considered to provide the most appropriate data for use in this assessment. Reference should be made to Appendix III for wind roses showing wind speed and direction frequency at Liverpool between 2013 and 2017.

3.3.3.2 Five years of sequential meteorological data observed between 2013 and 2017 was used within the assessment. Data was previously supplied by ADM Ltd, an established distributor of met data within the UK. The data provided by ADM Ltd was in ADMS format. This was

7 Deposition Parameterizations for the Industrial Source Complex (ISC3) Model. Environmental Research Division, Argonne National Laboratory on behalf of US Department of Energy, June 2002

converted to the required format required by AERMET using the ADMS UK to SAMSON converter, which is a tool within the AERMET processor. The AERMET processor within AERMOD was used to process the data to be site specific. US EPA guidance on processing met data for use within AERMOD states that land use up to 1km upwind from a site should be considered when determining surface roughness characteristics, whilst for Bowen ratio and albedo, land use types within a 10km by 10km area centred over the site should be considered[8]. AERMOD guidance states that albedo and Bowen ratio should be calculated as the arithmetic and geometric mean respectively of land use types over the 10km by 10km grid, not weighted by direction or distance. The Land Use Creator and AERSURFACE tool within AERMET was used to calculate the appropriate land-use characteristics, which are contained in the following table.

Table 3.3 - Parameters for Surface Roughness, Albedo and Bowen Ratio

Parameter	Directional Sector	Value
Surface Roughness	0-30°	0.239
	30-60°	0.229
	60-90°	0.251
	90-120°	0.143
	120-150°	0.101
	150-180°	0.129
	180-210°	0.113
	210-240°	0.192
	240-270°	0.579
	270-300°	0.194
	300-330°	0.104
	330-360°	0.105
Albedo	All	0.18
Bowen Ratio	All	0.68

8 AERMOD Implementation Guide, USEPA, August 2015.

3.3.4 Assessment Area

3.3.4.1 Two uniform cartesian receptor grids were used to define the modelling domain. This included a high resolution grid, extended over a 3000m by 3000m area with a spacing of 20m in X and Y direction, centred over the stack location. A further uniform cartesian receptor grid was extended over a 20,000m by 20,000m area with a spacing of 200m in X and Y direction, centred over the stack location. This ensured the maximum point of impact could be captured.

3.3.5 Terrain Data

3.3.5.1 Topographical features can have a significant impact on pollutant dispersion. Given that the gradient of the land between the site and receptors exceeds a gradient of 10% in places, terrain data was included in the model, in accordance with the relevant guidance[9]. The terrain data used was Ordnance Survey Terrain 5 data, which is 1:10,000 scale data, contoured at 5m vertical intervals. The digital terrain data was processed in AERMAP, the inbuilt terrain processor within AERMOD. This then applied elevation data to all sources, buildings and receptors within the modelling domain.

3.3.6 Building Downwash

3.3.6.1 Significant on-site buildings and structures were digitised within the model from site layout and elevation information provided by the site operator. As the closest buildings to the emission points, these would be expected to have an influence on pollutant dispersion. Height information for surrounding buildings was provided by the applicant. In accordance with the relevant guidance, buildings/structures included within the model are those within a distance of 5L of the proposed exhaust flue, where L is defined as the lesser of the

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9 LAQM.TG(16), DEFRA, 2016.

building/structure height and maximum projected width. The table below contains information on building heights used within the model. Reference should be made to Appendix I for a plan showing building locations. The integrated Building Profile Input Programme (BPIP) module within AERMOD was used to assess the potential impact of building downwash upon predicted dispersion characteristics. Building downwash occurs when turbulence, induced by nearby structures, causes pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. All buildings and structures were input into the BPIP processor.

Table 3.4 - Building Inputs

Structure	Length and Width (m)	Diameter (m)	Max Height (m)
Structure A	40 x 28	N/A	10.63
Structure B	312 x 50	N/A	12
Structure C	N/A – polygon structure	N/A	8
Structure D	12.2 x 2.4	N/A	3.9
Structure E	N/A – polygon structure	N/A	5.9
Structure F	3.7 x 2.4	N/A	6.99
Structure G	3.7 x 2.4	N/A	6.99
Structure H	N/A	1.2	14

3.4 Exposure Scenarios

3.4.1 The HHRAP recommends assessing the following exposure scenarios, when they are consistent with site specific exposure settings:

- Farmer;
- Farmer Child;
- Resident;
- Resident Child;
- Fisher:

- Fisher Child;
- Acute Receptor; and,
- Nursing Infant

3.4.2 In order to provide a conservative worst case assessment, the farmer and farmer child scenario has been included in the assessment and potential impacts have been assessed at the maximum point of impact surrounding the plant in addition to the worst case discrete receptor location. Therefore, this assumes that each person will be exposed via inhalation and that their diet consists of ingesting products grown at these locations, which is highly unlikely to be the case in reality.

3.4.3 A search of the site and surrounding has not identified any significant surface water bodies. Furthermore, the local population will predominantly obtain their drinking water from treated water provided by local water companies. As such, exposure via drinking water consumption has not been considered.

3.4.4 Although there are likely to be various places where fishing is undertaken as a recreational activity, it is highly unlikely that locally caught fish will contribute significantly to diet within the local population. As such, exposure via consumption of locally caught fish has not been included in the assessment.

3.4.5 The table below contain the exposure scenarios included within the risk assessment. The risk assessment has included the following principal exposure scenarios:

- Inhalation;
- Ingestion of homegrown produce and meat; and
- Ingestion of breast milk.

Table 3.5 – Exposure Scenarios Included in Risk Assessment

Exposure Pathways	Farmer	Farmer Child	Farmer Infant
Inhalation of vapours and particulates	✓	✓	X
Incidental ingestion of soil	✓	✓	X
Ingestion of drinking water from surface water sources	X	X	X
Ingestion of homegrown produce	✓	✓	X
Ingestion of homegrown beef	✓	✓	X
Ingestion of milk from homegrown cows	✓	✓	X
Ingestion of homegrown chicken	✓	✓	X
Ingestion of eggs from homegrown chickens	✓	✓	X
Ingestion of homegrown pork	✓	✓	X
Ingestion of fish	X	X	X
Ingestion of breast milk	X	X	✓

3.5 Sensitive Receptors

3.5.1 The following table outlines the sensitive receptors considered within this assessment. These are representative of the locations of worst case long term exposure. In addition, impacts have been assessed at the maximum point of impact surrounding the plant.

Table 1.1 - Sensitive Receptors

Receptor Identifier	Receptor Description	National Grid Reference (m)	
		X	Y
R1	Wood House Farm	342860	401189
R2	High Barn Farm	343225	401159.9
R3	Voces Farm	343464	401666.9
R4	Residential property off Siding Lane	343455.6	401032.8
R5	Residential property off Stopgate Lane	343527.3	401115.1

Receptor Identifier	Receptor Description	National Grid Reference (m)	
		X	Y
R6	Abram's Farm	343623.3	401154.1
R7	Newbridge Farm	344207.8	401333.5
R8	Peartree Cottage	344090.7	401551.9
R9	The Coach House	344454.7	401442.2
R10	Wild Goose Slack	344834.6	400855.5
R11	Moss Cottage	345274	400414
R12	Spencer's House Farm	343914	399950.3
R13	Bullens Farm	343630.7	399956.1
R14	Keeper's House	343349	400214.6
R15	South Head Farm	343183.3	400047.3
R16	Woods Farm	342780.3	400272.1
R17	Residential property off Dale Lane	342465.9	400031.5
R18	Residential property off Dorchester Drive	342226.4	400216.2
R19	Residential property off Freckleton Drive	342207.4	400267.9
R20	Residential property off Anders Drive	342195.8	400331.2
R21	Residential property off Anders Drive	342179.9	400410.3
R22	Residential property off Epsom Grange	342153.6	400557
R23	Residential property off Calder Close	342083.9	400759.5
R24	Simonswood Hall Barn	341737.9	401145.2
R25	Residential property off Hall Lane	341916.7	401304
R26	Grayson's Farm	342363	401510.8

3.6 Site Specific Parameters for Estimation of Media Concentrations

3.6.1 Annual Average Precipitation

3.6.1.1 The UK metoffice website was consulted to determine an appropriate value to assign for average annual precipitation. The nearest met station is Crosby, which was considered to provide a suitably representative figure for rainfall at the site. The metoffice website states an annual average rainfall amount of 836.6mm per annum at Crosby, which was used an input for the HHRAP.

3.6.2 Annual Average Evapo-Transpiration Rate

3.6.2.1 The annual average evapo-transpiration rate (E_v) was assumed to be 70% of the annual average precipitation level. Therefore, a value of 585.62mm/annum was assumed.

3.6.3 Annual Average Irrigation

3.6.3.1 Annual average irrigation (I) was assumed to be insignificant (0mm/year)

3.6.4 Annual Average Runoff

3.6.4.1 Annual average runoff (RO) was calculated based on a water mass balance, in accordance with the following formula.

$$P + I = E_v + RO$$

3.6.4.2 Therefore, a value of 250.98mm/annum was used as an input value for RO.

3.6.5 Annual Average Wind Velocity

3.6.5.1 Data from Liverpool John Lennon between 2013 and 2017 was used to determine annual average wind speed (W). A value of $4.83 m.s^{-1}$ was used as a model input.

3.6.6 Soil Zone Mixing Depth

3.6.6.1 A soil zone mixing depth of 2cm was assumed in the assessment, appropriate for untilled land. It should be noted that assuming untilled land results in a higher soil concentration value and therefore conservative assessment of potential impacts.

3.6.7 Exposure Duration

3.6.7.1 In accordance with the HHRAP, an exposure duration of 40 years was assumed for the farmer scenario and 6 years for farmer child.

3.6.8 Other Parameters

3.6.8.1 All other parameters used for estimation of media concentrations were the default parameters within the IRAP-h View model.

3.7 Calculation of Average Daily Dose

3.7.1 Ingestion

3.7.1.1 The Average Daily Dose (ADD) from ingestion of dioxins and furans via indirect exposure routes (including via soil, produce and milk) for each exposure scenario was calculated by IRAP-h View for each dioxin and furan congener. The ADD from each congener was summed to determine the total intake across all dioxin and furan congeners for each exposure scenario.

3.7.2 Inhalation

3.7.2.1 The ADD via inhalation was calculated using the following formula, based on the HHRAP guidance:

$$ADD\ from\ inhlation = \left(\frac{Ca\ \times IR \times ET\ \times EF \times ED}{BW\ \times AT}\right)$$

Where: Ca = Concentration of dioxins (pg.m^{-3}) (total)

IR = inhalation rate (m^{3}.hour.$^{-1}$)

ET = Exposure time (24 hours.day^{-1})

EF = Exposure frequency (350 days.year^{-1})

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Average Time (years)

3.7.2.2 For the farmer scenario, an IR of 0.83m^3.$hour^{-1}$ was assumed in accordance with the HHRAP guidance. For the farmer child scenario, an inhalation rate of 0.45m^3.$hour^{-1}$ was assumed, based on HMIP guidance. A BW of 70kg was assumed for adults and 15kg for child. An AT and ED of 40 years was assumed for farmer scenario and 6 years for farmer child scenario.

3.7.2 The ADD from each congener was summed to determine the total intake across all dioxin and furan congeners for each exposure scenario.

3.7.1 Total Daily Intake

3.7.1.1 Total intake was calculated by summing total intake via ingestion and inhalation routes for both the farmer and farmer child scenarios.

4 Results

4.1 Dispersion Modelling Results

4.1.1 The following tables present the maximum modelled dioxin/furan concentrations and dry and wet deposition values, based on a unitised emission rate of $1g.s^{-1}$. The maximum reported values for each have been used as inputs with IRAP-h View, in order to provide a conservative assessment. The assessment has been based on the maximum point of impact surrounding the plant and at the worst case long term receptor location, which is receptor R4.

Table 4.1 – Maximum Predicted Unitised Annual Mean Dioxin Concentrations

Receptor	Predicted Unitised Annual Mean Concentration ($\mu g.m^{-3}$)				
	2013	2014	2015	2016	2017
Maximum Point of Exposure	51.31725	59.1961	54.12153	53.33068	55.74799
R4	1.81641	2.31152	2.2179	2.27943	2.50187

Table 4.2 – Maximum Predicted Unitised Annual Dry Deposition

Receptor	Predicted Unitised Annual Dry Deposition ($g.m^{2}.Year^{-1}$)				
	2013	2014	2015	2016	2017
Maximum Point of Exposure	3.25967	3.83221	3.46094	3.34185	3.30258
R4	0.09875	0.10986	0.11252	0.10759	0.11393

Table 4.3 – Maximum Predicted Unitised Annual Wet Deposition

Receptor	Predicted Unitised Annual Wet Deposition ($g.m^2.Year^{-1}$)				
	2013	2014	2015	2016	2017
Maximum Point of Exposure	0.02942	0.02389	0.02961	0.03751	0.032
R4	0.00172	0.00281	0.00438	0.00406	0.00573

4.2 Dioxin and Furan Daily Intake Results

4.2.1 The table below presents the total daily intake for farmer and farmer child scenarios with comparison to the relevant TDI. The results show that at the maximum point of impact the predicted daily intake of dioxins/furans is significantly below the TDI for both the farmer and farmer child Scenarios, a 24.99% and 37.34% contribution to TDI respectively. However, this assumes that receptors would be permanently present at this location and consuming locally grown produce, which will not be the case in reality. At the worst case point of relevant long term exposure (receptor R4), the total daily intake of dioxins is predicted to be significantly lower, a 0.77% and 1.16% contribution to the TDI for the farmer and farmer child scenario respectively, again assuming that the receptors are present at this location throughout the whole year and consuming locally grown produce. As such, impacts from exposure to dioxins and furans as a result of plant emissions are not predicted to be significant.

Table 4.4 – Daily Intake Results – Farmer Adult and Farmer Child

Receptor	Farmer		Farmer Child	
	Total Daily Intake of Dioxins and Furans (I-TEQ/Kg body weight/day)	Total Daily Intake As Percentage of TDI (%)	Total Daily Intake of Dioxins and Furans (I-TEQ/Kg body weight/day)	Total Daily Intake As Percentage of TDI (%)
Maximum Point of Impact	0.0725	24.99	0.108	37.34
R4	0.00222	0.77	0.00336	1.16

4.2.2 The table below presents the total daily intake of dioxins and furans for breast fed farmer infant scenario, via ingestion from breast milk, with comparison to background exposure levels. As is indicated, the predicted daily intake is significantly less than background exposure levels, 56.75% at the point of maximum impact, falling to 1.74% of background exposure levels at the point of worst case relevant long term exposure. As such, impacts are not predicted to be significant.

Table 4.5 – Daily Intake Results – Breast Fed Farmer Infant

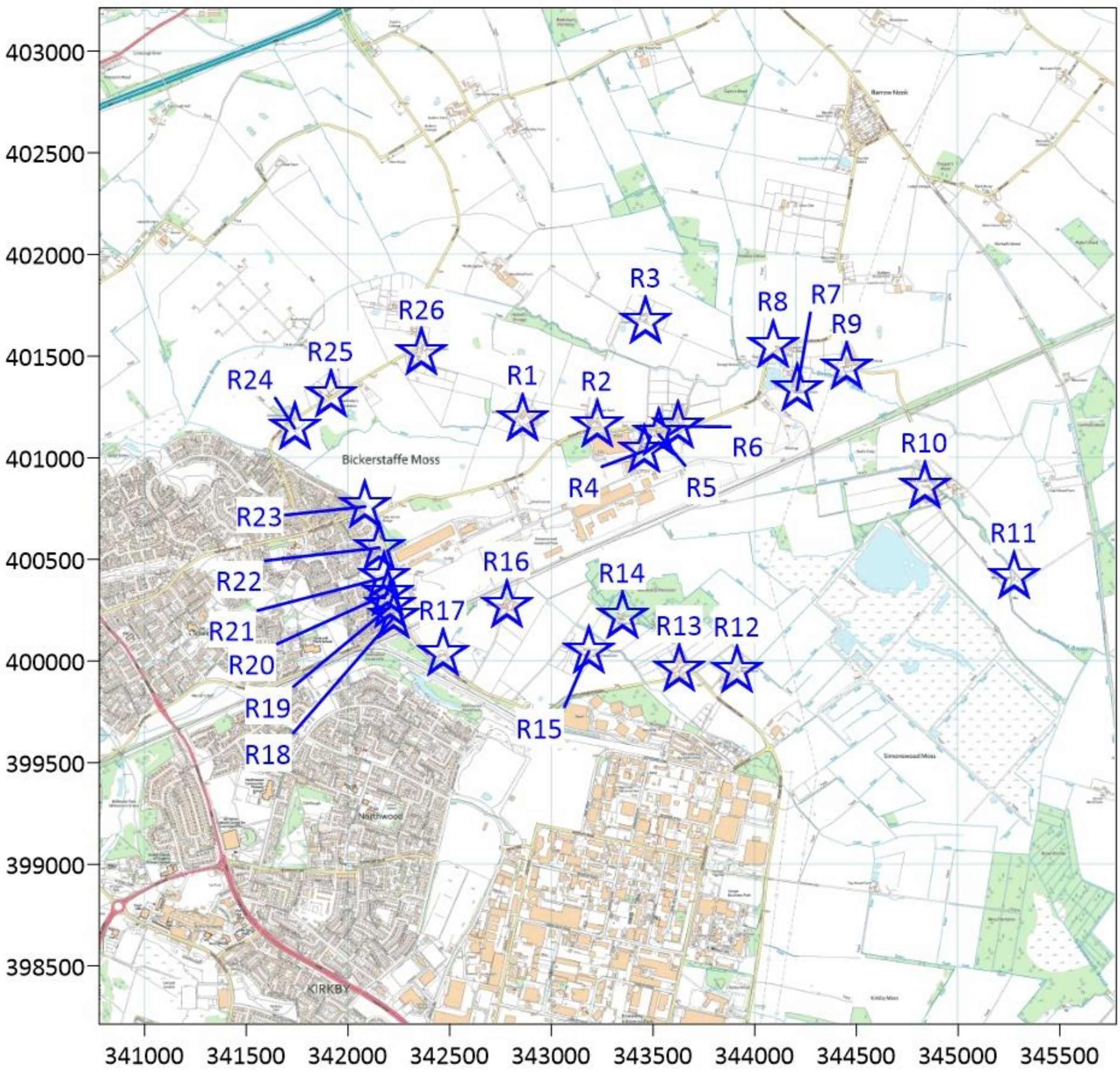
Receptor	Farmer Infant	
	Total Daily Intake of Dioxins and Furans (I-TEQ/Kg body weight/day)	Total Daily Intake As Percentage of Background Levels (%)
Maximum Point of Impact	1.02	56.74
R4	0.0313	1.74

5 Conclusions

5.1 A HHRA has been undertaken to assess potential health impacts as a result of exposure to emissions of dioxins and furans from the proposed medical waste incinerator at Stopgate Lane, Simonswood. The predicted total daily intake of dioxins and furans is significantly less than the TDI for farmer and farmer child scenarios at the worst case point of relevant long term exposure. Furthermore, predicted exposure of infants to dioxins via breast milk is not predicted to be significant, with exposure levels significantly lower than to existing background concentrations at the worst case point of relevant long term exposure. Given the above, potential health impacts as a result of potential dioxin and furan emissions from the proposed plant are not predicted to be significant.

Appendix I

Sensitive Receptors



Sensitive Receptors

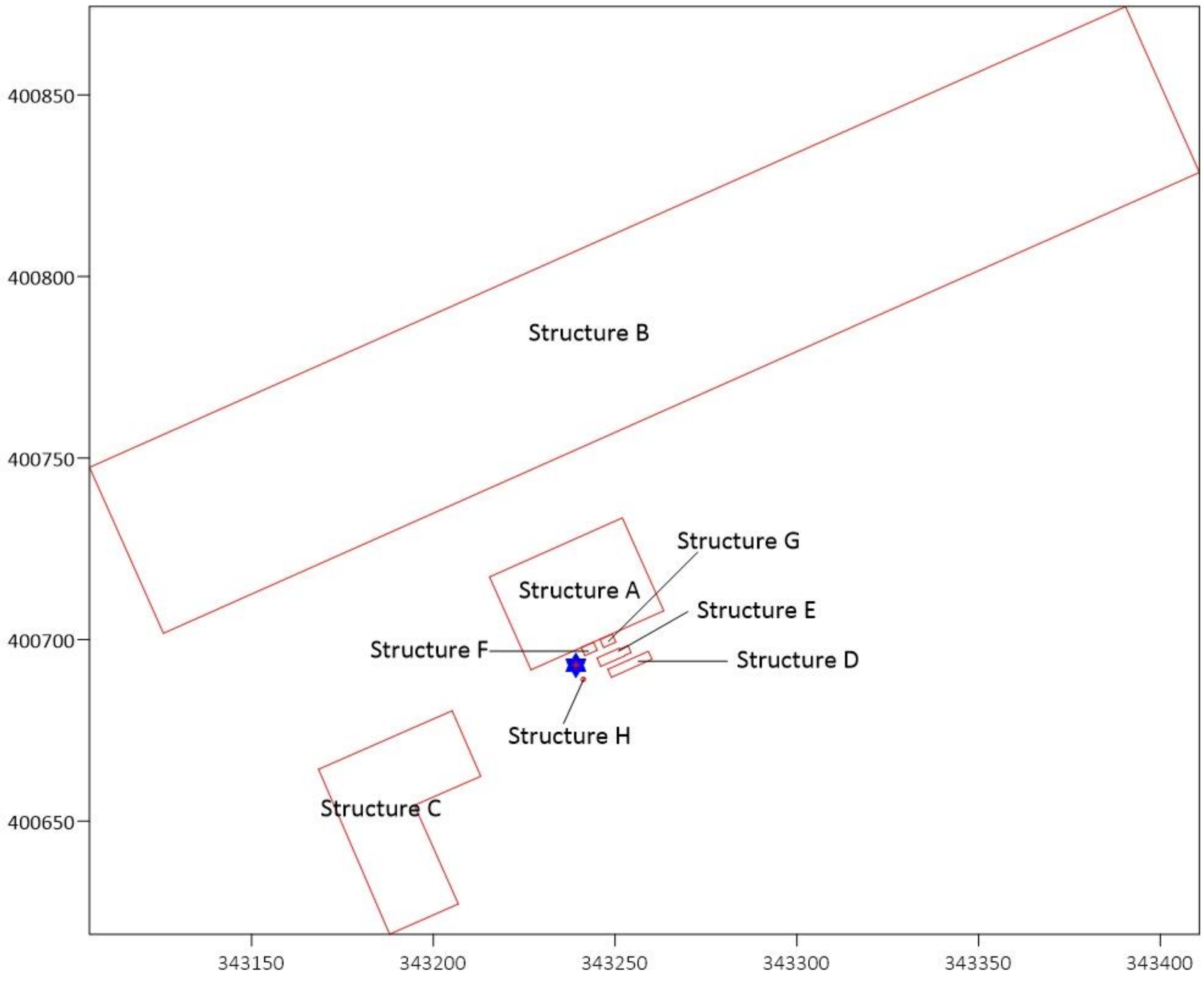
☆ Receptor Location

R1 Receptor Identifier

Oaktree Environmental Ltd
Lime House
2 Road Two
Winsford
Cheshire
CW7 3QZ

Appendix II

Buildings and Structures Digitised Within Model



Buildings and Stacks Digitised Within Model

Stack Location

Oaktree Environmental Ltd
Lime House
2 Road Two
Winsford
Cheshire
CW7 3QZ

Appendix III

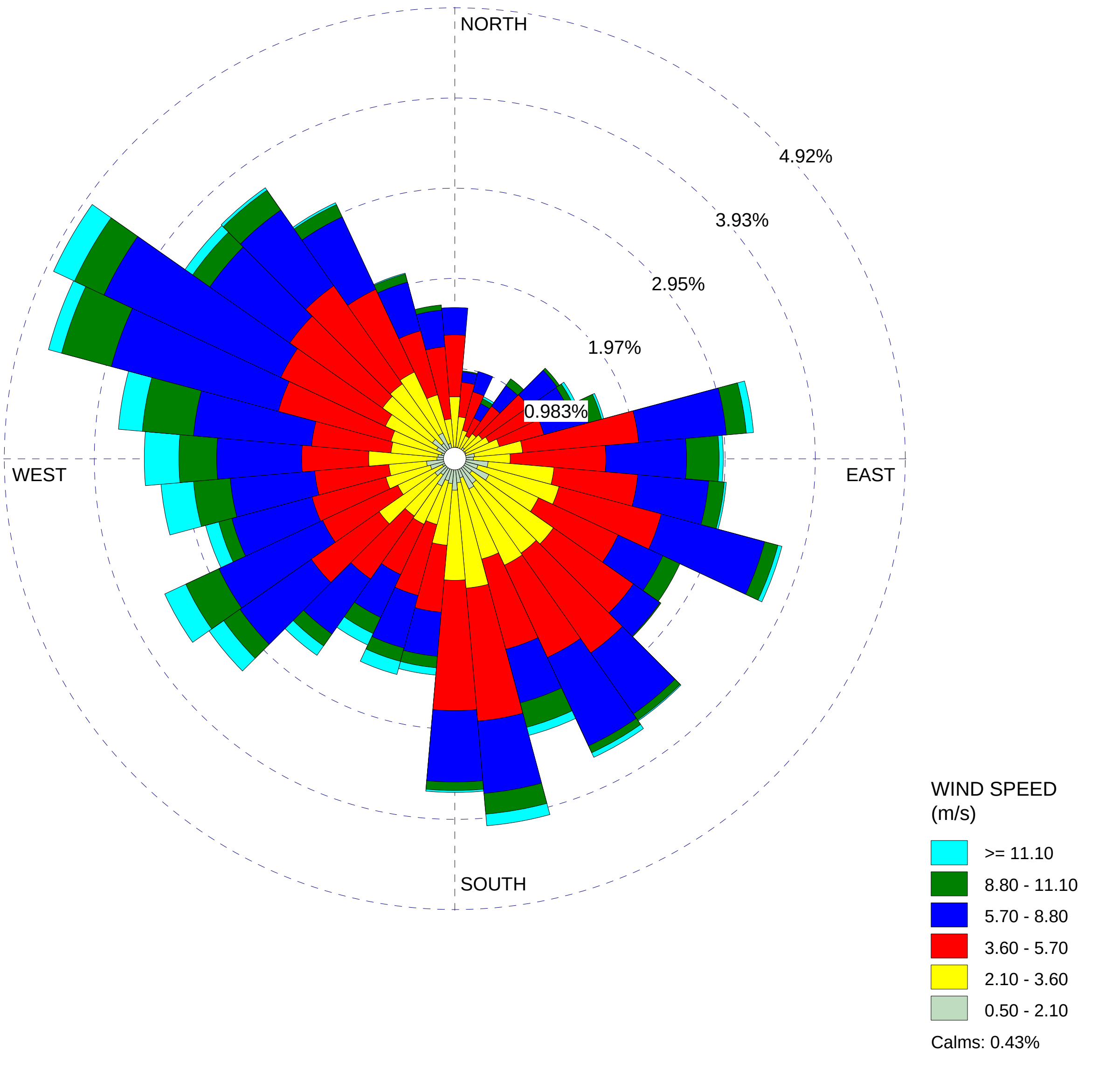
Wind Roses for Liverpool Airport

WIND ROSE PLOT:

Liverpool - Wind Speed and Direction Frequency

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 01/01/2013 - 00:00 **End Date: 31/12/2013 - 23:00**	MODELER:	
	CALM WINDS: **0.43%**	TOTAL COUNT: **8701 hrs.**	
	AVG. WIND SPEED: **5.02 m/s**	DATE: **15/01/2019**	PROJECT NO.: **4013**

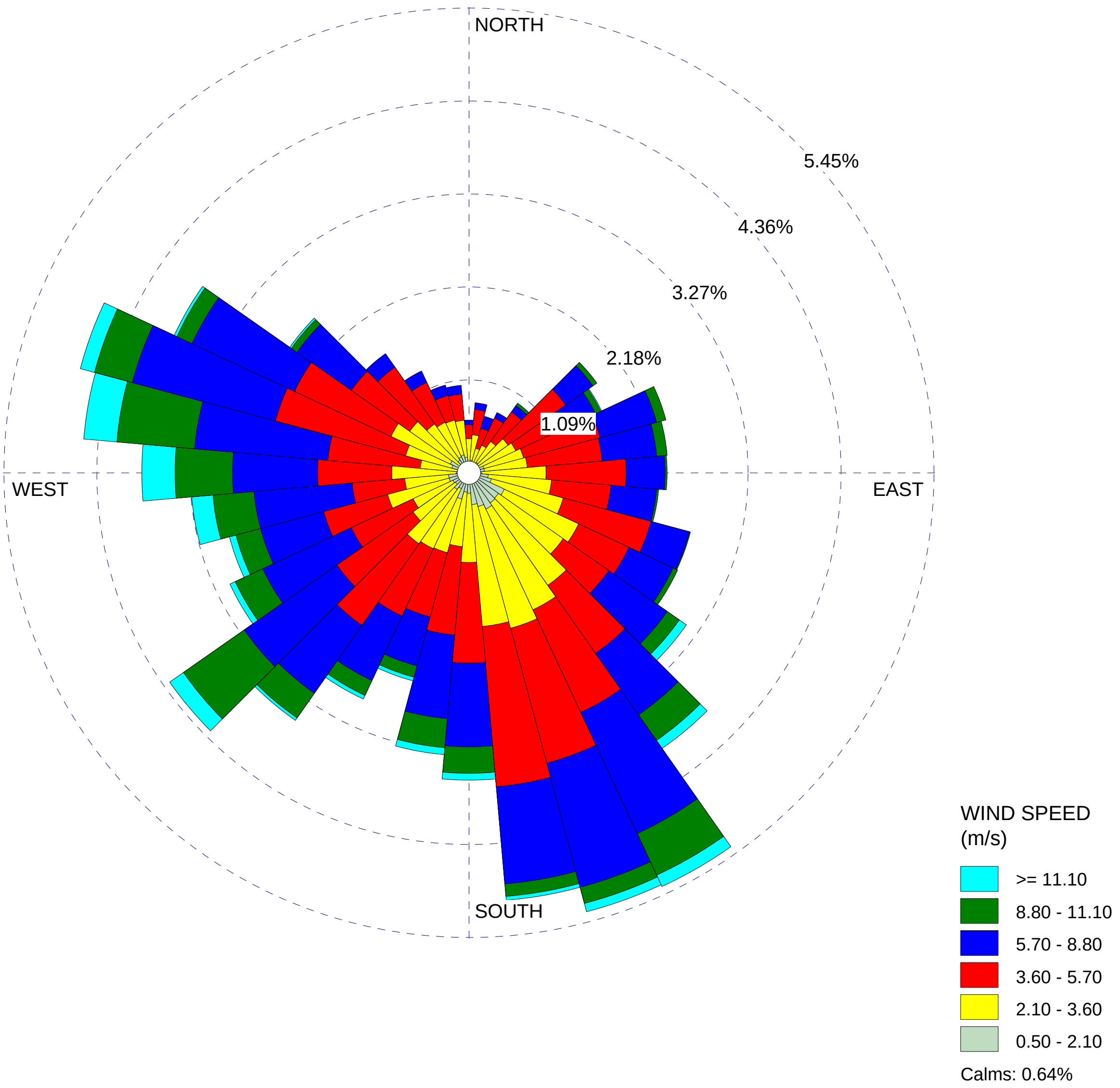
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Liverpool - Wind Speed and Direction Frequency

DISPLAY:

Wind Speed
Direction (blowing from)



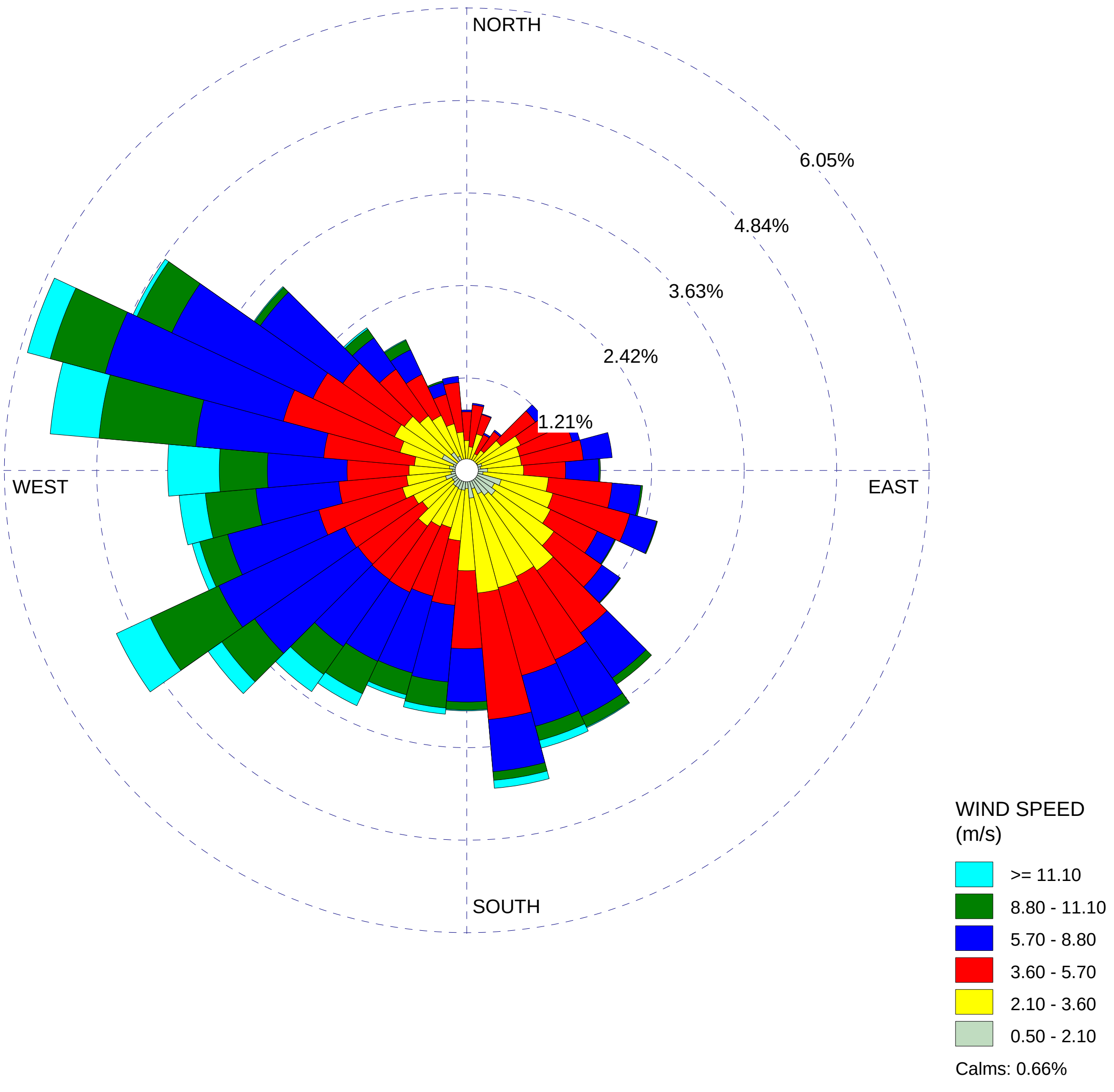
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 01/01/2014 - 00:00 **End Date: 31/12/2014 - 23:00**	MODELER:	
	CALM WINDS: **0.64%**	TOTAL COUNT: **8702 hrs.**	
	AVG. WIND SPEED: **4.86 m/s**	DATE: **15/01/2019**	PROJECT NO.: **4013**

WIND ROSE PLOT:

Liverpool - Wind Speed and Direction Frequency

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 01/01/2015 - 00:00 **End Date: 31/12/2015 - 23:00**	MODELER:	
	CALM WINDS: **0.66%**	TOTAL COUNT: **8727 hrs.**	
	AVG. WIND SPEED: **5.02 m/s**	DATE: **15/01/2019**	PROJECT NO.: **4013**

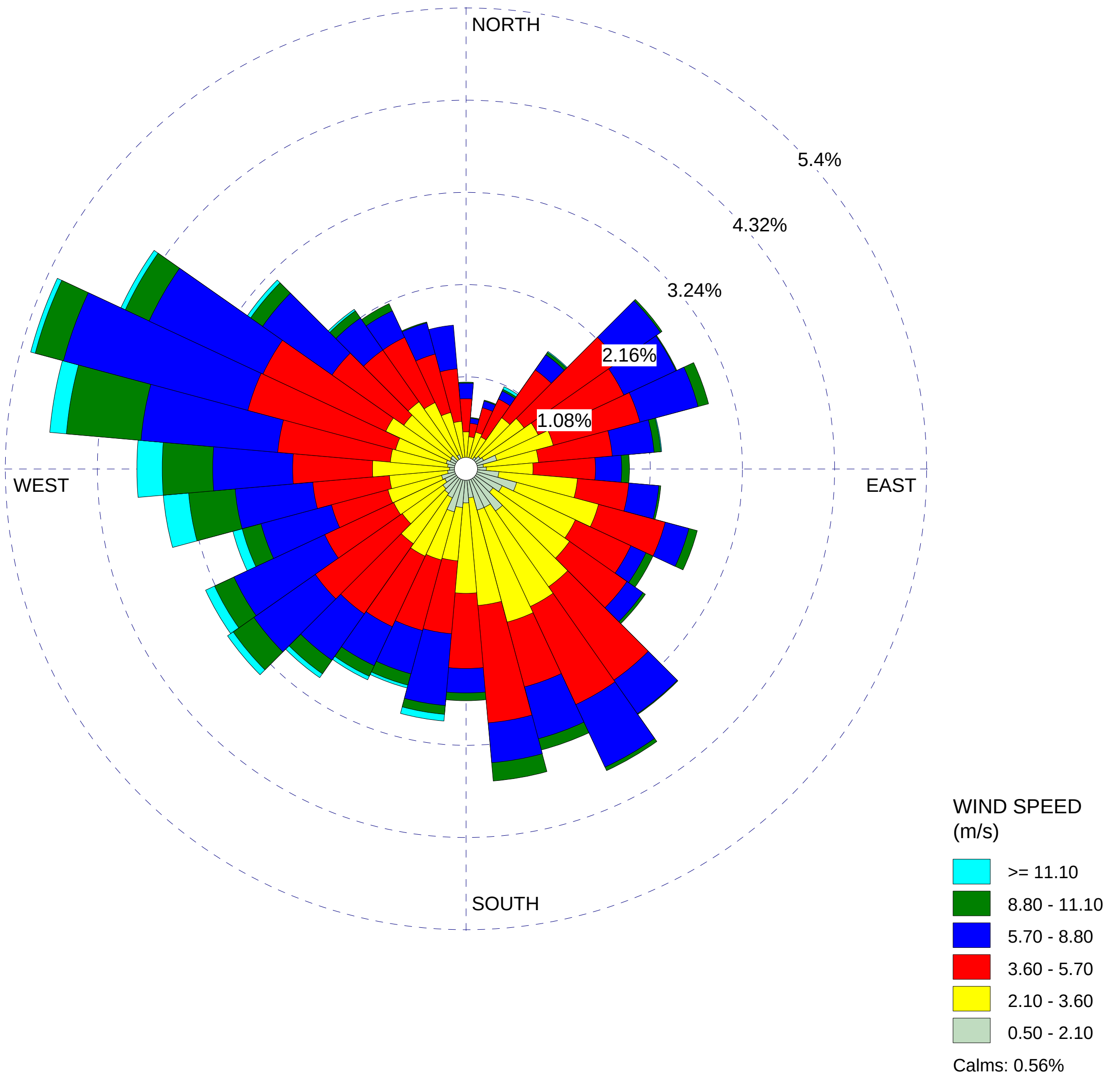
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Liverpool - Wind Speed and Direction Frequency

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 01/01/2016 - 00:00
End Date: 31/12/2016 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

0.56%

TOTAL COUNT:

8744 hrs.

AVG. WIND SPEED:

4.46 m/s

DATE:

15/01/2019

PROJECT NO.:

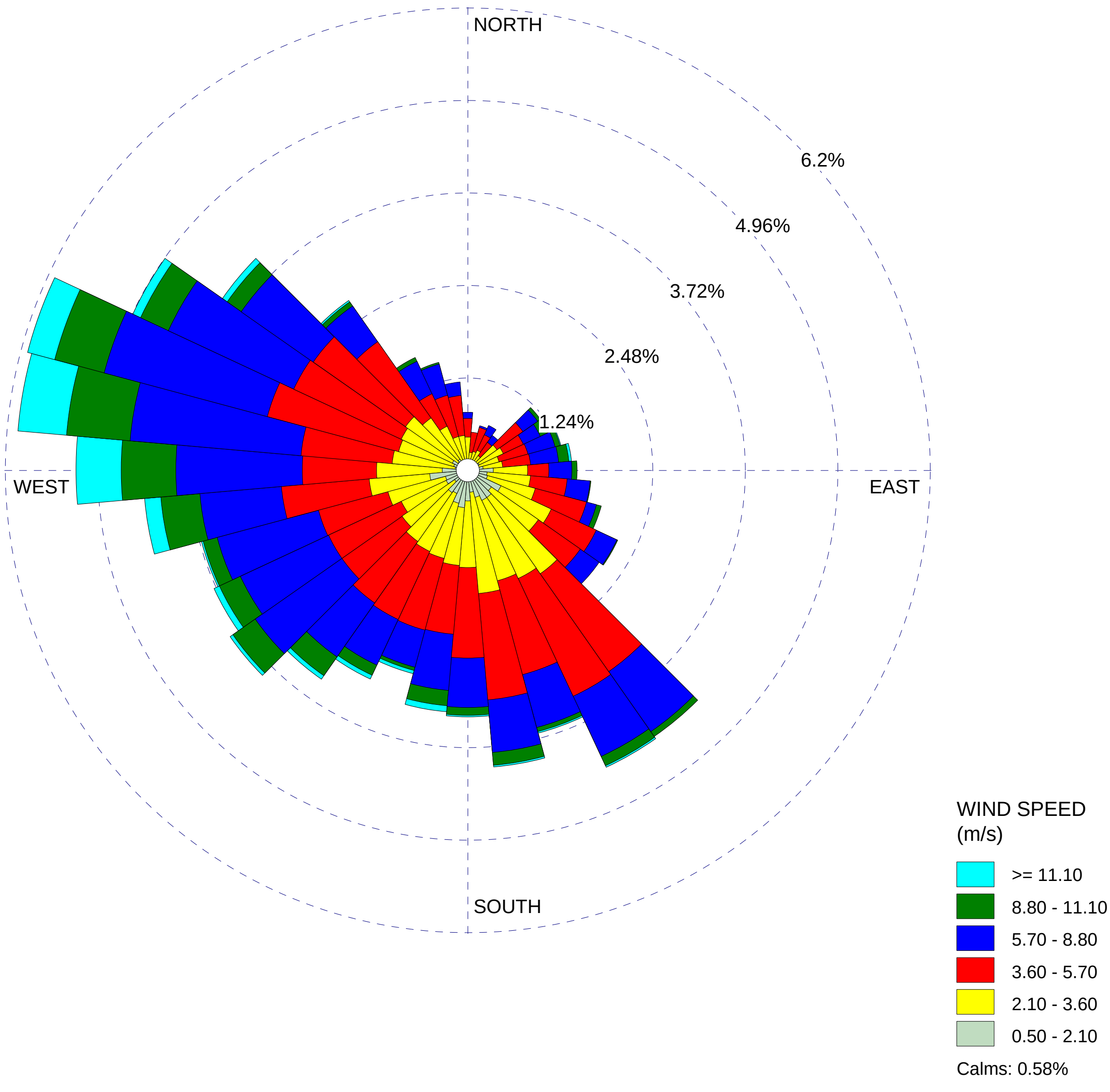
4013

WIND ROSE PLOT:

Liverpool - Wind Speed and Direction Frequency

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 01/01/2017 - 00:00
End Date: 31/12/2017 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

0.58%

TOTAL COUNT:

8708 hrs.

AVG. WIND SPEED:

4.77 m/s

DATE:

15/01/2019

PROJECT NO.:

4013

ES Appendix VIII

Noise Impact Assessment

ENVIRONMENTAL NOISE ASSESSMENT

Stopgate Lane, Simonswood

Culzean W2E Limited

Version:	1.0	**Date:**	30 November 2021		
Doc. Ref:	005-2776-F	**Author(s):**	TB	**Checked:**	
Client No:	2776	**Job No:**	005		

Oaktree Environmental Ltd

Waste, Planning & Environmental Consultants

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REGISTERED IN THE UK | COMPANY NO. 4850754

Document History:

Version	Issue date	Author	Checked	Description
1.0	30/11/2021	TB	DY	Application submission version

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List of Appendices:

1 Introduction

1.1 Background to Report

1.1.1 Oaktree Environmental have been commissioned by Culzean W2E Limited to undertake an environmental noise assessment for a site at Stopgate Lane, Simonswood.

1.1.2 This report is to be submitted in support of a planning application for the:

"Demolition of Existing Building and Erection of Purpose Built Building (and Ancillary Structures) to House High Temperature Treatment Facility for the Management of Medical Waste"

1.1.3 Given that the proposals include the disposal of hazardous wastes, they fall under Schedule 1 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017. As such, the proposals are Environmental Impact Assessment (EIA) development and an Environmental Statement (ES) has therefore been submitted as part of the application. An EIA scoping opinion has previously been received from Lancashire County Council whom have advised that "*It is therefore considered that noise impacts during the daytime period are unlikely to be a significant environmental effect given the distance to the nearest properties and the existing day time noise levels. However, it is noted that the plant would operate at night and therefore noise impacts during those times are likely to be more significant. The ES should therefore contain an assessment of night time noise impacts at the nearest residential properties on Sidings Lane. The assessment should be based upon a survey of existing background night time noise levels at these properties and should assess the likely noise impact during the proposed hours of operation. The noise assessment should be undertaken in accordance with recognised guidance (BS4142:2014 and the Noise Policy Statement for England)".*

1.2 Site Location

1.2.1 The application site is located at Stopgate Lane, Simonswood, within an existing industrial estate, which contains a number of existing industrial processes, including waste recycling facilities and other industrial processes.

1.2.2 The site is located within an industrial estate and therefore suitable for this type of development. There are a number of existing waste and other industrial operations in the vicinity with several large-scale structures. The existing site is permitted for waste management related use. As such, the proposals are in keeping with the location, both in terms of scale and proposed processes.

1.2.3 The site is accessed via Stopate Lane, via an existing purpose-built access point.

1.2.4 Reference should be made to Drawing No. 2776-008-01 and 2776-008-02 within Appendix I for the general location of the site and indicative red-line planning application boundary. All references to 'the site' in this statement shall mean this area. A site layout plan is also provided (2776-008-04).

1.2.5 The nearest noise sensitive receptors comprise the residential dwelling off Siding Lane approximately 300m to the northeast and the farmhouses to the south, ranging from 600-750m from the site boundary.

1.3 **Hours of operation**

1.3.1 The process will be operated on a continual basis, 24 hours per day, 7 days per week, except for periods of maintenance/shut down. However, the site will be open for the limited number of HGV movements for the delivery and export of materials between the hours of 06:00 and 20:00.

2 Planning Policy

2.1 Noise Policy Statement for England

1.1.1 The Noise Policy Statement for England (NPSE), March 2010, sets out the Governments long-term noise policy, the aims of which are:

1.1.2 "Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- Avoid significant adverse effects on health and quality of life:
- Mitigate and minimise adverse effects on health and quality of life;
- Where possible, contribute to the improvement of health and quality of life."

1.1.3 The first aim of the NPSE is to avoid significant adverse effects, considering the shared UK principles of sustainable development.

1.1.4 The second aim provides guidance on the scenario when the potential noise impact falls between the LOAEL (Lowest Observed Adverse Effect Level) and the SOAEL (Significant Observed Adverse Effect Level), in which case it is stated; "all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development". However, it is also stated "This does not mean that such adverse effects cannot occur".

1.1.5 With regards to the SOAEL, the document states "It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations", acknowledging that this is very much dependent on the noise source, the receptor and the time of day. Therefore, the NPSE provides the necessary policy flexibility until further guidance / evidence is available.

1.1.6 Other guidance will need to be taken into account when applying the principles of the NPSE, as well the nature of the proposed development and its specific circumstances.

2.2 National Planning Policy Framework

1.2.1 The NPPF, revised in 2021, replaces the Planning Policy Guidance Note 24 (PPG 24) and does not make reference to any other relevant noise guidance, other than the NPSE.

1.2.2 With regards to noise, the NPPF states the planning process should "contribute and enhance the natural and local environment", with regards to noise this means "preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affect by unacceptable levels" of, amongst other things, noise.

1.2.3 The NPPF states that Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life,

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

2.3 Planning Practice Guidance – Noise

1.3.1 It is important to set out the appropriate guidance set out in the NPPF which advises that the Local Authority should consider the following when decision making:

- Whether or not a significant adverse effect is occurring or likely to occur.
- Whether or not an adverse effect is occurring or likely to occur.
- Whether or not a good standard of amenity can be achieved.

1.3.2 As previously discussed within the NPSE, the guidance discusses the LOAEL and SOAEL and provides scenarios that could be expected for the perception level of noise, plus the associated activities that may be required to bring about the desired outcome. Again, as with the NPSE, no objective noise levels are provided for LOAEL or SOAEL.

1.3.3 It is stated that “the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation”. These factors include:

- The absolute noise level of the source and the time of day it occurs.
- Where the noise is non-continuous (intermittent), the number of noise events along with any patterns of occurrence.
- The frequency of content and acoustic characteristics (tonality etc.) of the noise.
- The effects of noise on the surrounding wildlife.
- The acoustic environment of external amenity areas provided as an intrinsic part of the overall design.
- The impact of noise from certain commercial developments such as night clubs and pubs where activities are often at their peak during the evening and night.

3 Noise Assessment Criteria

3.1 Overview

3.1.1 In order to assess the impacts of existing road traffic and industrial noise on the proposed development, the following documents have been used:

- BS8233:2014
- BS4142:2014
- World Health Organisation (WHO) Guidelines on Community Noise

3.2 BS8233:2014

3.2.1 This document provides guidance on the relevant level of sound insulation required by a variety of building types affected by general environmental noise and provides recommendations for appropriate internal ambient noise level criteria for a variety of different situations including residential dwellings. The table below includes the proposed noise criteria within BS8283:2014 with regards to residential properties:

Table 3.1 - BS8233:2014 Internal Criteria

Activity	Location	07:00 – 23:00	23:00 – 7:00
Resting	Living rooms	35 $L_{Aeq,\ 16hour}$	-
Dining	Dining room	40 $L_{Aeq,\ 16hour}$	-
Sleeping	Bedroom	35 $L_{Aeq,\ 16hour}$	30 $L_{Aeq,\ 16hour}$

3.3 BS4142:2014

3.3.1 BS4142:2014 provides a method for assessing and rating sound of an industrial / commercial nature. The method described in the standard uses the rating level from a noise source and the existing background noise level to assess the potential effects of sound on the residential premises upon which sound is incident.

3.3.2 Using this method the background sound level is subtracted from the rating level. The resulting figure is assessed using the following guidance from the document:

- The greater the difference between the background sound level and the rating level, the greater the impact on the receptor.
- An exceedence of the background level of around 10dB or more is likely to be an indication of a significant adverse impact, dependent on the context.
- An exceedence of the background level of around 5dB is likely to be an indication of an adverse impact, dependent on the context.
- The lower the rating level compared to the existing background level, the less likely an adverse impact or a significant adverse impact. Where the rating level does not exceed the background level, this is indicative of a low impact, dependent on context.

3.3.3 The document introduces a requirement to consider and report the uncertainty in the data as well as also including guidance for applying a correction/penalty for certain adverse acoustic features such as tonality, impulsivity or intermittency. The following table summarises the corrections based on the subjective assessment of the noise.

Table 3.2 - BS4142:2014 Corrections and Penalties

	Tonality	**Impulsivity**	**Other characteristics**
Just perceptible	+ 2dB	+ 3dB	
Clearly perceptible	+ 4dB	+ 6dB	
Highly perceptible	+ 6dB	+ 9dB	
Readily Distinctive against Residual Environment			+ 3dB

3.4 WHO Guidelines for Community Noise

3.4.1 The WHO Guidelines (1999) recommends indoor night-time guidelines in order to avoid sleep disturbance, the document states these to be 30 dB (LAeq)and 45 dB (LA_{fmax})for continuous and individual noise events respectively.

3.4.2 The document states that the number of noise events should also be considered and that individual noise events should not exceed 45 dB (LA_{fmax})more than 10 – 15 times per night.

3.4.3 The WHO document also recommends that steady, continuous noise levels should not exceed 55 dB (LAeq) on outdoor living areas (balconies, terraces etc.). However, in order protect the majority of individuals from moderate annoyance, external noise levels should not exceed 50 dB (LAeq).

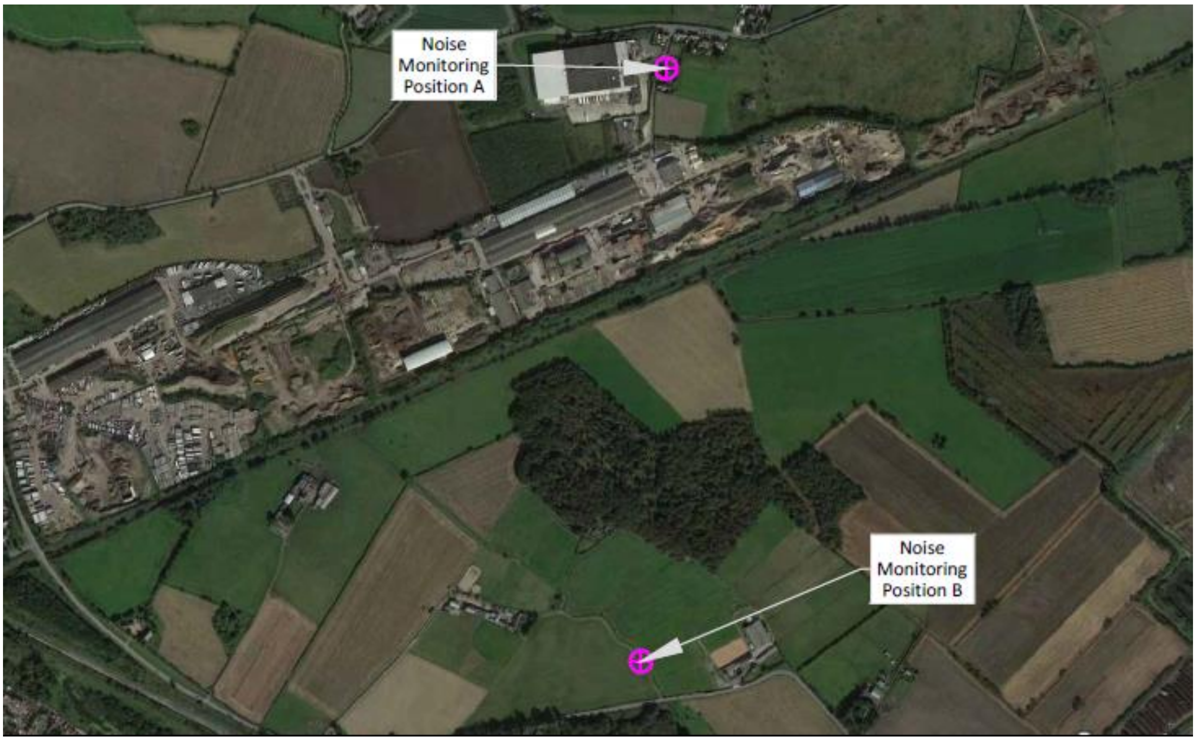
4 Existing Noise Climate and Background Levels

4.1 Procedure and Monitoring Locations

2.1.1 An initial noise survey was completed on the 14-15th December 2020 in accordance with BS 7445-1: 2003 by Thomas Benson of Oaktree Environmental Ltd. Attended background level measurements were taken at locations representative of the nearest noise sensitive receptors within the vicinity of the site.

2.1.2 The measurement locations are presented within the Noise Monitoring Plan within Figure 4.1 below:

Figure 3.1 - Site location and noise monitoring position



4.2 Weather conditions

2.2.1 The weather during the background surveys is summarised in the table below, this was recorded via a mixture of an anemometer and ongoing onsite observations:

Table 4.1 – Weather conditions

Date	Wind Speed (max)	Cloud Cover	Temperature	Precipitation
14/12/2020 - 15/12/2020	Mainly still with gusts up to 3.1 m/s	30-50%	9oC falling to 6.5oC	None recorded whilst onsite

4.3 Equipment Used During the Survey

2.3.1 Details of the equipment used during the survey are shown in the table below:

Table 4.2 - Survey Equipment

Description	Model	Manufacturer	Serial No.	Calibration Date
Class 1 Sound Analyser	NOR 150	Norsonic	15030504	02/10/2020
Microphone	Norsonic Type 1225	Norosnic	305208	02/10/2020
Field Calibrator	NOR 1251	Norsonic	35205	03/03/2020

4.4 Results

2.3.2 The results of the background noise monitoring survey are tabulated overleaf in tables 4.3-4.6.

Table 4.3 - Measurement Results for Noise Monitoring Position A (Siding Lane)

Measurement Time	LA_{eq}	LA_{90}	LA_{10}	LA_{max}
14/12/2020 23:00-00:00	42.3	40.5	43.6	61.3
15/12/2020 01:20-02:20	43.8	42.3	44.9	66.5
15/12/2020 03:45-04:45	43.7	42.3	44.7	66.9

Table 4.4 - Measurement Results for Noise Monitoring Position B (to the north of North Perimeter Road)

Measurement Time	LA_{eq}	LA_{90}	LA_{10}	LA_{max}
15/12/2020 00:10-01:10	47.7	41.5	45.3	70.4
15/12/2020 02:35-03:35	46.6	41.5	46.4	68.5
15/12/2020 04:55-05:55	56.0	45.6	60.4	70.8

Table 4.5 – 15-minute LA_{90} values for Noise Monitoring Position A (Siding Lane)

Measurement Time	LA_{90}	Measurement Time	LA_{90}
14/12/2020 23:00-23:15	40.0	14/12/2020 23:15-23:30	40.5
14/12/2020 23:30-23:45	41.2	14/12/2020 23:045-00:00	42.2
15/12/2020 01:20-01:35	42.1	15/12/2020 01:35-01:50	42.2
15/12/2020 01:50-02:05	42.1	15/12/2020 02:05-02:20	42.7
15/12/2020 03:45-04:00	42.1	15/12/2020 04:00-04:15	42.3
15/12/2020 04:15-04:30	42.5	15/12/2020 04:30-04:45	42.7

Table 4.6 – 15-minute LA90 values for Noise Monitoring Position B (to the north of North Perimeter Road)

Measurement Time	LA_{90}	Measurement Time	LA_{90}
15/12/2020 00:10-00:25	41.3	15/12/2020 00:25-00:40	41.9
15/12/2020 00:40-00:55	41.7	14/12/2020 00:55-01:10	41.9
15/12/2020 02:35-02:50	41.7	15/12/2020 02:50-03:05	40.9
15/12/2020 03:05-03:20	42.3	15/12/2020 03:20-03:35	41.9
15/12/2020 04:55-05:10	44.9	15/12/2020 05:10-05:25	45.2
15/12/2020 05:25-05:40	47.2	15/12/2020 05:40-05:55	47.9

4.5 **Existing Noise Climate – NMP A**

4.5.1 During the attended background measurements, it was evident that the existing noise climate at the closest residential receptors on Siding Lane is dominated by fixed external plant (ventilation, extraction etc.) at the large manufacturing unit to the west. Noise from this source comprises a constant tonal hum whilst occasionally internal processes may be audible.

4.5.2 Sporadic noise from the industrial estate to the south was also audible, however this was at a level similar to or below that of the noise sources previously discussed.

4.5.3 Contribution from road traffic throughout the night time monitoring was very occasional and generally lower than that of the sources mentioned previously.

4.6 **Existing Noise Climate - NMP B**

4.6.1 During the attended background measurements, it was evident that the existing noise climate at this location is more variable than that of NMP A. Noise sources included ventilation/extraction from the industrial estate to the south as well as occasional crashes/bangs from moving plant and associated processes to the south. In addition, passing road traffic along North Perimeter Road was audible, vehicle movements were observed to range from 6-64 movements per hour (the 03:45-04:45 monitoring period was substantially more busy) with a large portion of movements including large HGVs.

5 Noise Impact Assessment

5.1 Introduction

5.1.1 Table 5.1 below includes the noise sources associated with the proposed operation of the site.

Table 5.1 - Noise levels Associated with Proposed Operations

Activity	Noise Level (LAeq)	Sound Power Level	Source	Location
In-feed system	80.0dB (A) at 1m	91	Provided by the manufacturer	Internal
Pyrolysis Unit	80.0dB (A) at 1m	91	Provided by the manufacturer	Internal
Thermal oxidiser	80.0dB (A) at 1m	91	Provided by the manufacturer	Internal
Screw conveyor	80dB (A) at 1m	91	Provided by the manufacturer	Internal
Air filtration	72dB (A) at 1m	83	Provided by the manufacturer	Internal
Air compressor	85dB (A) at 1m	96	Provided by the manufacturer	Internal
Induced draft fan	80.0dB (A) at 1m	88	Provided by the manufacturer	External
Air blast cooler	65dB (A) at 10m	93	Provided by the manufacturer	External
Flue gas abatement	83.0dB (A) at 1m	94	Provided by the manufacturer	External
Flare	80.0dB (A) at 1m	91	Provided by the manufacturer	External

5.1.2 To assess the potential noise impacts associated with the installation of the facility on the on the nearby noise sensitive receptors, noise models have been created using CadnaA. The software package utilises standardised noise prediction methodologies and algorithms in order to predict the propagation of noise from source to receiver.

5.1.3 The CadnaA noise model was constructed using OS mapping Opendata and Google Earth satellite imagery.

5.1.4 The following assumptions/parameters are made within the model:

- The intervening land between the site boundary and residential properties was modelled with G = 0.8 as it was considered that the land is predominantly acoustically absorbent.
- Noise sources are assumed to be constant with no significant variation,
- Buildings were set as acoustically reflective, with a reflection loss of 1 dB.
- Noise levels were determined on a grid and at residential properties representing the nearest residential facades. The height of each receiver was 2.0 m, consistent with the height of a typical first storey window.
- The predicted noise levels were free-field, A-weighted, sound pressure levels. The noise contours generated within the model are also at a height of 2.0 m, assumed to be the worst-case scenario.
- Surrounding building heights have been taken from observations and information provided from the Local Authority public access where available.
- The main treatment building height was modelled at 10m to the eaves, whilst the internal surface area (walls and ceiling) was assumed to be 1,360m^2 .
- The roller shutters on the northern and southern façade are assumed to be closed, consistent with the proposed operation throughout the hours of 23:00-07:00,
- As per the proposed elevations drawings submitted in support of the planning application, external noise sources were modelled as a point source with a height of 14m for the flare, 5.8m for the air blast coolers, 3.8m for the flue gas abatement and 2.5m for the induced draft fan.

- The value of R (sound reduction index offered by the building) was based upon trapezoidal 45mm steel sheeting whilst roller shutters were assumed to comprise 1mm steel sheeting,

5.1.5 Figure 6.2 overleaf details the predicted noise levels (in dB A) associated with the proposed operations at the relevant receptors.

Figure 6.2 – Noise modelling of noise associated with the proposed operations

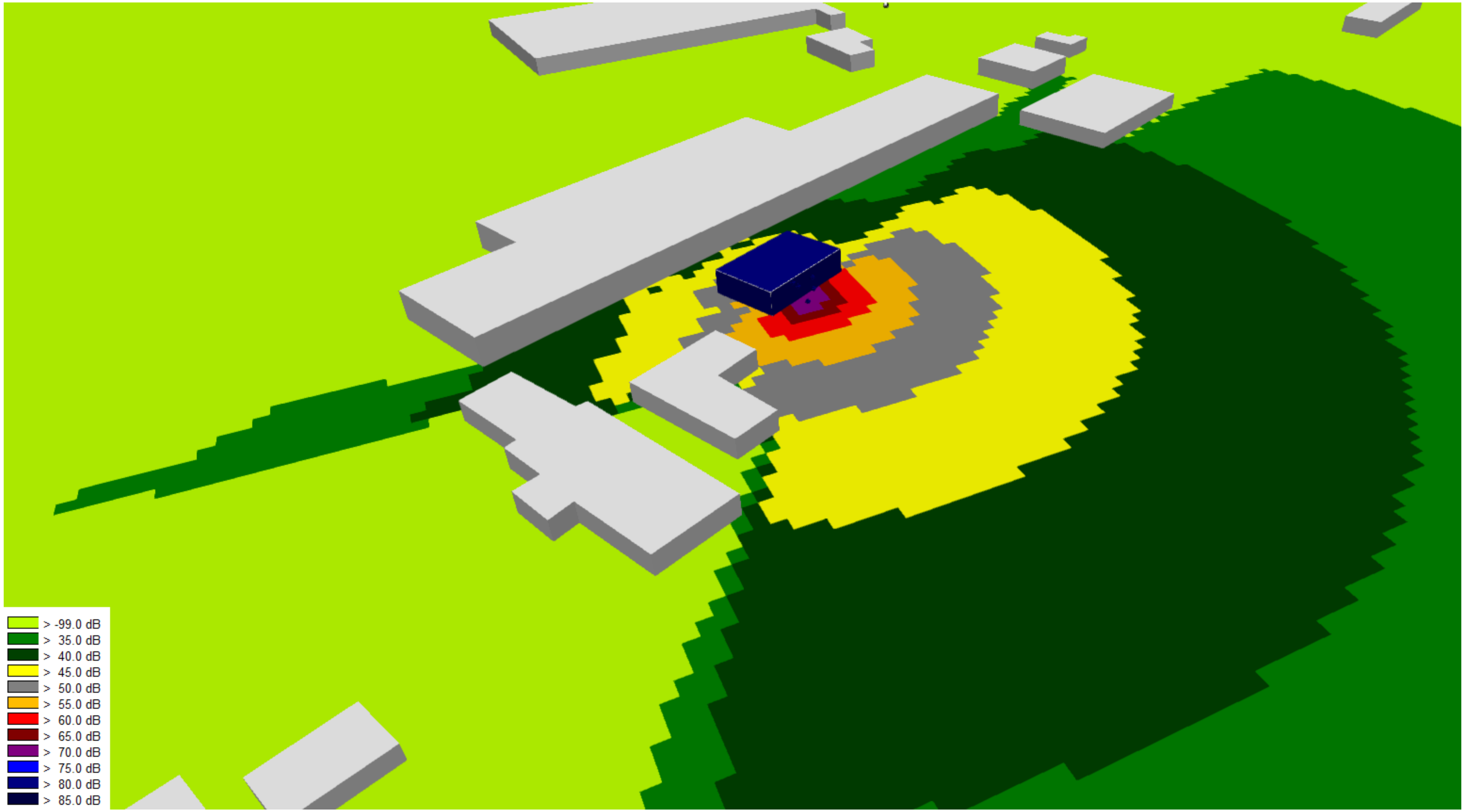
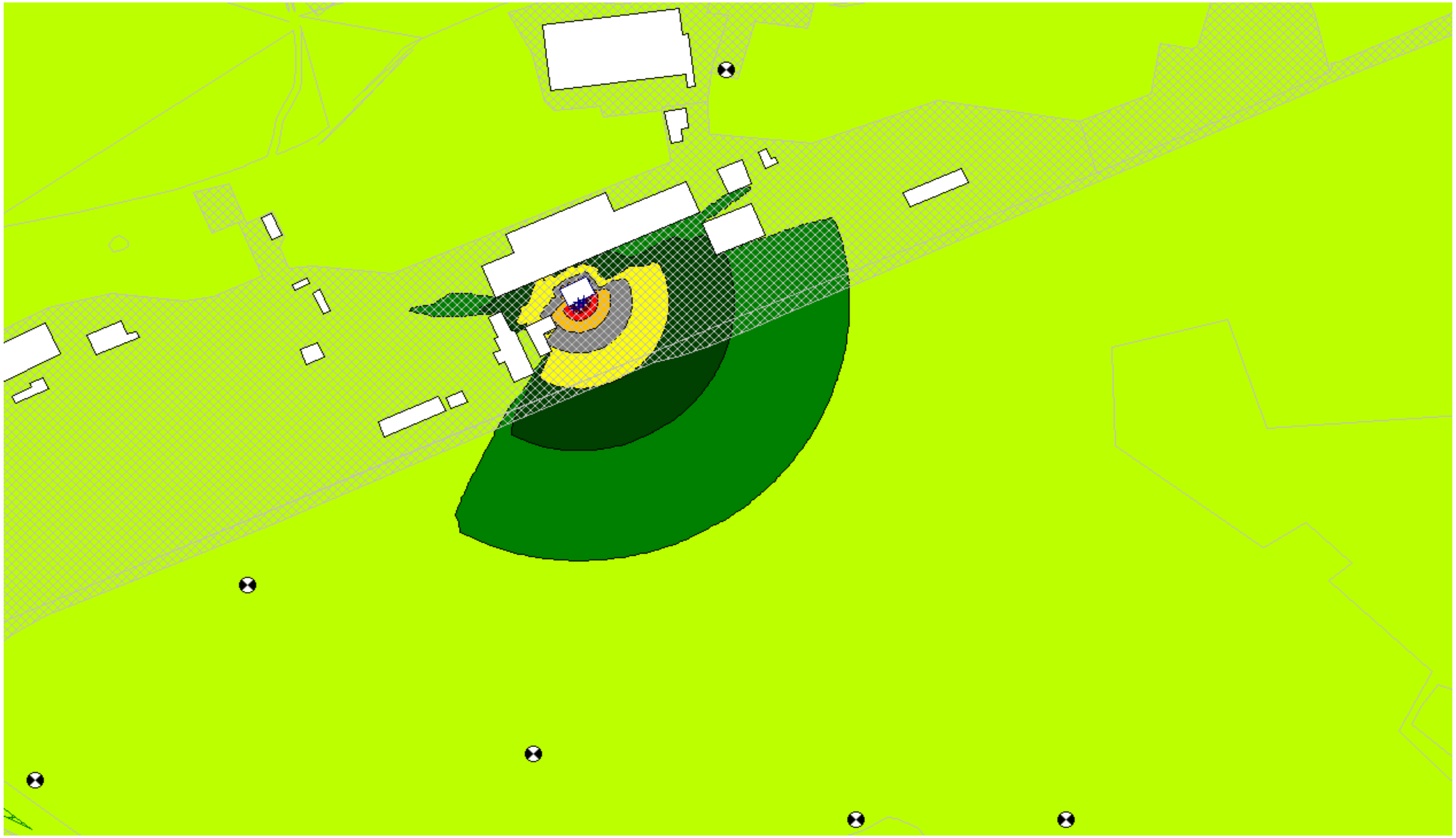


Figure 6.3 – Noise modelling of noise associated with the proposed operations



5.2 Discussion

5.2.1 With regards to impulsive penalties, the system is free from any impulsive crashes or bangs due to the nature of the noise sources. However, there is a tonal element to the plant that may be just perceptible at the nearest dwellings. Therefore, a 2dB penalty has been applied to the operation of the site between the hours of 23:00-07:00.

5.2.2 With regards to background levels, BS4142:2014 states the importance of ascertaining the representative background level rather than the lowest: *it is important to ensure that results are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods* (paragraph 8.1, page 11). With this in mind, the median value of the 15 minute LA90 values provided in Table 4.5 and Table 4.6 has been utilised.

Table 5.3 – Preliminary BS4142:2014 assessment with regards to operation between 23:00-07:00

	Calculated noise level at Siding Lane	**Calculated noise level at 5no. dwellings to the south**	**Comments**
Calculated noise level as per figure 6.2-6.3	23.4	22.5 to 31.4	
Addition of relevant penalties as per bs4142:2014	+2 = 25.4	+2 = 24.5 to 33.4	As per Section 5.2.1
Comparison to median background level – 23:00-07:00	25.4-42.2 = 16.8dB (A) below	24.5 to 33.4-41.9 = 17.4 to 8.5dB (A) below	Negligible/low impact as per BS4142:2014

5.2.3 Therefore, the preliminary assessment shows that with regards to the proposed operations during the night time, the rating level is considerably below the measured background level at these times and therefore the impacts associated with noise as a result of the proposed operation of the site at these times are negligible/low.

5.2.4 It may also be observed that BS4142:2014 gives an indication with regards to external noise levels and is not intended to be applied to the derivation of indoor sound levels arising from external noise sources or the assessment of indoor sound levels. However, it is reasonable to assume that residents would not expect to be utilising external amenity areas between 23:00 and 07:00 and therefore, in some instances it may be more appropriate to assess night time noise levels using the internal criteria within BS8233:2014 in order to give an indication of the likelihood of noise complaints given the context of the other standards. Whilst, BS8233:2014 is not intended for the assessment of noise generating activities, it does serve to give an additional layer indication of the likelihood of noise complaints.

5.2.5 The WHO Guidelines for Community Noise consider that a typical window left open for ventilation provides 15 dB attenuation from external noise sources. The table below calculates a worst-case scenario internal noise level at these properties as a result of the activities between the hours of 23:00-07:00. Tonal/impulsive penalties have not been applied as these would only be relevant with regards to BS4142:2014.

Table 5.4 – BS8233:2014 assessment with regards internal noise levels

Operation	**Predicted façade level**	**Predicted internal noise level**	**Guideline limit (daytime bedroom/ living room value)**
Siding Lane	23.4	-15 = 8.4	30
5no. dwellings to the south	22.5 to 31.4	-15 = 7.5 to 16.4	30

5.2.6 As can be seen from Table 5.4, the internal levels fall in well within those quoted within BS8233:2014. As discussed previously, the noise source is also free from impulsive crashes and bangs which may cause undue disturbance during the evening.

5.3 Uncertainty

5.3.1 Uncertainty in this assessment was controlled via the following precautions/procedures:

- Both the sound level meter and calibrator have a traceable laboratory calibration and the meter was field-calibrated both before and after the measurements.
- Background monitoring undertaken during a time of national restrictions taking place in late 2020 as a result of the ongoing COVID-19 pandemic. At this time people are asked to stay at home, except for specific purposes and to avoid meeting people with whom you do not live (including working from home where possible). The closure of certain business and venues was taking place. It would therefore be reasonable to assume that measured LA90 values may be lower than would normally be the case, thus providing a robust, worst-case scenario assessment.
- Weather during the background sound monitoring was ideal for outdoor noise monitoring (dry, wind speed under 5m/s).
- As per Section 4.5-4.6, tonal noise arising from ventilation/extraction systems within the vicinity of the receptors both to the north and south form part of the existing noise climate. It could therefore be reasoned that the tonal nature of the noise from the proposed operations may not be distinguishable from the existing sources and that the 2dB penalty applied within the assessment need not be included. However, this has been applied in order to provide a robust assessment.

6 Conclusion

6.1 Summary & Recommendations

6.1.1 Oaktree Environmental have undertaken a noise impact assessment for a site at Stopgate Lane, Simonswood.

6.1.2 This report is to be submitted in support of a planning application for the:

"Demolition of Existing Building and Erection of Purpose Built Building (and Ancillary Structures) to House High Temperature Treatment Facility for the Disposal of Medical Waste."

6.1.3 The local authority has also provided comment on the nature of the assessment, confirming that they do not expect daytime noise levels to warrant consideration.

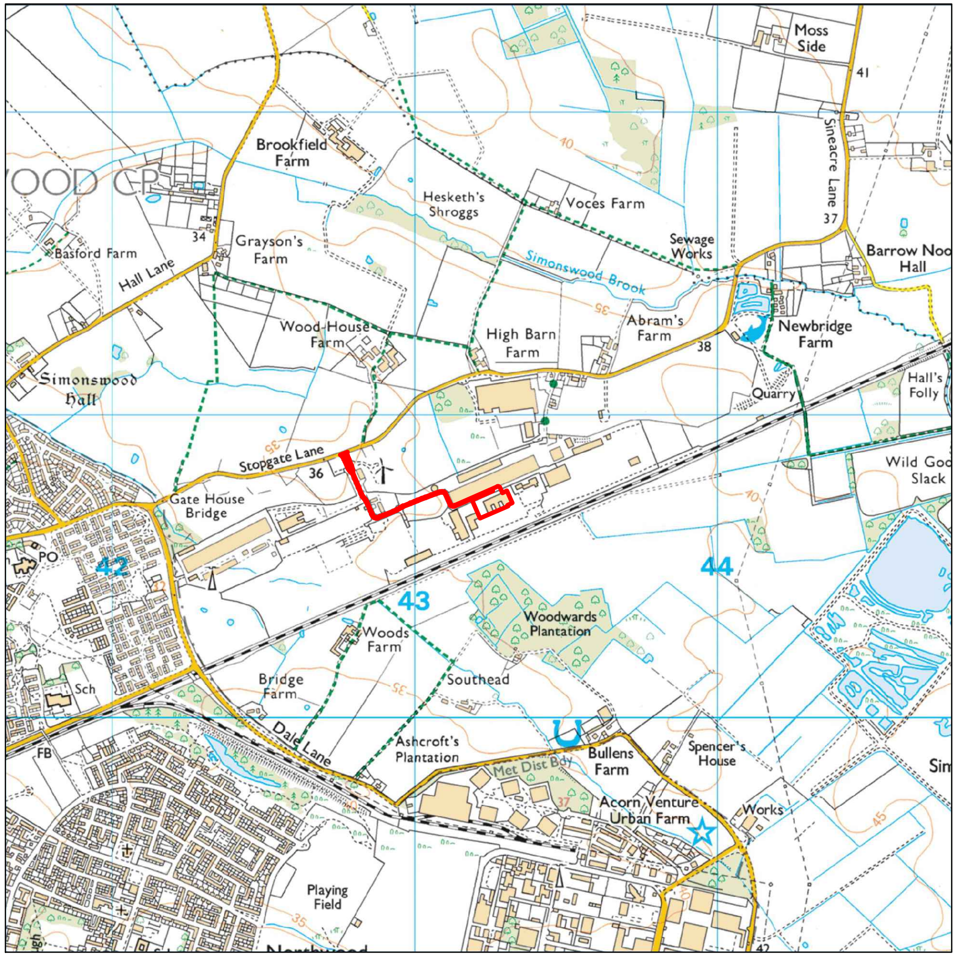
6.1.4 The primary receptors are considered to be the residential dwellings to the residential dwelling off Siding Lane approximately 300m to the northeast and the farmhouses to the south, ranging from 600-750m from the site boundary.

6.1.5 The rating level of the proposed operations at the nearest residential receptors are considerably below that of the background levels measured previously and therefore a negligible/low impact is derived as per the guidance within BS4142:2014. In addition, it has been confirmed that the noise levels associated with the operation of the plant will not breach internal criterion as per BS8233:2014.

6.1.6 It should therefore be considered that noise need not be an impediment to the grant of planning consent. Indeed in order to ensure ongoing compliance, a Schedule 13 EP will be required to be in place for the operations, which will be regulated on a continual basis by West Lancashire Borough Council, who will undertake regular compliance inspections to ensure the site operator is complying with stringent permit conditions so designed to protect air, land and water and human health/amenity.

Appendix I

Drawings



Scale Bar (1:25,000)

0 km 1 km 2 km

NOTES

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REVISION HISTORY

Rev:	Date:	Init:	Description:
-	30.11.21	RS	Initial drawing
A	01.12.21	RS	Boundary amended
B	08.12.21	RS	Minor amendment

KEY:

Site location (planning boundary)

Oaktree Environmental Ltd

Waste, Planning and Environmental Consultants

DRAWING TITLE

SITE LOCATION MAP

CLIENT

Culzean W2E Limited

PROJECT/SITE

Proposed High Temperature Treatment Facility, Stopgate Lane, Simonswood

SCALE @ A4	CLIENT NO	JOB NO
1:25,000	2776	008

DRAWING NUMBER	REV	STATUS
2776-008-01	B	Issued

DRAWN BY	CHECKED	DATE
RS	RS	08.12.21

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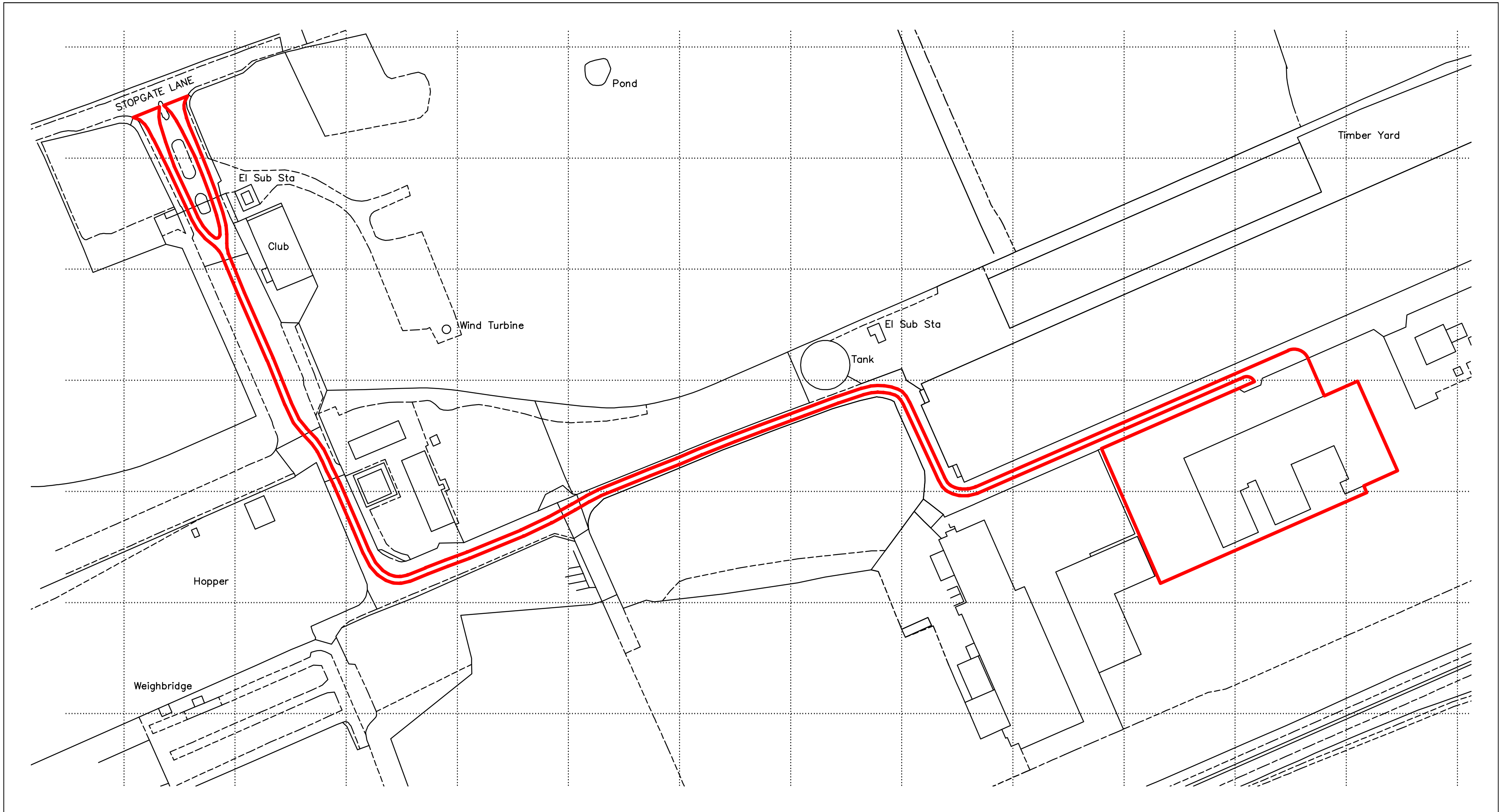

Oaktree Environmental Ltd
Waste, Planning and Environmental Consultants

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DRAWING TITLE
SITE LOCATION MAP

CLIENT
Culzean W2E Limited

PROJECT/SITE
Proposed High Temperature Treatment Facility, Stopgate Lane, Simonswood

SCALE @ A4	CLIENT NO	JOB NO
1:2,500	2776	008
DRAWING NUMBER	**REV**	**STATUS**
2776-008-02	B	Issued
DRAWN BY	**CHECKED**	**DATE**
RS	RS	08.12.21

KEY

Planning application boundary

Scale Bar (1:2,500)

0 m 20 40 60 80 100 m

NOTES

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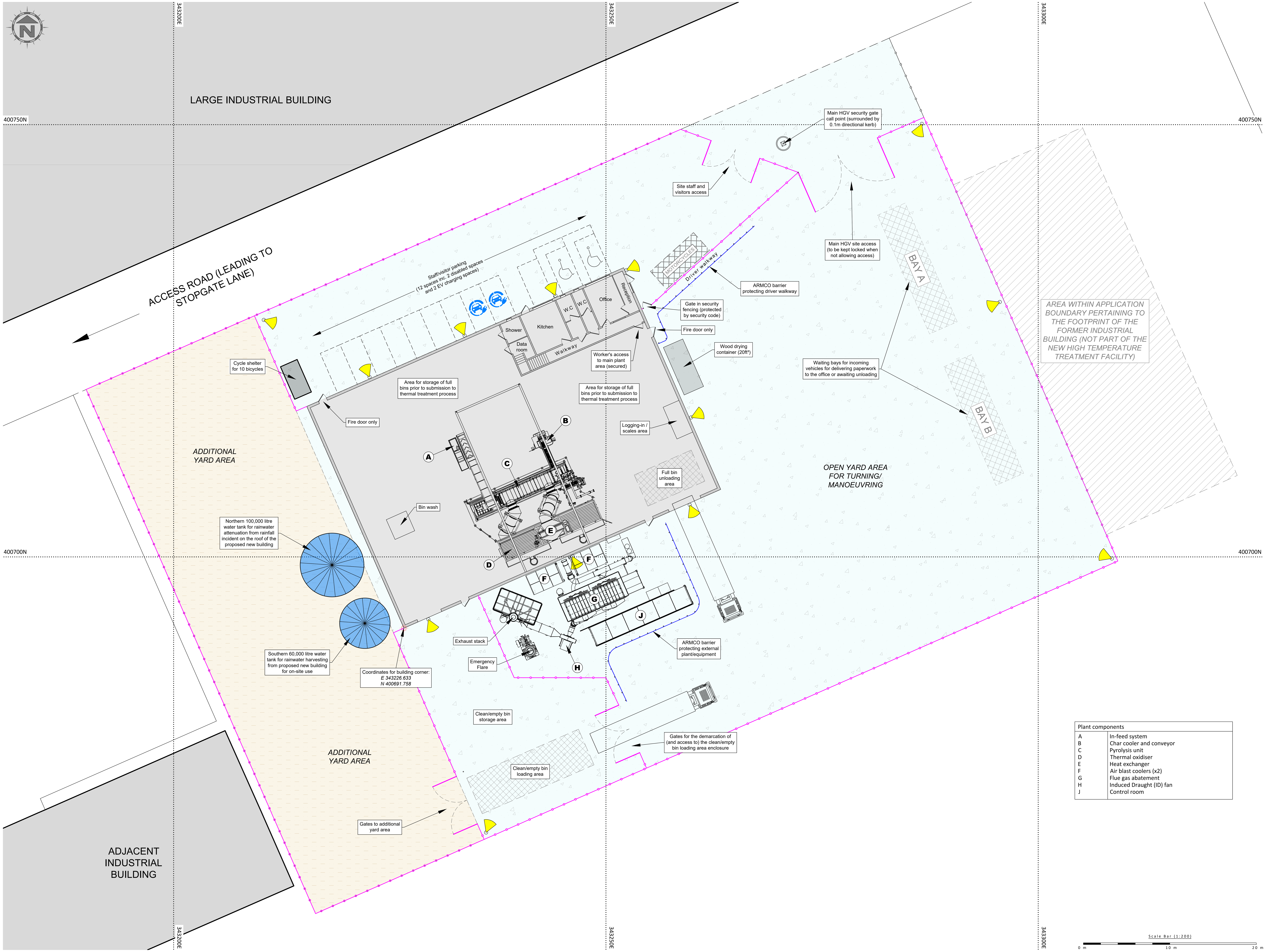
REVISION HISTORY

Rev:	Date:	Init:	Description:
-	30.11.21	RS	Initial drawing
A	01.12.21	RS	Boundary amended
B	08.12.21	RS	Minor amendment



Plant components

A	In-feed system
B	Char cooler and conveyor
C	Pyrolysis unit
D	Thermal oxidiser
E	Heat exchanger
F	Air blast coolers (x2)
G	Flue gas abatement
H	Induced Draught (ID) fan
J	Control room

NOTES

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REVISION HISTORY

Rev	Date	Init:	Description:
-	03.12.20	RS	Initial drawing
A	05.08.21	RS	Layout amended
B	11.08.21	RS	Wood drying container added
C	08.10.21	RS	Amended plant configuration
D	23.11.21	RS	Client comments
E	28.11.21	RS	Amendments; surfacing added
F	30.11.21	CG	Water tanks
G	01.12.21	RS	Amendment to water tanks
H	07.12.21	RS	Client comments (submission)

KEY:

- Fixed lighting
- Electrical vehicle (EV) charging point
- Perimeter security fencing (minimum 2.0m high)
- Main site area (surfaced with concrete)
- Additional yard area (surfaced with stone overlying existing concrete)

Oaktree Environmental Ltd
Waste, Planning and Environmental Consultants

DRAWING TITLE
PROPOSED LAYOUT PLAN

CLIENT
Culzean W2E Limited

PROJECT/SITE
Proposed High Temperature Treatment Facility, Stopgate Lane, Simonswood

SCALE @ A1	JOB NO	CLIENT NO
1:200	3285	1452

DRAWING NUMBER	REV	STATUS
2776-008-04	H	Issued

DRAWN	CHECKED	DATE
RS	RS	07.12.21

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ES Appendix IX

Sustainable Drainage Strategy

DRAINAGE STRATEGY

Stopgate Lane, Simonswood

Culzean W2E Limited

Version:	1.0	**Date:**	30 November 2021		
Doc. Ref:	2776-008-DRAINAGE	**Author(s):**	CG	**Checked:**	
Client No:	2776	**Job No:**	008		

Oaktree Environmental Ltd

Waste, Planning & Environmental Consultants

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REGISTERED IN THE UK | COMPANY NO. 4850754

Document History:

Version	Issue date	Author	Checked	Description
1.0	30/11/21	CG		Document issue

CONTENTS

List of Support Drawings:

Appendix I - Drawings

Drawing No. 2776-008-04 – Proposed Layout Plan

1 General Considerations

1.1 Development site and location

1.1.1 Oaktree Environmental was commissioned by Culzean W2E Limited to prepare a Drainage Strategy in support of a planning application for the construction of a purpose built building, 28m by 40m in length and width and 10.635m in height to the ridge. This will be located as shown on the site layout plan. The proposals also include the demolition of an existing ageing building on-site, to make way for the footprint of the new development/building.

1.1.2 The site hydrological setting has been reviewed in the context of the Lancashire County Council Planning Application Validation Checklist and associated guidance. The site is in flood zone 1 which comprises land having less than a 1 in 1,000 annual probability of flooding from rivers or the sea. A significant proportion of the site area comprises the access from Stopgate Lane to the north. The Applicant will have sole control only of the area within the footprint of the building and surrounding surface as shown on Drawing No. 2776-008-04 which comprises less than 1 Ha. The site location with respect to the surrounding flood zone designations is shown at Appendix I. It is therefore concluded that the preparation of a formal SFRA is not necessary in order to validate the application.

1.1.3 Notwithstanding the above the drainage proposals included within the application are set out in further detail in this drainage assessment.

2 General principles

2.1.1 The site is already developed for industrial use. No changes to the area comprising impermeable surfaces at the site are proposed as part of the planning application.

2.1.2 The proposals include the demolition and reconstruction of a currently dilapidated building. As part of the development proposals, it will be necessary to provide a significant quantity of water for non-potable use, as well as to minimise the volume of runoff draining to the existing surrounding over which the Applicant does not have sole control.

2.1.3 The site generally falls gently towards the north west. The site is in the catchment of the Simonswood Brook. Surface water incident to the site discharges generally towards the site access at the north western corner of the site and thence northwards towards an unnamed tributary of the Simonswood Brook approximately 105m north of the site at its closes point. The unnamed tributary discharges northwards, is culverted beneath Stopgate Lane and discharges to Simonswood Brook approximately 1.3km north west of the site.

2.1.4 Sustainable drainage principles will be built into the scheme, including the harvesting of rainwater from the roof of the new building, which will be used for operations on site, such as bin and vehicle washdown.

2.1.5 It is proposed that water incident to the roof of the proposed building is conveyed first to a rainwater harvesting but then an attenuation tank. The rainwater harvesting butt will overflow via a non-return valve to the larger above ground attenuation tank. The attenuation tank will discharge to the surrounding site surface at a rate significantly reduced compared to the rainfall volume incident to the building footprint as part of the current situation.

2.1.6 Consistent with the current situation, the replaced concrete surface will drain towards the site access road. Runoff from the proposed building roof will discharge to the site surface consistent with the current situation, nevertheless at a significantly reduced rate compared with the current situation.

2.1.7 The specifications for the drainage system components are provided in Section 3.

3 Drainage system component specifications

3.1.1 The Flood Estimation Handbook (FEH) data is provided with this assessment. The Standard Average Annual Rainfall is 873mm. The area of the building roof will comprise 40m x 28m which is equal to 1,120m^2. The annual volume of rainfall is therefore calculated as 977.76m^3, which is the equivalent to a monthly rainfall of 81.48m^3. On this basis, it is recommended that the rainwater harvesting butt comprises a volume of 60m^3, and that any excess rainfall discharges via a non-return valve to the larger attenuation tank.

3.1.2 The capacity of the attenuation tank is calculated at Appendix II. It is calculated that a tank with 100m^3 capacity and a discharge rate of 0.5l/s will have sufficient capacity to attenuate the 1 in 100 year rainfall event and still have fully discharged at the end of the 96 hour duration event. It is therefore proposed that 100m^3 capacity attenuation tank is installed with an outlet to the site drainage system fitted with a suitable flow restriction device for the purposes of limiting the discharge to 0.5l/s.

3.1.3 It is therefore considered that the harvesting and attenuation proposals will result in a significant betterment with respect to runoff generation in the catchment of the Simonswood Brook compared with the current situation.

4 Conclusion

4.1.1 Based on the information presented in and appended to this strategy there is adequate information in respect of the proposed drainage arrangements to determine this planning application in accordance with Lancashire County Council Policy and the National Planning Policy Framework.

4.1.2 The proposed harvesting and drainage proposals will result in a significant betterment compared with the current situation with respect to runoff generation in the catchment of the Simonswood Brook and the sustainable harvesting of rainwater for non-potable uses.

Appendix I

Drawings

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
Simonswood	**343282/400724**	**30 Nov 2021 17:00**

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Environment Agency

Flood map for planning

Your reference
Simonswood

Location (easting/northing)
343282/400724

Scale
1:2500

Created
30 Nov 2021 17:00

Selected point

Flood zone 3

Flood zone 3: areas benefitting from flood defences

Flood zone 2

Flood zone 1

Flood defence

Main river

Flood storage area

0 20 40 60m

Appendix II

Attenuation calculations

Flood risk assessment

Calculation of storm water containment for a 1 in 100 year storm event plus an allowance for climate change

Parameter	Value	Units	
Positively drained area	0.11	ha	Building area
Specified discharge rate	0.5	l/s	Lowest discharge rate considered achievable in order to maximise storage
Assumed runoff coefficient for current site	1	unitless	No evaporative loss assumed conservatively
Climate change factor	0.4	unitless	Precautionary allowance for rainfall intensity increase due to climate change for the 2080s

Storm Duration (hr)	Rainfall for the site derived from reference 1 (mm)	Rainfall Intensity corrected for climate change (mm/hr)	Volume of runoff generated during 1 in 100 year plus 40% rainfall event (m^3)	Storage required at specified discharge rate (m)
0.25	25.44	142.46	39.89	39.44
0.5	33.69	94.33	52.83	51.93
0.75	38.71	72.26	60.70	59.35
1	42.37	59.32	66.44	64.64
1.25	44.9	50.29	70.40	68.15
1.5	46.9	43.77	73.54	70.84
1.75	48.6	38.88	76.20	73.05
2	50.07	35.05	78.51	74.91
4	58.7	20.55	92.04	84.84
6	64.1	14.96	100.51	89.71
8	67.88	11.88	106.44	92.04
10	70.79	9.91	111.00	93.00
10.25	71.11	9.71	111.50	93.05
10.5	71.43	9.52	112.00	93.10
10.75	71.73	9.34	112.47	93.12
11	72.03	9.17	112.94	93.14
11.25	72.33	9.00	113.41	93.16
11.5	72.61	8.84	113.85	93.15
11.75	72.89	8.68	114.29	93.14
12	73.17	8.54	114.73	93.13
12.25	73.43	8.39	115.14	93.09
24	82.32	4.80	129.08	85.88
48	92.96	2.71	145.76	59.36
72	101.14	1.97	158.59	28.99
93	107.5	1.62	168.56	1.16
93.25	107.57	1.61	168.67	0.82
93.5	107.64	1.61	168.78	0.48
93.75	107.72	1.61	168.90	0.15
94	107.79	1.61	169.01	-0.19
94.25	107.86	1.60	169.12	-0.53
96	108.37	1.58	169.92	-2.88

Maximum storage volume	93.16	m^3
Critical Storm Period	11.25	hr

References

Reference 1. Flood Estimation Handbook 2013 data. https://fehweb.ceh.ac.uk/