Portland energy recovery facility

Environmental statement
Technical appendix D:

Air quality

(part 2 of 3)

D2

D2

Process emissions modelling

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Appendix D.2: Process Emissions Modelling

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Document approval

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Contents

1 Introduction

This Appendix sets out the approach taken to modelling process emissions from the Facility. This includes all model inputs and justifications where appropriate. Finally, this Appendix presents the results of the modelling, the results of which are drawn upon in the Air Quality ES chapter 4.

2 Air Quality Standards, Objectives and Guidelines

In the UK, Ambient Air Directive (AAD) Limit Values, Targets, and air quality standards and objectives for major pollutants are described in The Air Quality Strategy (AQS). In addition, the Environment Agency include Environmental Assessment Levels (EALs) for other pollutants in the environmental management guidance 'Air Emissions Risk Assessment for your Environmental Permit'[1] ("Air Emissions Guidance"), which are also considered. The long-term and short-term EALs from these documents have been used when the AQS does not contain relevant objectives. Standards and objectives for the protection of sensitive ecosystems and habitats are also contained within the Air Emissions Guidance and the Air Pollution Information System (APIS).

2.1 Regulated pollutants

2.1.1 Nitrogen dioxide

All combustion processes produce nitric oxide and nitrogen dioxide, known by the general term of nitrogen oxides. In general, the majority of the nitrogen oxides released is in the form of NO, which then reacts with ozone in the atmosphere to form nitrogen dioxide. Of the two compounds, nitrogen dioxide is associated with adverse effects on human health, principally relating to respiratory illness. The World Health Organisation has stated that "many chemical species of nitrogen oxides exist, but the air pollutant species of most interest from the point of view of human health is nitrogen dioxide".

The single greatest source of nitrogen oxides in England is road transport. According to the most recent annual report from the National Atmospheric Emissions Inventory (NAIE)[2], in 2017 road transport accounted for 51% of UK emissions. Power stations (16%) and industrial, commercial and residential combustion (18%) are also significant contributors. High levels of nitrogen oxides in urban areas are almost always associated with high traffic densities.

The AQS includes two objectives, which are also included in the Air Quality Directive.

- A limit for the one-hour mean of 200 µg/m³, not to be exceeded more than 18 times a year (equivalent to the 99.79th percentile).
- A limit for the annual mean of 40 µg/m³.

The Air Quality Directive includes objectives for the protection of sensitive vegetation and ecosystems of 30 µg/m³ for the annual mean nitrogen oxides. This is also transposed within the AQS. The APIS also defines the daily mean Critical Level as 75 µg/m³ for nitrogen oxides.

2.1.2 Sulphur dioxide

Sulphur dioxide is predominantly released by the combustion of fuels containing sulphur. Emissions of sulphur dioxide have reduced by 96% since 1990, due to a reduction in the number of coal-fired combustion plants, the installation of flue gas desulphurisation plants on a number of large coal-

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

[2] NAIE Air Pollution Inventories for England, Scotland, Wales and Northern Ireland: 1990-2017, DEFRA.

fired power stations and the reduction in sulphur content of liquid fuels. The AQS contains three objectives for the control of sulphur dioxide:

- A limit for the 15-minute mean of 266 µg/m³, not to be exceeded more than 35 times a year (the 99.9th percentile).
- A limit for the one hour mean of 350 µg/m³, not to be exceeded more than 24 times a year (the 99.73rd percentile).
- A limit for the daily mean of 125 µg/m³, not to be exceeded more than 3 times a year (the 99.2nd percentile).

The hourly and daily objectives are included in the Air Quality Directive.

The Air Quality Directive includes a Critical Level for the protection of vegetation and ecosystems of 20 µg/m³ as an annual mean and as a winter average. This is also transposed into the AQS. In addition, APIS defines the long-term Critical Level as 10 µg/m³ where lichens or bryophytes are present.

2.1.3 Particulate matter

Concerns over the health impact of solid matter suspended in the atmosphere tend to focus on particles with a diameter of less than 10 µm, known as PM_{10}. These particles have the ability to enter and remain in the lungs. Various epidemiological studies have shown increases in mortality associated with high levels of PM_{10}, although the underlying mechanism for this effect is not yet understood. According to the NAIE, significant sources of PM_{10} include industrial combustion (13%) industrial processes (30%), residential, commercial and public sector combustion (27%), and transport (14%).

The AQS includes two objectives for PM_{10}, both of which are included in the Air Quality Directive.

- A limit for the annual mean of 40 µg/m³.
- A daily limit of 50 µg/m³, not to be exceeded more than 35 times a year (the 90.41st percentile).

There a previous AQS included some provisional objectives for particulate matter with a diameter less than 2.5 µm ($PM_{2.5}$). These have been replaced by an exposure reduction objective for $PM_{2.5}$ in urban areas and a target value for $PM_{2.5}$ of 25 µg/m³ as an annual mean. This target value is included in the Air Quality Directive. The single greatest source of $PM_{2.5}$ is residential, commercial and public sector combustion (43%).

2.1.4 Carbon monoxide

Carbon monoxide is produced by the incomplete combustion of fuels containing carbon. The most significant sources are residential, commercial public sector combustion (36%), industrial combustion (30%) and transport (24%). Carbon monoxide can interfere with the processes that transport oxygen around the body, which can prove fatal at very high levels.

Concentrations in the UK are well below levels at which health effects can occur. The AQS includes the following objective for the control of carbon monoxide, which is also included in the Air Quality Directive:

- A limit for the 8-hour running mean of 10 mg/m³.

The Environment Agency’s Air Emissions Guidance also defines the hourly EAL as 30 mg/m³.

2.1.5 Hydrogen chloride

There are no objectives for hydrogen chloride contained within the AQS. The Air Emissions Guidance defines the short-term EAL as 750 µg/m³, but provides no long-term EAL.

2.1.6 Hydrogen fluoride

There are no objectives for hydrogen fluoride contained within the AQS. The Air Emissions Guidance defines the short-term EAL as 160 µg/m³ and the long-term EAL as 16 µg/m³. In addition, Critical Levels for the protection of vegetation and ecosystems of 5 µg/m³ as a daily mean and 0.5 µg/m³ as a weekly mean concentration are set for hydrogen fluoride.

2.1.7 Ammonia

There are no objectives for ammonia contained within the AQS. However, the Air Emissions Guidance defines the short term EAL as 2,500 µg/m³ and the long term EAL as 180 µg/m³.

APIS also provides Critical Levels for the protection of vegetation and ecosystems. This level is 3 µg/m³ as an annual mean, reduced to 1 µg/m³ where lichens or bryophytes are present.

2.1.8 Volatile Organic Compounds (VOCs)

A variety of VOCs could be released from the stack, of which benzene and 1,3-butadiene are included in the AQS and monitored at various stations around the UK. The AQS includes the following objectives for the running annual mean:

- Benzene – 5 µg/m³; and
- 1,3-butadiene – 2.25 µg/m³.

The Environment Agency's Air Emissions Guidance includes a short-term EAL for benzene, calculated from occupational exposure. This is a limit of 195 µg/m³ for an hourly mean. There are no short-term EALs for 1,3-butadiene.

2.1.9 Metals

Lead is the only metal included in the AQS. Emissions of lead in the UK have declined by 98% since 1970, due principally to the virtual elimination of leaded petrol.

The AQS includes objectives to limit the annual mean to 0.5 µg/m³ by the end of 2004 and to 0.25 µg/m³ by the end of 2008. Only the first objective is included in the Air Quality Directive.

The fourth Daughter Directive on air quality (Commission Decision 2004/107/EC) includes target values for arsenic, cadmium and nickel. However, the preamble to the Directive makes it clear that the use of these target values is relatively limited. Paragraph (5) states:

"The target values would not require any measures entailing disproportionate costs. Regarding industrial installations, they would not involve measures beyond the application of best available techniques (BAT) as required by Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (5) and in particular would not lead to the closure of installations. However, they would require Member States to take all cost-effective abatement measures in the relevant sectors."

And paragraph (6) states:

"In particular, the target values of this Directive are not to be considered as environmental quality standards as defined in Article 2(7) of Directive 96/61/EC and which, according to Article 10 of that Directive, require stricter conditions than those achievable by the use of BAT."

Although these target values have been included in the assessment, it is important to note that the application of the target values would not have an effect on the design or operation of the Facility. The Facility will be designed in accordance with BAT and will include cost effective methods for the abatement of arsenic, cadmium and nickel, including the injection of activated carbon and a fabric filter.

Emissions limits have been set in permits for similar facilities for a number of heavy metals which do not have air quality standards associated with them. The EALs for these metals, and lead, are summarised in Table 1. Some metals included in this assessment do not have EALs.

Table 1: Environmental Assessment Levels (EALs) for metals

Metal	AAD Limit / Target (ng/m³)	EALs (ng/m³)	
		Long-term	Short-term
Arsenic	6	3	-
Antimony	-	5,000	150,000
Cadmium	5	5	-
Chromium (II & III)	-	5,000	150
Chromium (VI)	-	0.2	-
Cobalt	-	-	-
Copper	-	10,000	200
Lead	500 (250 AQS Target)	250	-
Manganese	-	150	1500
Mercury	-	250	7.5
Nickel (total nickel compounds in the PM10 fraction)	20	20	-
Thallium	-	-	-
Vanadium	-	5	1

2.1.10 Dioxins and furans

Dioxins and furans are a group of organic compounds with similar structures, which are formed as a result of combustion in the presence of chlorine. Principal sources include steel production, power generation, coal combustion and uncontrolled combustion, such as bonfires. The Municipal Waste Incineration Directive and UK legislation imposed strict limits on dioxin emissions in 1995, with the result that current emissions from incineration of municipal solid waste in the UK in 1999 were less than 1% of the emissions from waste incinerators in 1995. The Waste Incineration Directive, now included in the IED, imposed even lower limits, reducing the limit to one tenth of the previously permitted level and the BAT-AELs in the WI BREF reduce the limits even more.

One dioxin, 2,3,7,8-TCDD, is a definite carcinogen and a number of other dioxins and furans and dioxin-like PCBs are considered to be possible carcinogens. A tolerable daily intake for dioxins, furans and dioxin-like PCBs of 2 pg I-TEQ per kg bodyweight per day has been recommended by the Committee on the Toxicity of Chemicals in Food, Consumer Products and the Environment. This is expressed as the total intake from inhalation and ingestion. The Human Health Risk Assessment (technical appendix G1) considers the intake from inhalation and ingestions and compares this to the tolerable daily intake.

2.1.11 Polychlorinated biphenyl (PCBs)

PCBs have high thermal, chemical and electrical stability and were manufactured in large quantities in the UK between the 1950s and mid 1970s. Commercial PCB mixtures, which contained a range of dioxin-like and non-dioxin like congeners, were sold under a variety of trade names, the most common in the UK being the Aroclor mixtures. UK legislative restrictions on the use of PCBs were first introduced in the early 1970s.

Although now banned from production current atmospheric levels of PCBs are due to the ongoing primary anthropogenic emissions (e.g. accidental release of products or materials containing PCBs), volatilisation from environmental reservoirs which have previously received PCBs (e.g. sea and soil) or incidental formation of some congeners during the combustion process.

There are no objectives for PCBs contained within the AQS. However, the Air Emissions Guidance defines the short-term EAL as 6 $\mu g/m^3$ and the long-term EAL as 0.2 $\mu g/m^3$.

A number of PCBs are considered to possess dioxin like toxicity and are known as dioxin-like PCBs. The effect of emissions of dioxins, furans and dioxin-like PCBs has been assessed within technical appendix G1 [Human Health Risk Assessment].

2.1.12 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are members of a large group of organic compounds widely distributed in the atmosphere. The best known PAH is benzo[a]pyrene (B[a]P). The AQS included an objective to limit the annual mean of B[a]P to 0.25 ng/m^3. This goes beyond the requirements of European Directives, since the fourth Daughter Directive on air quality (Commission Decision 2004/107/EC) includes a target value for B[a]P of 1 ng/m^3 as an annual mean.

2.1.13 Summary

AAD Target and Limit Values, AQS Objectives, and EALs are set at levels well below those at which significant adverse health effects have been observed in the general population and in particularly sensitive groups. For the remainder of this report these are collectively referred to as AQALs. Table 2 to Table 4 summarise the air quality objectives and guidelines used in this assessment. The sources for each of the values can be found in the preceding sections.

Table 2: Air Quality Assessment Levels (AQALs)

Pollutant	AQAL ($\mu g/m^3$)	Averaging period	Frequency of exceedances	Source
Nitrogen dioxide	200	1 hour	18 times per year (99.79th percentile)	AAD Limit Value
	40	Annual	-	AAD Limit Value

Pollutant	AQAL (µg/m³)	Averaging period	Frequency of exceedances	Source
Sulphur dioxide	266	15 minutes	35 times per year (99.9th percentile)	AQS Objective
	350	1 hour	24 times per year (99.73rd percentile)	AAD Limit Value
	125	24 hours	3 times per year (99.18th percentile)	AAD Limit Value
Particulate matter (PM_{10})	50	24 hours	35 times per year (90.41st percentile)	AQS Objective
	40	Annual	-	AQS Objective
Particulate matter ($PM_{2.5}$)	25	Annual	-	AQS Target
Carbon monoxide	10,000	8 hours, running	-	AAD Limit Value
	30,000	1 hour	-	Air Emissions Guidance
Hydrogen chloride	750	1 hour		Air Emissions Guidance
Hydrogen fluoride	160	1 hour	-	Air Emissions Guidance
	16	Annual	-	Air Emissions Guidance
Ammonia	2,500	1 hour	-	Air Emissions Guidance
	180	Annual	-	Air Emissions Guidance
Benzene	5	Annual	-	Air Emissions Guidance
	195	1 hour	-	Air Emissions Guidance
1,3-butadiene	2.25	Annual, running	-	AQS Objective
PCBs	6	1-hour	-	Air Emissions Guidance
	0.2	Annual	-	Air Emissions Guidance
PAHs	0.00025	Annual	-	AQS Objective

Table 3: Air Quality Assessment Levels for metals

Pollutant	AQAL (ng/m³)	Averaging period	Source
Cadmium	-	1 hour	-
	5	Annual	AAD Target Value
Mercury	7,500	1 hour	Air Emissions Guidance
	250	Annual	Air Emissions Guidance
Antimony	150,000	1 hour	Air Emissions Guidance
	5,000	Annual	Air Emissions Guidance
Arsenic	-	1 hour	-

Pollutant	AQAL (ng/m³)	Averaging period	Source
	3	Annual	Air Emissions Guidance
Chromium (II & III)	150,000	1 hour	Air Emissions Guidance
	5,000	Annual	Air Emissions Guidance
Chromium (VI)	-	1 hour	-
	0.2	Annual	Air Emissions Guidance
Copper	200,000	1 hour	Air Emissions Guidance
	10,000	Annual	Air Emissions Guidance
Lead	-	1 hour	-
	250	Annual	AQS Target
Manganese	1,500,000	1 hour	Air Emissions Guidance
	150	Annual	Air Emissions Guidance
Nickel	-	1 hour	-
	20	Annual	AAD Limit
Vanadium	1,000	1 hour	Air Emissions Guidance
	5,000	Annual	Air Emissions Guidance

Table 4: Critical Levels for the protection of vegetation and ecosystems

Pollutant	Concentration (µg/m³)	Measured as	Source
Nitrogen oxides (as nitrogen dioxide)	75	Daily mean	APIS
	30	Annual mean	AAD Critical Level
Sulphur dioxide	10	Annual mean for sensitive lichen communities and bryophytes and ecosystems where lichens and bryophytes are an important part of the ecosystems integrity	Air Emissions Guidance / APIS
	20	Annual mean for all higher plants	AAD Critical Level
Hydrogen fluoride	5	Daily mean	Air Emissions Guidance / APIS
	0.5	Weekly mean	Air Emissions Guidance / APIS
Ammonia	1	Annual mean for sensitive lichen communities and bryophytes and ecosystems	APIS

Pollutant	Concentration (µg/m³)	Measured as	Source
		where lichens and bryophytes are an important part of the ecosystems integrity	
	3	Annual mean for all higher plants	APIS

2.2 Areas of relevant exposure

The AQALs apply only at areas of exposure relevant to the assessment level. The following table extracted from Local Authority Air Quality Technical Guidance (2016) (LAQM.TG(16))[3] explains where the AQALs apply.

Table 5: Guidance on where AQALs apply

Averaging period	AQALs should apply at:	AQALs should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short-term.
24-hour mean and 8-hour mean	All locations where the annual mean AQAL 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 AQALs apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are	Kerbside sites where the public would not be expected to have regular access.

3 Department for Environment, Food and Rural Affairs, Local Air Quality Management Technical Guidance (TG16), February 2018, available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf

Averaging period	AQALs should apply at:	AQALs should generally not apply at:
	not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	

Source: LAQM.TG(16)

3 Sensitive Receptors

As part of this assessment, the predicted process contribution (PC) at the point of maximum impact has been evaluated. Where the impact is greater than 0.5% of the long term or 10% of the short term AQAL further consideration has been made to the spatial distribution of emissions using plot files to ensure all receptor locations are captured.

3.1 Ecological sensitive receptors

A study was undertaken to identify the following sites of ecological importance in accordance with the following screening distances laid out in the Air Emissions Guidance:

- Special Protection Areas (SPAs), Special Areas of Conservation (SACs), or Ramsar sites within 10 km of the site;
- Sites of Special Scientific Interest (SSSIs) within 2 km of the site; and
- National Nature Reserves (NNR), Local Nature Reserves (LNRs), sites of nature conservation interest (SNCI) and ancient woodlands within 2 km of the site.

The sensitive ecological receptors identified as a result of the study are displayed in Figure 1 of Annex A and are listed in Table 6. A review of the citation and APIS website for each site has been undertaken to determine if lichens or bryophytes are an important part of the ecosystem's integrity. If lichens or bryophytes are present, the more stringent Critical Level has been applied as part of the assessment.

Table 6: Ecological sensitive receptors

ID	Site	Designation	Distance from stack at closest point (km)	Lichens/ bryophytes present
European designated sites within 10 km				
E1	Isle of Portland to Studland Cliffs	SAC	0.07	Yes
E2	Chesil and The Fleet	SAC, SPA, Ramsar	1.46	No
UK designated sites within 2 km				
E3	Isle of Portland	SSSI	0.07	Yes
E4	Nicodemus Heights	SSSI	0.85	Yes
E5	Chesil and The Fleet	SSSI	1.46	No
Local sites within 2 km				
E6	Verne to Grove	SNCI	0.80	Yes
E7	East Weare Camp	SNCI	0.02	Yes
E8	Verne Yeates	LNR / SNCI	0.86	Yes
E9	King Barrow Quarries	DWT Reserve	1.20	Yes
E10	Tout Quarries	DWT Reserve	1.74	Yes
E11	Portland Heights	SNCI	1.57	Yes
E12	Grove Quarry	SNCI	1.85	Yes

ID	Site	Designation	Distance from stack at closest point (km)	Lichens/ bryophytes present
E13	Osprey Quay Bunds	SNCI	1.65	Yes
E14	East Weare Rifle Range	SNCI	1.25	Yes
NOTES: DWT Reserve – Dorset Wildlife Trust Nature Reserve SNCI – Site of Nature Conservation Interest				

The Isle of Portland SSSI and Nicodemus Heights are components of the Isle of Portland to Studland Cliffs SAC. The Chesil and The Fleet is designated as a SAC, SPA, Ramsar and SSSI. Crookhill Brick Pit SAC is within 10 km of the site. This has been identified as of geological importance and as such is not sensitive to air quality impacts. Therefore, an assessment of the impact of air quality at Crookhill Brick Pit SAC has not been undertaken.

Each site falls within the modelling domain and as such the impact has been calculated as the maximum of any grid point across the site.

As a precautionary approach it has been assumed that lichens are present at the local sites as recommended by the project ecologist.

4 Process Emissions Dispersion Modelling Methodology

4.1 Selection of model

Detailed dispersion modelling was undertaking using the model ADMS 5.2, developed and supplied by Cambridge Environmental Research Consultants (CERC) This is a new generation dispersion model, which characterises the atmospheric boundary layer in terms of the atmospheric stability and the boundary layer height. In addition, the model uses a skewed Gaussian distribution for dispersion under convective conditions, to take into account the skewed nature of turbulence. The model also includes modules to take account of the effect of buildings and complex terrain.

ADMS is routinely used for modelling of emissions for planning and Environmental Permitting purposes to the satisfaction of the Environment Agency and local authorities. The maximum predicted concentration for each pollutant and averaging period has been used to determine the significance of any potential impacts.

4.2 Source and emissions data

The principal inputs to the model with respect to the emissions to air from the Facility are presented in Table 7 and Table 8.. This data has been provided by the proposed contractors.

Table 7: Stack source data

Item	Unit	Value
Stack Data		
Height	m	80
Internal diameter	m	2
Location	m, m	369607, 74248
Flue Gas Conditions		
Temperature	°C	140
Exit moisture content	% v/v	14.90%
	kg/kg	0.105
Exit oxygen content	% v/v dry	8.11%
Reference oxygen content	% v/v dry	11.0%
Volume at reference conditions (dry, ref O_2)	Nm^3/s	39.07
Volume at actual conditions	Am^3/s	53.81
Flue gas exit velocity	m/s	17.13

Table 8: Stack emissions data

Pollutant	Conc. (mg/Nm³)		Release rate (g/s)	
	Daily or periodic	Half-hourly	Daily or periodic	Half-hourly
Oxides of nitrogen (as NO_2)	120	400	4.689	15.630
Sulphur dioxide	30	200	1.172	7.815
Carbon monoxide	50	150(1)	1.954	5.861
Fine particulate matter (PM)(2)	5	30	0.195	1.172
Hydrogen chloride	6	60	0.234	2.344
Volatile organic compounds (as TOC)	10	20	0.391	0.781
Hydrogen fluoride	1	4	0.039	1.156
Ammonia (3)	8	-	0.391	-
Cadmium and thallium	0.02	-	0.781 mg/s	-
Mercury	0.02	0.035	0.781 mg/s	1.368 mg/s
Other metals(4)	0.3	-	11.722 mg/s	-
Benzo(a)pyrene (PaHs)(5)	0.105 µg/Nm³	-	4.103 µg/s	-
Dioxins and furans	0.06 ng/Nm³	-	2.344 ng/s	-
PCBs(6)	5.0 µg/Nm³	-	4.103 µg/s	-

Notes:

All emissions are expressed at reference conditions of dry gas, 11% oxygen, 273.15K.

(1) Averaging period for carbon monoxide is 95% of all 10-minute averages in any 24-hour period.

(2) As a worst-case it has been assumed that the entire PM emissions consist of either PM_{10} or $PM_{2.5}$ for comparison with the relevant AQALs.

(3) A more stringent limit for ammonia is being applied for 8 mg/Nm^3

(4) Other metals consist of antimony (Sb), arsenic (As), lead (Pb), chromium (Cr), cobalt (Co), copper (Cu), manganese (Mn), nickel (Ni) and vanadium (V).

(5) The highest recorded emission concentration of B[a]P from the Environment Agency's public register was 0.105 ug/m³, or 0.000105 mg/m³ (dry, 11% oxygen, 273K). In lieu of any specific limit, this has been assumed to be the emission concentration for the Facility.

(6) The Waste Incineration BREF provides a range of values for PCB emissions to air from European municipal waste incineration plants. This states that the annual average total PCBs is less than 0.005 mg/Nm³ (dry, 11% oxygen, 273K). In lieu of any specific limit, this has been assumed to be the emission concentration for the Facility.

The Facility is designed to operate at full capacity and is not anticipated to have significant changes in loading. Therefore, it is appropriate to base the assessment on the design point of the system.

If the Facility continually operated at the half-hourly limits, the daily limits would be exceeded. The Facility is designed to achieve the daily limits and as such will only operate at the shorter-term limits for short periods on rare occasions.

4.3 Other Inputs

4.3.1 Modelling domain

Modelling has been undertaken over a 4.2 km x 3 km grid with a spatial resolution of 60 m. The grid spacing in each direction is less than 1.5 times the minimum stack height considered in accordance with the Environment Agency's modelling guidance. Reference should be made to Figure 2 of Annex A for a graphical representation of the modelling domain used. The extent of the modelling domain is detailed in Table 9.

Table 9: Modelling domain

Parameter	Value
Grid spacing (m)	60
Grid points	71 x 51
Grid Start X (m)	366760
Grid Finish X (m)	370960
Grid Start Y (m)	72860
Grid Finish Y (m)	75860

4.3.2 Meteorological data and surface characteristics

The impact of meteorological data was taken into account by using weather data from the Portland meteorological recording station for the years 2014 – 2018. This station is located approximately 5 km to the south-west of the site and is the closest and most representative meteorological station available. This site is located at the National Coastwatch station which is located on the western side of the Isle of Portland. The application site is to the north east of the Isle of Portland and as such the wind conditions will be different than that monitored at the Portland meteorological station. However, this is accounted for in the dispersion modelling by using the terrain and surface roughness functions of the model (FLOWSTAR). For each hour of meteorological data the model computes the effect of the terrain and surface roughness on the wind flow characteristics across the modelling domain both laterally and with altitude. Alternative data from the monitoring stations in the harbour have been analysed. These stations only record wind speed and direction and therefore do not contain all the variables needed for modelling purposes. The wind speed and direction data is not significantly different to that from the Isle of Portland meteorological station. Therefore, it is considered appropriate to use the fuller dataset and the terrain and surface roughness modules in ADMS.

The period 2014 to 2018 was chosen as this was the most recent full set of data available at the time of starting the air quality modelling. The Environment Agency recommends that 5 years of data are used to take into account inter-annual fluctuations in weather conditions. Wind roses for each year are presented in Figure 3 of Annex A.

The minimum Monin-Obukhov length can be selected in ADMS for both the dispersion site and the meteorological site. This is a measure of the minimum stability of the atmosphere and can be adjusted to account for urban heat island effects which prevent the atmosphere in urban areas from ever becoming completely stable. The minimum Monin-Obukhov length has been set to 10 m for the dispersion site and the model default for the meteorological sites. The value of 10 m is appropriate for small towns like the surroundings of the dispersion site, and the model default is applicable for rural areas like the meteorological site.

4.3.3 Terrain and surface roughness

It is recommended that, where gradients within 500 m of the modelling domain are greater than 1 in 10, the complex terrain module within ADMS (FLOWSTAR) should be used. A review of the local area has deemed that the effect of terrain should be taken into account in the modelling. The FLOWSTAR module creates a modified flow field both laterally and with altitude. This allows for the variances in wind flow around the Isle of Portland to be accounted for.

A terrain file large enough to cover the output grid of points was created using Ordnance Survey Terrain 50 data. The parameters of the terrain files used are outlined in Table 10.

Table 10: Terrain file parameters

Parameter	Value
Grid Start X	366225
Grid Finish X	371475
Grid Start Y	72325
Grid Finish Y	77575
Resolution	128 x 128

The surface roughness across the modelling domain varies considerably. Therefore, the variable surface roughness option within the ADMS model has been used. This together with the terrain data are used in FLOWSTAR to create the modified flow field. This allows the model to account for the more laminar flow across the sea and the changes associated with more turbulent flow when the air flow meets the land and the effect that this has upon the dispersion of emissions.

The surface roughness covers the same extents as the terrain file. Reference should be made to Figure 2 of Annex A for a graphical representation of the modelling domain, terrain file, and surface roughness file used.

4.3.4 Buildings

The presence of adjacent buildings can significantly affect the dispersion of the atmospheric emissions in various ways:

- Wind blowing around a building distorts the flow and creates zones of turbulence. The increased turbulence can cause greater plume mixing.
- The rise and trajectory of the plume may be depressed slightly by the flow distortion. This downwash leads to higher ground level concentrations closer to the stack than those which would be present without the building.

The Environment Agency recommends that buildings should be included in the modelling if they are both:

- Within 5L of the stack (where L is the smaller of the building height and maximum projected width of the building); and
- Taller than 40% of the stack.

The ADMS 5.2 user guide also states that buildings less than one third of the stack height will not have any effect on dispersion.

The ADMS dispersion model approximates an "effective building" based on the buildings inputted into the model. This effective building is a single building with a cross wind width and length for each wind direction. The size (footprint and height) of this effective building depends upon the height of each building inputted into the model, and the location of the centre of this building in relation to the stack.

A review of the site layout has been undertaken and the details of the applicable buildings are presented in Table 11. A site plan showing which buildings have been included in the model is presented in Figure 4 of Annex A.

Table 11: Building details

Buildings	Centre point		Height (m)	Length (m)	Width (m)	Angle (°)
	X (m)	Y (m)				
A	369618.8	74237.2	41.0	61.3	20.3	133.7
B	369661.8	74222.3	36.5	18.6	52.4	43.9
C	369688.7	74197.6	32.0	20.3	18.8	133.0
D	369654.0	74203.0	45.0	20.0	36.7	44.5
E	369615.9	74221.1	25.0	6.4	43.1	43.7
F	369664.3	74172.1	32.0	11.2	20.7	40.3
G	369674.5	74183.0	45.0	20.3	20.6	44.5
H	369709.5	74126.9	23.5	136.9	37.4	159.1

4.4 Chemistry

The Facility will release nitric oxide (NO) and nitrogen dioxide (NO_2) which are collectively referred to as NOx. In the atmosphere, nitric oxide will be converted to nitrogen dioxide in a reaction with ozone which is influenced by solar radiation. Since the air quality objectives are expressed in terms of nitrogen dioxide, it is important to be able to assess the conversion rate of nitric oxide to nitrogen dioxide.

Ground level NOx concentrations have been predicted through dispersion modelling. Nitrogen dioxide concentrations reported in the results section assume 70% conversion from NOx to nitrogen dioxide for annual means and a 35% conversion for short term (hourly) concentrations, based upon the worst-case scenario in the Environment Agency methodology. Given the short travel time to the areas of maximum concentrations, this approach is considered conservative.

4.5 Baseline concentrations

Background concentrations for the assessment have been derived from monitoring and national mapping as presented in Appendix D.1 [Baseline Analysis]. For short term averaging periods, the background concentration has been assumed to be twice the long-term ambient concentration following the Air Emissions Guidance methodology.

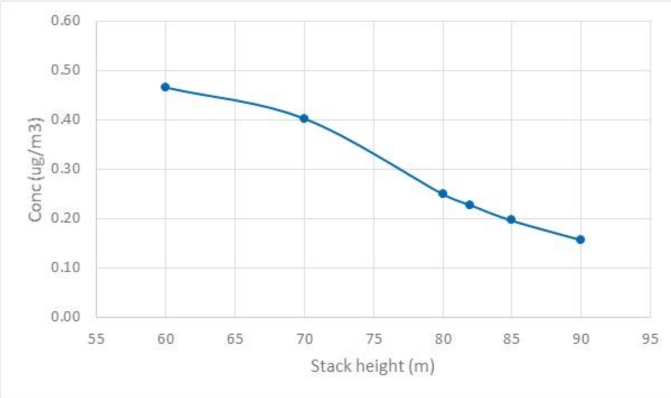
5 Stack Height Assessment

When determining a suitable stack height, it is best practice to identify the stack height where the rate of reduction in maximum ground level concentration with increased height slows down. This can be identified on a graph as a step change in the slope.

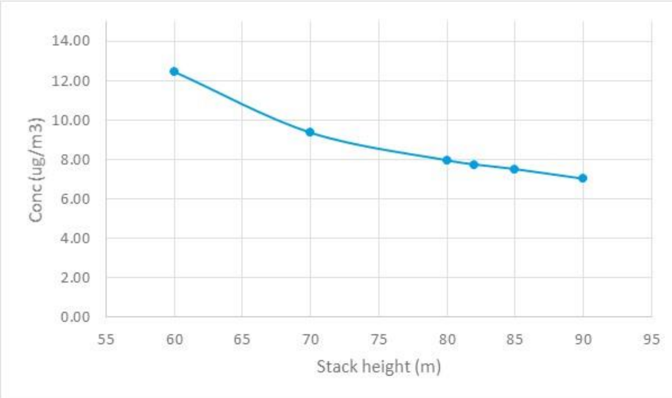
5.1 Analysis

The following graphs show the annual mean (Graph 1) and maximum 1-hour (Graph 2) ground level concentration based on an emission rate of 1 g/s from the Facility. This is based on the maximum impact using 5-years of weather data.

Graph 1: Annual mean



Graph 2: Maximum 1-hour



As shown, there is no clear change in the angle of the slope in annual mean impacts, but there is a slight change in the angle of slope for peak 1-hour concentrations at a height of 70 m. This is based on the peak impact which occurs in the sea to the north-east of the Facility. In this instance it is considered appropriate to determine the stack height based on impacts at areas of exposure.

5.2 Impact on human health

5.2.1 Screening threshold

The EPUK and Institute of Air Quality Management IAQM guidance document "Land-Use Planning and Development Control: Planning for Air Quality (2017) includes a matrix which should be used to determine the impact of a proposal based on the change in concentration relative to the AQAL and the overall predicted concentration from the scheme. This methodology is set out in Chapter 4 of the ES. Applying this matrix, a change in impact of less than 0.5% of the annual mean AQAL can be described as negligible irrespective of baseline concentrations. For short term concentrations a change of less than 10% of the AQAL can be described as negligible.

The Air Emissions Guidance also includes a screening criteria which should be applied to the permitting process. This states that

"process contributions can be considered insignificant if:

- *the long term process contribution is <1% of the long term environmental standard; and*
- *the short term process contribution is <10% of the short term environmental standard."*

Consultation with the Environment Agency has confirmed that if the above criteria are achieved, it can be concluded that "*it is not likely that emissions would lead to significant environmental impacts*" and the process contributions can be screened out.

The long-term 1% process contribution threshold is based on the judgement that:

- it is unlikely that an emission at this level will make a significant contribution to air quality; and
- the threshold provides a substantial safety margin to protect health and the environment.

The short-term 10% process contribution threshold is based on the judgement that:

- spatial and temporal conditions mean that short-term process contributions are transient and limited in comparison with long-term process contributions; and
- the threshold provides a substantial safety margin to protect health and the environment.

IPPC H1 also provides the following commentary on the 1% screening criterion for long term emissions:

"This is based on judgement of the level at which it is unlikely that an emission will make a significant contribution to any impact even if an EQS or EAL is exceeded. For long-term releases, it is usually the existing background concentration of a substance that dominates, rather than the long-term process contribution. As the proposed 1% criterion is two orders of magnitude below the EQS or EAL that represents maximum acceptable concentration for the protection of the environment, a substantial safety factor is built in. Even if the existing ambient quality meant that an EQS or other benchmark was already at risk due to releases from other sources, a contribution from the process of less than 1% (which is in itself likely to be an overestimate) would be only a small proportion of the total."

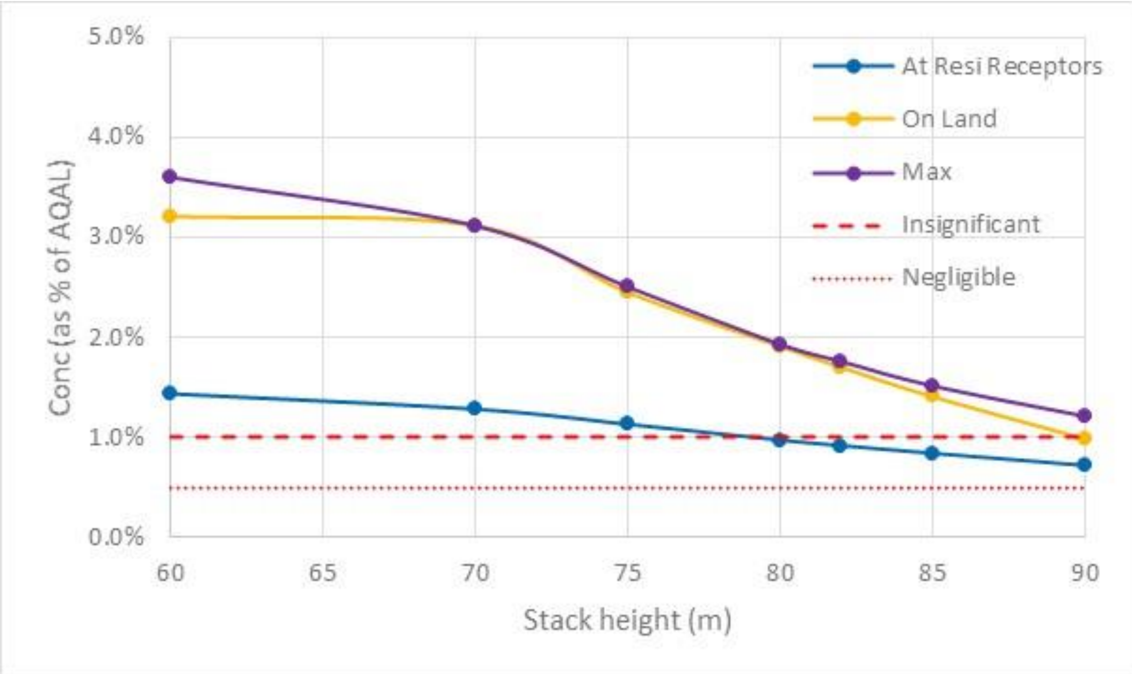
5.2.2 Analysis

The stack height modelling has been analysed to take into consideration the following key pollutants and averaging periods which align with the AQALs for the protection of human health:

- Annual mean nitrogen dioxide impacts
- Annual mean particulate matter (as PM_{10}) impacts
- Annual mean particulate matter (as $PM_{2.5}$) impacts
- Annual mean chromium VI impacts
- 90.41st percentile of daily mean particulate matter (as PM_{10}) impacts
- 99.18th percentile of daily mean sulphur dioxide impacts
- 99.79th percentile of 1-hour nitrogen dioxide impacts
- 99.73rd percentile of 1-hour mean sulphur dioxide impacts
- 99.9th percentile of 15-minute mean sulphur dioxide impacts

The following graph shows the maximum predicted annual mean nitrogen dioxide impact of the Facility at the point of maximum impact, and the maximum impact on areas of land and at areas of residential receptors. The model output has been post processed to determine the maximum impact at all grid points which are on land and those within residential areas and on land.

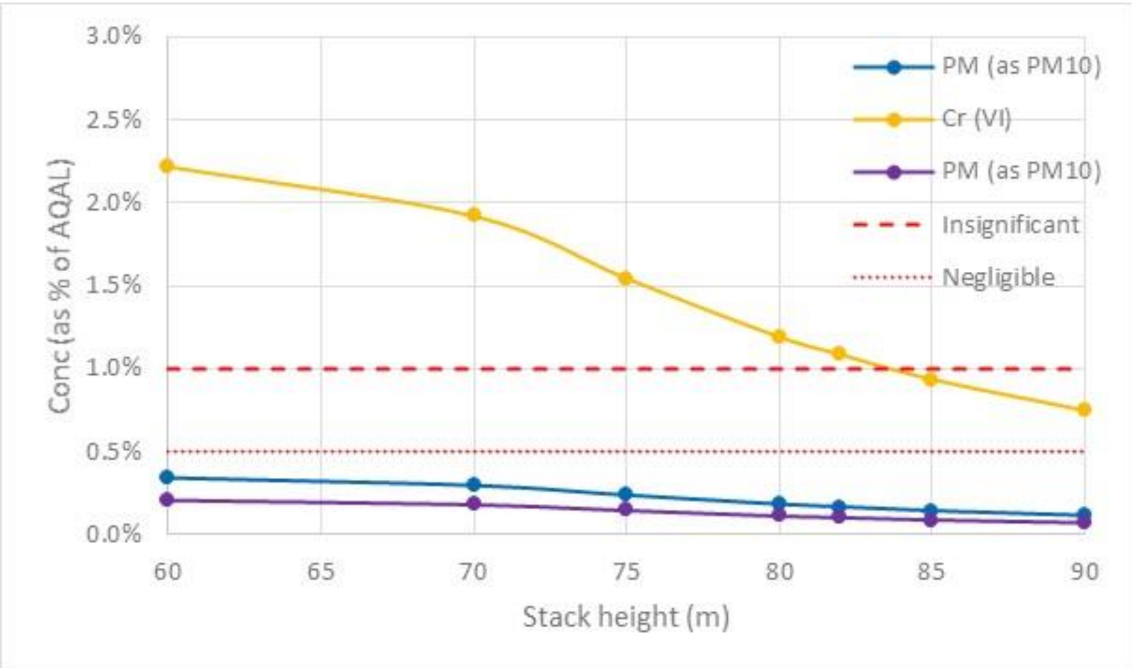
Graph 3 Annual mean nitrogen dioxide



Notes: Assumes continual operation at the ELVs, maximum all 5years of weather data

As shown the peak impact does not occur at residential areas where the annual mean AQAL applied.

Graph 4: Annual mean – other key pollutants



Notes: Assumes continual operation at the ELVs, maximum all 5years of weather data

The maximum impact of particulate matter is well below 1% of the relevant AQAL even if it is assumed that the entire PM emissions consist of only PM_{10} or $PM_{2.5}$. The peak chromium VI impact exceeds 1%, but this peak occurs at sea. The peak concentration for all stack heights on land is less than 1% of the AQAL.

5.2.3 Summary

The stack height analysis has shown that there is no clear change in the angle of slope for annual mean impacts either at the point of maximum impact or at areas of relevant exposure. However, there is a change in the angle of the slope at 70 m for short term impacts. At a height of 70 m the impact on human health cannot be screened out as 'insignificant' but it can be described as negligible. Therefore, the recommended stack height for the protection of human health is 70 m. This does not account for the impact at ecological receptors which is covered in the following section.

5.3 Impact at European designated sites

As part of the stack height analysis further consideration has been made to the impacts at the Isle of Portland to Studland Cliffs and Chesil and The Fleet which are both European designated sites.

The Environment Agency has produced Operational Instruction documents which explain how to assess aerial emissions from new or expanding Integrated Pollution Prevention and Control (IPPC) regulated industry applications, issued under the Environmental Permitting Regulations. The process to follow to satisfy the requirements of the Conservation of Habitats and Species Regulations 2017 (as amended), Countryside and Rights of Way (CRoW) Act 2000, and the Environment Agency's wider duties under the Environment Act 1995 and the Natural Environment and Rural Communities Act 2006 (NERC06) are outlined.

Operational Instruction 67_12 "Detailed assessment of the impact of aerial emissions from new or expanding IPPC regulated industry for impacts on nature conservation" provides a risk-based screening criteria for nature conservation sites. This states that at European sites:

- If the PC is less than 1% of the relevant Critical Level or Critical Load the emissions from the application are 'not significant'; and
- If the PEC is less than 70% of the relevant Critical Level or Critical Load it can be concluded 'no significant effect (alone and in-combination)'.

AQTAG 17 – "Guidance on in combination assessments for aerial emissions from EPR permits" states that:

"Where the maximum process contribution (PC) at the European site(s) is less than the Stage 2 de-minimis threshold of the relevant critical level or load, the PC is considered to be inconsequential and there is no potential for an alone or in-combination effects with other plans and projects."

The 'Stage 2 de-minimis threshold' refers to the criteria from Operational Instruction 67_12 detailed above.

In June 2019 the IAQM released the guidance document 'A guide to the assessment of air quality impacts on designated nature conservation sites' (the IAQM (2019) guidance). This guidance draws on the permitting guidance above.

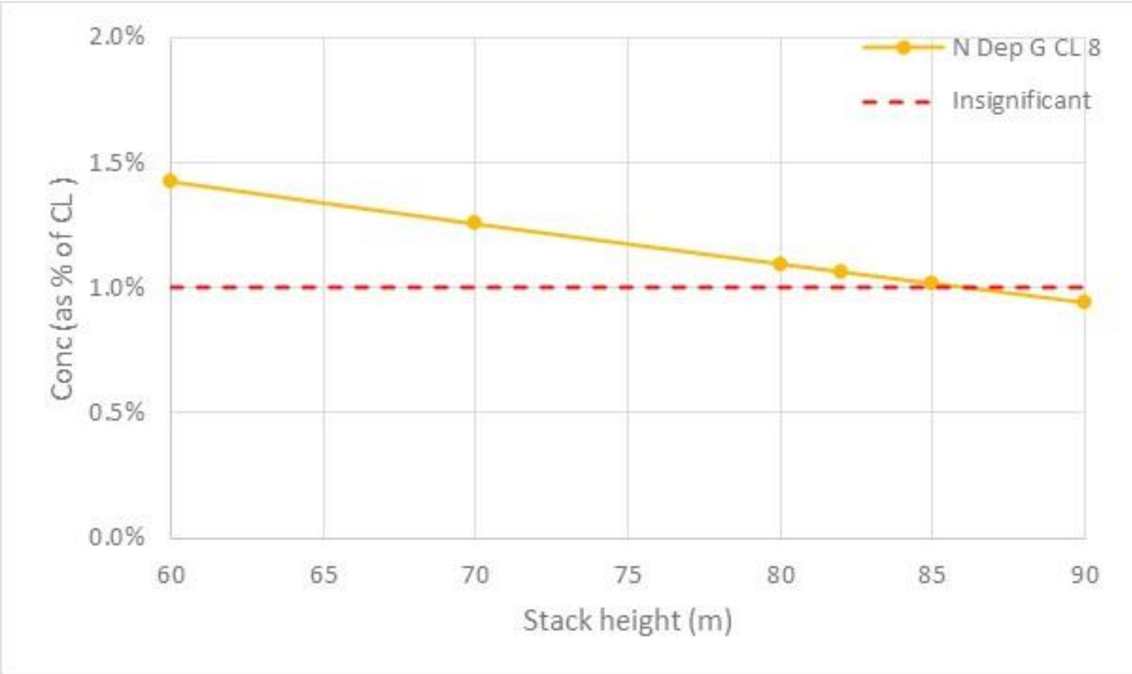
5.3.1 Emissions at the BAT AELs

5.3.1.1 Chesil and The Fleet

The background concentrations at Chesil and The Fleet exceeds 70% of the Critical Load for nitrogen deposition based on the assumption that the Critical Load of 8 kgN/ha/yr is applicable across the whole of the site. Therefore, for the impact to be screened out as 'not significant', based on the dispersion modelling results, the impact of the Facility would need to be less than 1% of the Critical Load. Lichens and bryophytes have not been identified at the designated site.

The following graph shows the peak impact of nitrogen deposition impacts at Chesil and The Fleet. This assumes that the ammonia emissions are at the BAT AEL of 10 mg/Nm^3. The impact is presented as a percentage of the Critical Load of 8 kgN/ha/yr, which is the lowest Critical Load identified in APIS for the SAC features of Chesil and The Fleet SAC.

Graph 5: Maximum N deposition impact at Chesil and The Fleet



NOTES: Assumes continual operation at the BAT AELs, impacts calculated as the maximum across the site and presented as a percentage of the most stringent Critical Load identified in APIS – i.e. 8kgN/ha/yr

As shown a stack height of over 85 m would be needed for the impact to be screened out as 'not significant'. In all instances the PEC exceeds the Critical Load of 8 kgN/ha/yr. There is no step change in the decrease in impact with increased stack height.

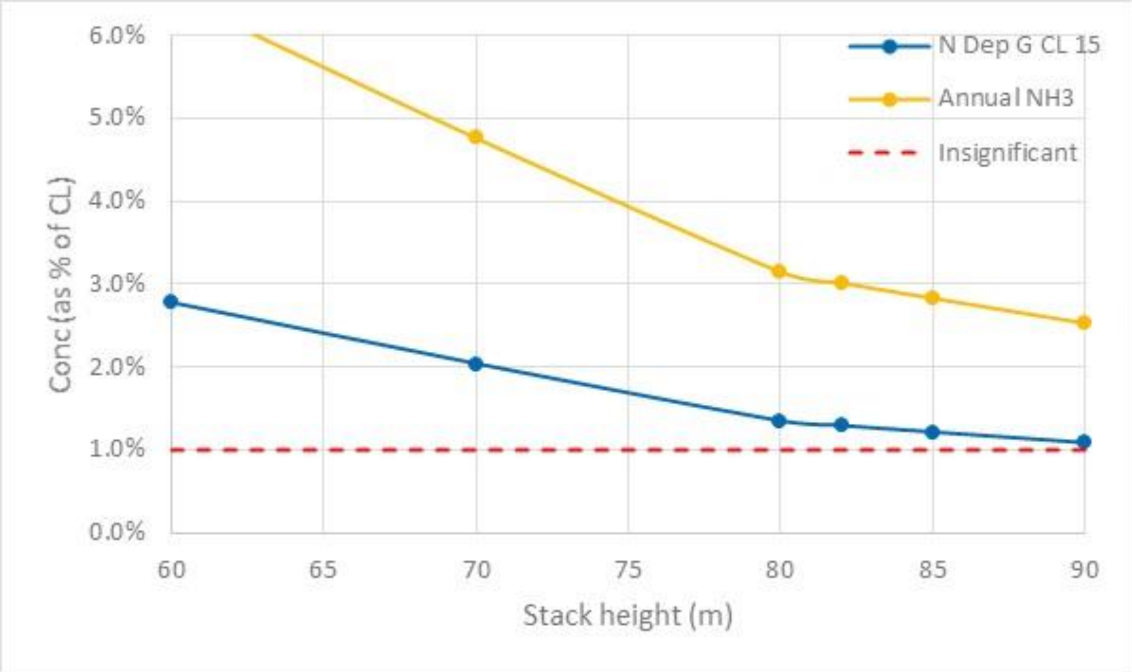
5.3.1.2 Isle of Portland to Studland Cliffs

The analysis of the ecological baseline data has shown that lichens and bryophytes have been identified as being present at the Isle of Portland to Studland Cliffs, and the background concentrations do not exceed 70% of the relevant Critical Levels or Loads.

The following graph shows the peak impact of ammonia and nitrogen deposition impacts at Isle of Portland to Studland Cliffs. This assumes that the ammonia emissions are at the BAT AEL of 10 mg/Nm^3. The impact of nitrogen deposition is presented as a percentage of the Critical Load of

15 kgN/ha/yr which is the lowest Critical Load identified in APIS for the SAC features of Isle of Portland to Studland Cliffs. The impact of ammonia is presented as a percentage of the Critical Level of 1 µg/m^3 which is applicable for lichen and bryophyte communities.

Graph 6: Maximum N deposition and ammonia impact at Isle of Portland to Studland Cliffs



NOTES: Assumes continual operation at the BAT AELs, impacts calculated as the maximum across the site and presented as a percentage of the most stringent Critical Load identified in APIS – i.e. 15kgN/ha/yr for N deposition, and 1µg/m^3 for ammonia

As shown a stack height of over 90 m would be needed for the impact to be screened out as 'insignificant'.

As detailed in Appendix D.1 [Baseline Analysis], at the Isle of Portland to Studland Cliffs the background ammonia is 62% of the Critical Level, and the background nitrogen deposition rate is 54% of the Critical Load of 15 kgN/ha/yr. Therefore, for the PEC to be less than 70% the maximum process contribution of ammonia would need to be less than 8% of the Critical Level, and nitrogen deposition 16%. At all heights considered the maximum PEC would be below 70% of the appropriate Critical Level and Critical Load at the Isle of Portland to Studland Cliffs SAC and therefore screened out as 'not significant'.

The graph shows a significant benefit of increasing the stack height from 70 m to 80 m. At 80 m the rate of decrease in maximum concentration in the SAC with increased stack height is reduced.

5.3.2 Effect of a reduced ELV for ammonia

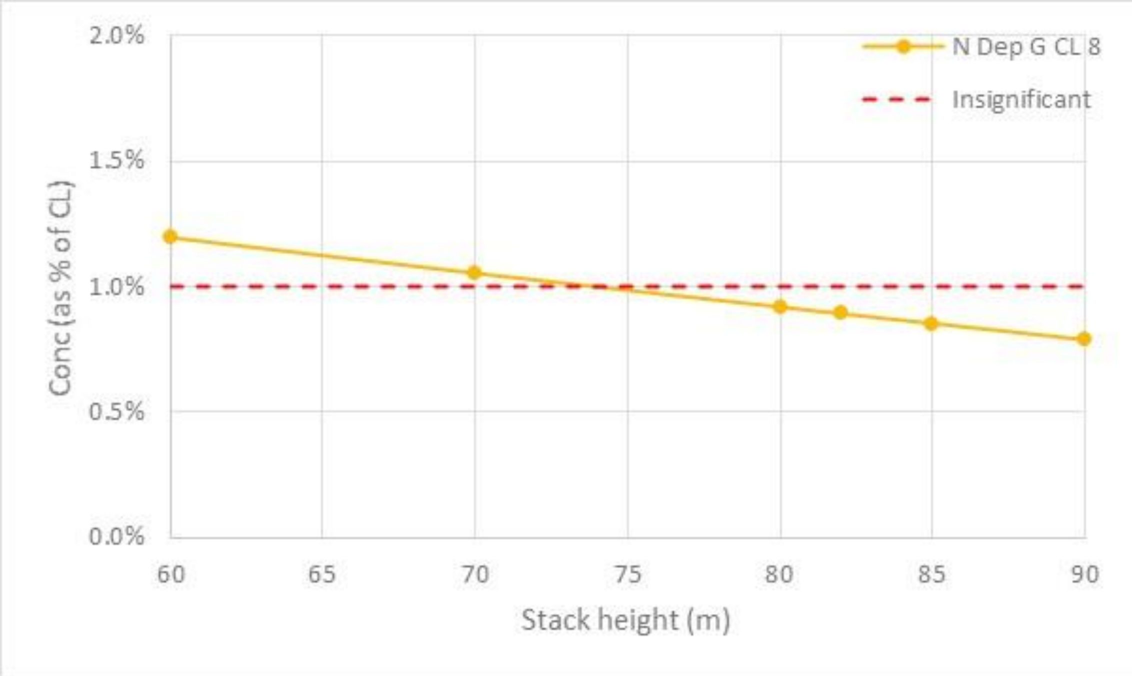
With an 80 m high stack the impact of nitrogen deposition at Chesil and The Fleet cannot be screened out as 'not significant' and the PEC would exceed the Critical Load. Nitrogen deposition is a function of emissions of oxides of nitrogen and ammonia. By far the greater contributor to nitrogen deposition is ammonia due to the higher deposition velocity and conversion factor from model µg/m^3/s to kg/ha/yr (as set out in Section 8.1). The following graphs shows the effect of decreasing the ammonia limit to 8 mg/Nm^3 on nitrogen deposition impacts on Chesil and The Fleet, and ammonia and nitrogen deposition impacts at Isle of Portland to Studland Cliffs.

As shown, with a reduced ELV of 8 mg/Nm^3 for ammonia and an 80 m high stack the impact at the Chesil and The Fleet would be less than 1% of the Critical Load and screened out as 'not significant'. Although the impact at Portland to Studland Cliffs cannot be screened out as 'not significant' the PEC is not significant as it remains below 70% of the relevant Critical Levels and Loads. Reducing the ammonia emissions significantly reduces the impact of ammonia at Portland to Studland Cliffs. Therefore, this application is seeking planning permission for an 80 m high stack and a reduced ammonia limit of 8 mg/Nm^3.

5.4 Summary

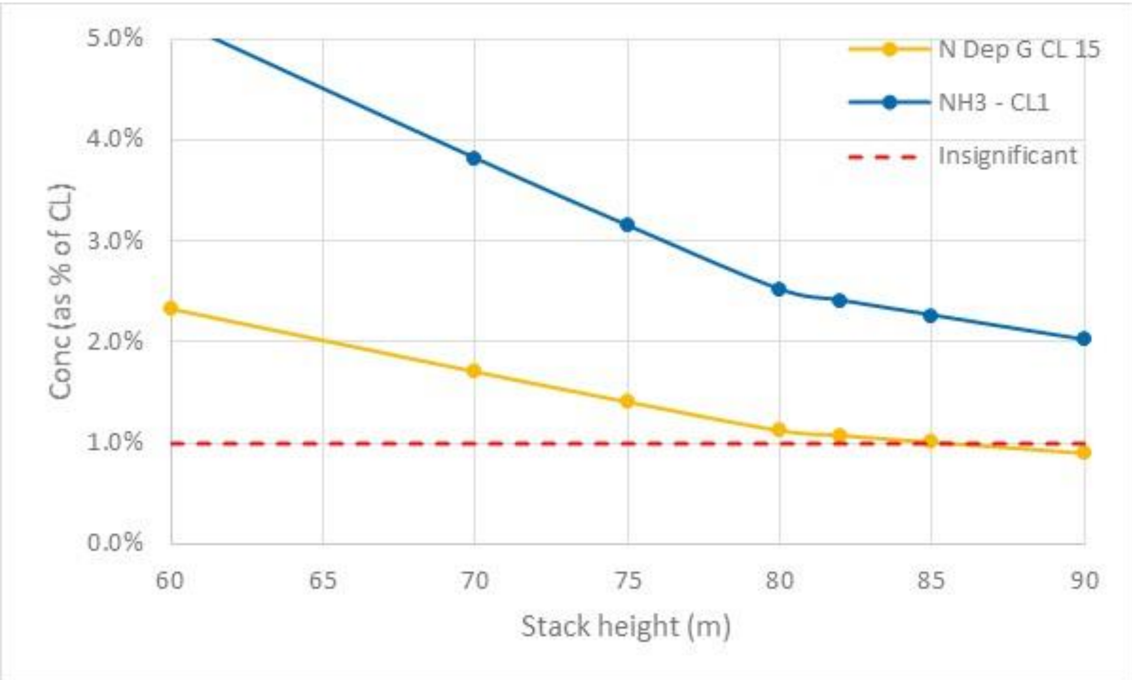
The stack height assessment has shown that a 70 m high stack is recommended for the protection of human health. However, at this height the impact at the Chesil and The Fleet SAC cannot be screened out as 'not significant'. Therefore, it was recommended that the stack height is increased to 80 m and a reduced ammonia limit of 8 mg/Nm^3 is applied for. With this combination the change in impact at the Chesil and The Fleet SAC will be less than 1% of the appropriate Critical Level and Loads and screened out as 'not significant'. For the remainder of this report results are presented based on an 80 m high stack and a reduced ammonia limit of 8 mg/Nm^3.

Graph 7: Maximum N deposition impact at Chesil and The Fleet



NOTES: Assumes continual operation with a reduced ammonia ELV of 8 mg/Nm³, impacts calculated as the maximum across the site and presented as a percentage of the most stringent Critical Load identified in APIS – i.e. 8kgN/ha/yr

Graph 8: Maximum N deposition and ammonia impact at Isle of Portland to Studland Cliffs



NOTES: Assumes continual operation with a reduced ammonia ELV of 8 mg/Nm³, impacts calculated as the maximum across the site and presented as a percentage of the most stringent Critical Load identified in APIS – i.e. 15kgN/ha/yr for N deposition, and 1µg/m³ for ammonia

6 Sensitivity Analysis

6.1 Terrain and surface roughness

The sensitivity analysis would generally consider the effect of changing assumptions on surface roughness values and the treatment of terrain. In this instance the terrain and surface roughness features are significant and modelling without these would be considered inappropriate. A suitable grid and terrain resolution were chosen to ensure that the terrain features are captured in the modelling. Therefore, it has not been considered appropriate to undertake a sensitivity analysis of these parameters.

6.2 Operating below the design point

Dispersion modelling has been undertaken based on the emission parameters based on the design point for the Facility. The Facility is to be operated as a commercial plant, so it is beneficial to operate at full capacity. If loading does fall below the design point the volumetric flow rate and the exit velocity of the exhaust gases would reduce. The effect on this would be to decrease the quantity of pollutants emitted but also to reduce the buoyancy of the plume due to momentum. The reduction in buoyancy, which would lead to reduced dispersion, would be more than offset by the decrease in the amount of pollutants being emitted, so that the impact of the Facility when running below the design point would be reduced.

7 Impact on Human Health

7.1 At the point of maximum impact

Table 12 and Table 13 present the results of the dispersion modelling of process emissions from the Facility at the point of maximum impact. This is the maximum predicted concentration based on the following:

- Modelling domain size – 4.2 km x 3 km at 60 m resolution;
- Buildings – included;
- Terrain – included at 128 x 128 resolution;
- Stack height – 80 m;
- 5 years of weather data 2014 to 2018 from Portland meteorological recording station;
- Operation at the long term ELVs for 100% of the year;
- Operation at the short term ELVs during the worst-case conditions for dispersion of emissions (Table 13 only);
- Environment Agency's worst case conversion of oxides of nitrogen to nitrogen dioxide;
- The entire VOC emissions are assumed to consist of either benzene or 1,3-butadiene; and
- Cadmium is released at the combined emission limit for cadmium and thallium.

The baseline concentration is taken from the review of baseline monitoring contained in Appendix D.1 [Baseline Review].

Impacts that cannot be described as 'negligible' irrespective of the total concentration in accordance with the EPUK and IAQM 2017 criteria are highlighted. Where the impact cannot be screened out as 'negligible' irrespective of the total concentration, further analysis has been undertaken.

Table 12: Point of maximum Impact - daily ELVs

Pollutant	Quantity	Units	AQAL	Bg Conc.	PC at Point of Maximum Impact						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2014	2015	2016	2017	2018	Max			
Nitrogen dioxide	Annual mean	µg/m³	40	22.02	0.68	0.77	0.71	0.70	0.55	0.77	1.93%	22.79	56.98%
	99.79th%ile of hourly means	µg/m³	200	44.04	7.74	8.14	7.99	7.19	8.38	8.38	4.19%	52.42	26.21%
Sulphur dioxide	99.18th%ile of daily means	µg/m³	125	6.64	1.80	2.25	1.73	1.92	2.38	2.38	1.91%	9.02	7.22%
	99.73rd%ile of hourly means	µg/m³	350	6.64	5.20	5.73	5.52	4.94	5.93	5.93	1.69%	12.57	3.59%
	99.9th%ile of 15 min. means	µg/m³	266	6.64	6.67	6.86	6.89	6.53	7.37	7.37	2.77%	14.01	5.27%
PM_{10}	Annual mean	µg/m³	40	14.74	0.04	0.05	0.04	0.04	0.03	0.05	0.11%	14.79	36.96%
	90.4th%ile of daily means	µg/m³	50	29.48	0.13	0.14	0.13	0.13	0.11	0.14	0.28%	29.62	59.24%
$PM_{2.5}$	Annual mean	µg/m³	25	8.68	0.04	0.05	0.04	0.04	0.03	0.05	0.18%	8.73	34.90%
Carbon monoxide	8 hour running mean	µg/m³	10,000	418	8.58	8.16	8.73	7.04	8.99	8.99	0.09%	426.99	4.27%
	Hourly mean	µg/m³	30,000	418	14.34	11.76	14.61	14.20	14.49	14.61	0.05%	432.61	1.44%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	1.72	1.41	1.75	1.70	1.74	1.75	0.23%	3.17	0.42%
Hydrogen fluoride	Annual mean	µg/m³	16	2.35	0.01	0.01	0.01	0.01	0.01	0.01	0.06%	2.36	14.74%
	Hourly mean	µg/m³	160	4.7	0.29	0.24	0.29	0.28	0.29	0.29	0.18%	4.99	3.12%
Ammonia	Annual mean	µg/m³	180	0.82	0.07	0.07	0.07	0.07	0.05	0.07	0.04%	0.89	0.50%
	Hourly mean	µg/m³	2,500	1.64	2.29	1.88	2.34	2.27	2.32	2.34	0.09%	3.98	0.16%

Pollutant	Quantity	Units	AQAL	Bg Conc.	PC at Point of Maximum Impact						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2014	2015	2016	2017	2018	Max			
VOCs (as benzene)	Annual mean	µg/m³	5	0.27	0.08	0.09	0.08	0.08	0.07	0.09	1.84%	0.36	7.24%
	Hourly mean	µg/m³	195	0.54	2.87	2.35	2.92	2.84	2.90	2.92	1.50%	3.46	1.77%
VOCs (as 1,3-butadiene)	Annual mean	µg/m³	2.25	0.09	0.08	0.09	0.08	0.08	0.07	0.09	4.08%	0.18	8.08%
Mercury	Annual mean	ng/m³	250	2.8	0.16	0.18	0.17	0.17	0.13	0.18	0.07%	2.98	1.19%
	Hourly mean	ng/m³	7500	5.6	5.74	4.70	5.84	5.68	5.80	5.84	0.08%	11.44	0.15%
Cadmium	Annual mean	ng/m³	5	0.57	0.16	0.18	0.17	0.17	0.13	0.18	3.67%	0.75	15.07%
	Hourly mean	ng/m³	-	1.14	5.74	4.70	5.84	5.68	5.80	5.84	-	6.98	-
PAHs	Annual mean	pg/m³	200	980	0.85	0.96	0.88	0.87	0.68	0.96	0.39%	980.96	392.39%
Dioxins	Annual mean	fg/m³	-	32.99	0.49	0.55	0.50	0.50	0.39	0.55	-	33.54	-
PCBs	Annual mean	ng/m³	250	0.13	0.04	0.05	0.04	0.04	0.03	0.05	0.02%	0.17	0.09%
	Hourly mean	ng/m³	6000	0.26	1.43	1.18	1.46	1.42	1.45	1.46	0.02%	1.72	0.03%
Other metals	Annual mean	ng/m³	-	-	2.44	2.75	2.51	2.48	1.95	2.75	See metals assessment – Section 7.6		
	Hourly mean	ng/m³	-	-	86.05	70.53	87.64	85.17	86.96	87.64			

Note:

All assessment is based on the maximum PC using all 5 years of weather data.

Table 13: Point of maximum impact - short-term ELVs

Pollutant	Quantity	Units	AQAL	Bg Conc.	PC (PC) at Point of Maximum Impact						Max as % of AQAL	PEC (PC +Bg)	PEC as % of AQAL
					2014	2015	2016	2017	2018	Max			
Nitrogen dioxide	99.79th%ile of hourly means	µg/m³	200	44.04	73.73	77.54	76.08	68.46	79.84	79.84	39.92%	123.88	61.94%
Sulphur dioxide	99.73rd%ile of hourly means	µg/m³	350	6.64	34.67	38.19	36.81	32.91	39.53	39.53	11.29%	46.17	13.19%
	99.9th%ile of 15 min. means	µg/m³	266	6.64	44.43	45.70	45.93	43.50	49.16	49.16	18.48%	55.80	20.98%
Carbon monoxide	8 hour running mean	µg/m³	10,000	418	25.74	24.47	26.18	21.13	26.97	26.97	0.27%	444.97	4.45%
	Hourly mean	µg/m³	30,000	418	43.02	35.27	43.82	42.59	43.48	43.82	0.15%	461.82	1.54%
Hydrogen chloride	Hourly mean	µg/m³	750	1.42	17.21	14.11	17.53	17.03	17.39	17.53	2.34%	18.95	2.53%
Hydrogen fluoride	Hourly mean	µg/m³	160	4.7	1.15	0.94	1.17	1.14	1.16	1.17	0.73%	5.87	3.67%
VOCs (as benzene)	Hourly mean	µg/m³	195	0.54	5.74	4.70	5.84	5.68	5.80	5.84	3.00%	6.38	3.27%
Mercury	Hourly mean	ng/m³	7,500	5.6	10.04	8.23	10.22	9.94	10.15	10.22	0.14%	15.82	0.21%

Note:
All assessment is based on the maximum PC using all 5 years of weather data and operation at the short-term ELVs.

As shown, the maximum impact of the Facility is less than 10% of the short-term AQAL and less than 0.5% of the annual mean AQAL and can be screened out as 'negligible' irrespective of the total concentrations in accordance with the IAQM 2017 guidance, with the exception of the following:

- Annual mean nitrogen dioxide impacts;
- Annual mean VOCs impacts;
- Annual mean cadmium impact;
- 99.79th percentile of 1-hour nitrogen dioxide impacts assuming operation at the half-hourly ELV;
- 99.73rd percentile of 1-hour mean sulphur dioxide assuming operation at the half-hourly ELV; and
- 99.9th percentile of 15-minute mean sulphur dioxide assuming operation at the half-hourly ELV.

7.2 Further analysis – annual mean nitrogen dioxide

The above analysis does not account for any difference in the spatial distribution of impacts. Therefore, additional consideration has been made to the spatial distribution of the annual mean nitrogen dioxide impacts.

The point of maximum impact is located in the sea to the north-east of the Facility. This is not in an area of relevant exposure where the annual mean AQAL applies. The following table provides a breakdown of the maximum impact on any grid point identified as land, and within an area of residential properties. This is calculated as the maximum over the 5 years of weather data.

Table 14: Annual mean nitrogen dioxide further analysis

Area	Maximum PC		PEC (PC +Bg)	
	µg/m³	as % of AQAL	µg/m³	as % of AQAL
Max any point	0.77	1.93%	22.79	56.98%
Land	0.76	1.91%	22.78	56.96%
Residential	0.39	0.97%	22.41	56.02%

As shown, the point of maximum impact does not occur at any point of relevant exposure. The maximum impact at a residential property is less than 1% of the AQAL.

7.3 Further analysis – annual mean VOCs

There are two VOCs for which an AQAL has been set: benzene and 1,3-butadiene. For the purpose of this analysis it has been assumed that the entire VOC emissions consist of only benzene or 1,3-butadiene. This is a highly conservative assumption as it does not take into account the speciation of VOCs in the emissions and the modelling does not take into account the volatile nature of the compounds.

The maximum PC from the Facility is predicted to be 1.84% of the AQAL for benzene and 4.08% of the AQAL for 1,3-butadiene at the point of maximum impact. However, this occurs in the sea to the north-east of the Facility. This is not in an area of relevant exposure where the annual mean AQAL applies. The following table provides a breakdown of the maximum impact on any grid point identified as land, and within an area of residential properties. This is calculated as the maximum over the 5 years of weather data.

Table 15: Annual mean VOC further analysis

Area	Maximum PC		PEC (PC +Bg)	
	µg/m³	as % of AQAL	µg/m³	as % of AQAL
Benzene				
Max any point	0.092	1.84%	0.36	7.24%
Land	0.091	1.82%	0.36	7.22%
Residential	0.05	0.92%	0.32	6.32%
1,3-butadiene				
Max any point	0.092	4.08%	0.18	8.08%
Land	0.091	4.04%	0.18	8.04%
Residential	0.05	2.05%	0.14	6.05%

As shown the point of maximum impact does not occur at any point of relevant exposure.

7.4 Further analysis – annual mean cadmium

The annual mean cadmium PC from the Facility is predicted to be 3.67% of the AQAL. However, this assumes that the entire cadmium and thallium emissions consist of only cadmium. The Waste Incineration BREF shows that the average concentration recorded from UK plants equipped with bag filters was 1.6 µg/Nm^3 (or 8% of the ELV of 0.02 mg/Nm^3), the highest recorded concentration of cadmium and thallium was 14 µg/Nm^3 (or 70% of the ELV of 0.02 mg/Nm^3) and only three lines recorded concentrations higher than 10 µg/Nm^3 (or 50% of the ELV of 0.02mg/Nm^3).

Table 16shows the annual mean cadmium PC at the point of maximum impact, and the maximum in an area of residential properties, for cadmium emitted at 100%, 50% and 8% of the ELV, referred to as the 'screening', 'worst case' and 'typical' scenarios. Figure 7 of Annex A shows the spatial distribution of emissions assuming cadmium is emitted at 8% of the combined cadmium and thallium emission limit.

Table 16: Annual mean cadmium further analysis

Area	Maximum PC		PEC (PC +Bg)	
	ng/m³	as % of AQAL	ng/m³	as % of AQAL
Screening – 100% of the ELV				
Max any point	0.184	3.67%	0.75	15.07%
Land	0.182	3.64%	0.752	15.04%
Residential	0.092	1.84%	0.662	13.24%
Worst-case – 50% of the ELV				
Max any point	0.092	1.84%	0.17	3.50%
Land	0.091	1.82%	0.661	13.22%
Residential	0.046	0.92%	0.616	12.32%

Area	Maximum PC		PEC (PC +Bg)	
	ng/m^3	as % of AQAL	ng/m^3	as % of AQAL
Typical – 8% of the ELV				
Max any point	0.015	0.29%	46.17	923.33%
Land	0.015	0.29%	0.585	11.69%
Residential	0.007	0.15%	0.577	11.55%

7.5 Further analysis – short term impact

If it assumed that the Facility operates at the half hourly ELVs set in the IED, the 1-hour nitrogen dioxide, and 1-hour and 15-minute sulphur dioxide impacts, exceed 10% of the relevant AQALs at the point of maximum impact. However, this assumes that the Facility operates at the half-hourly ELVs during the worst-case weather conditions for dispersion. This is a highly conservative assumption. The half-hourly ELV is that from the IED. The BREF introduces a lower daily limit for oxides of nitrogen and sulphur dioxide. The IED half-hourly limit for oxides of nitrogen is 2 times the daily limit, whilst the half-hourly limit for sulphur dioxide is 4 times the daily limit. With the reduced ELVs the half-hourly limit is 3.3 times the daily ELV for oxides of nitrogen, and 6.7 times the daily ELV for sulphur dioxide. Therefore, it is unlikely that peaks in short term emissions would be this high given that a lower daily ELV needs to be achieved.

The half-hourly ELV in the IED is 2 times the daily ELV for oxides of nitrogen and 4 times the daily ELV for sulphur dioxide. The following table applies the same ratio to the emissions from the Facility.

Table 17: Short term impacts further analysis

Area	Maximum PC – assuming at IED half-hourly ELV		Maximum PC – assuming at same ratio of half-hourly to daily ELV is applied to the BAT AEL	
	$\mu g/m^3$	as % of AQAL	$\mu g/m^3$	as % of AQAL
99.79^{th} percentile of 1-hour nitrogen dioxide				
Max any point	27.94	13.97%	16.77	8.38%
Land	27.94	13.97%	16.77	8.38%
Residential	27.92	13.96%	16.75	8.38%
99.73^{rd} percentile of 1-hour sulphur dioxide				
Max any point	39.53	11.29%	23.72	6.78%
Land	39.53	11.29%	23.72	6.78%
Residential	39.53	11.29%	23.72	6.78%
99.9^{th} percentile of 15-min sulphur dioxide				
Max any point	49.16	18.48%	29.50	11.09%
Land	49.16	18.48%	29.50	11.09%
Residential	46.94	17.65%	28.16	10.59%

As shown, if this same ratio is applied to the emissions from the Facility and it is assumed that the Facility operates at this level during the worst-case meteorological conditions for dispersion the maximum 1-hour impact of nitrogen dioxide and sulphur dioxide is less than 10% of the AQAL. The maximum impact of 15-minute sulphur dioxide emissions remains slightly above 10% of the AQAL.

7.6 Heavy metals – at the point of maximum impact

Detailed results tables showing the process contribution and PEC are provided in Table 18 and Table 19. These tables present the result assuming that each metal is released at the combined long and short-term metal ELVs respectively. If the PC is greater than 1% of the AQAL when it is assumed that each metal is emitted at the total metal ELV, further analysis has been undertaken assuming the release is no greater than the maximum monitored at an existing waste facility. The Environment Agency metals guidance details the maximum monitored concentrations of group 3 metals emitted by Municipal Waste Incinerators and Waste Wood Co-Incinerators as a percentage of the group ELV. The maximum monitored emission presented in the Environment Agency's analysis has been used as a conservative assumption.

As shown, if it is assumed that the entire emissions of metals consist of only one metal, the impact of the Facility is generally less than 1% of the long term and less than 10% of the short term AQAL, with the exception of annual mean impacts of arsenic, chromium (VI), lead, manganese and nickel. The PEC is only predicted to exceed the long term AQAL for arsenic and chromium (VI) using this worst-case screening assumption. If it is assumed that the Facility would perform no worse than a currently operating facility, the PC is below 1% of the long term and 10% of the short term AQAL for all pollutants with the exception of annual mean arsenic and nickel. However, in both instances the PEC is well below the AQAL.

Table 18: Long-Term metals results

Metal	AQAL	Background conc.	Metals emitted at combined metal limit				Metal as % of ELV [(1)]	Metals emitted no worse than a currently permitted facility			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	3	1.10	2.75	91.79%	3.85	128.45%	8.3%	0.23	7.65%	1.33	44.32%
Antimony	5,000	-	2.75	0.06%	-	-	3.8%	0.11	0.002%	-	-
Chromium	5,000	39.00	2.75	0.06%	41.75	0.84%	30.7%	0.84	0.02%	39.84	0.80%
Chromium (VI)	0.2	7.80	2.75	1376.8%	10.55	5276.8%	0.043%	0.00	0.60%	7.80	3901%
Cobalt	-	0.92	2.75	-	3.67	-	1.9%	0.05	-	0.97	-
Copper	10,000	33.00	2.75	0.03%	35.75	0.36%	9.7%	0.27	0.003%	33.27	0.33%
Lead	250	9.80	2.75	1.10%	12.55	5.02%	16.8%	0.46	0.18%	10.03	4.01%
Manganese	150	36.00	2.75	1.84%	38.75	25.84%	20.0%	0.55	0.37%	36.55	24.37%
Nickel	20	2.70	2.75	13.77%	5.45	27.27%	73.3%	2.02	10.10%	4.72	23.60%
Vanadium	5,000	1.70	2.75	0.06%	4.45	0.09%	2.0%	0.06	0.001%	1.76	0.04%

Notes:
(1) Metal as maximum percentage of the group 3 BAT-AEL, as detailed in Environment Agency metals guidance document (V.4) Table A1.

Table 19: Short-Term metals results

Metal	AQAL	Background conc.	Metals emitted at combined metal limit				Metal as % of ELV (1)	Metals emitted no worse than a currently permitted facility			
			PC		PEC			PC		PEC	
	ng/m³	ng/m³	ng/m³	as % AQAL	ng/m³	as % AQAL		ng/m³	as % AQAL	ng/m³	as % AQAL
Arsenic	-	2.20	104.54	-	4.95	-	8.3%	8.71	-	10.91	-
Antimony	150,000	-	104.54	0.07%	-	-	3.8%	4.01	0.003%	-	-
Chromium	150,000	78.00	104.54	0.07%	80.75	0.05%	30.7%	32.06	0.02%	110.06	0.07%
Chromium (VI)	-	15.60	104.54	-	18.35	-	0.043%	0.05	-	15.65	-
Cobalt	-	1.84	104.54	-	4.59	-	1.9%	1.95	-	3.79	-
Copper	200,000	66.00	104.54	0.05%	68.75	0.03%	9.7%	10.11	0.005%	76.11	0.04%
Lead	-	19.60	87.64	-	22.35	-	16.8%	14.69	-	19.83	-
Manganese	1,500,000	72.00	104.54	0.01%	74.75	0.005%	20.0%	20.91	0.001%	92.91	0.006%
Nickel	-	5.40	104.54	-	8.15	-	73.3%	76.66	-	82.06	-
Vanadium	1,000	3.40	104.54	10.45%	6.15	0.62%	2.0%	2.09	0.209%	5.49	0.55%

Notes:
(1) Metal as maximum percentage of the group 3 BAT-AEL, as detailed in Environment Agency metals guidance document (V.4) Table A1.

8. Impact at Ecological Receptors

This section provides an assessment of the impact of emissions at the ecological receptors identified in Section 3.1.

8.1 Methodology

8.1.1 Atmospheric emissions - Critical Levels

The impact of emissions from the Facility have been modelled and the impact has been compared to the Critical Levels listed in Table 4 and the results are presented in Section 8.2.

If the PC is than 1% of the long-term or 10% of the short-term Critical Level further consideration will be made to the PEC and baseline concentrations. The baseline concentration used are those set out in the Appendix D.1 – Baseline Analysis.

8.1.2 Deposition of emissions - Critical Loads

In addition to the Critical Levels for the protection of ecosystems, habitat specific Critical Loads for nature conservation sites at risk from acidification and nitrogen deposition (eutrophication) are outlined in APIS.

An assessment has been made for each habitat feature identified in APIS for the specific site. The site specific features tool has been used to identify the feature habitats. The lowest Critical Loads for each designated site have been used to ensure a robust assessment.

If the impact of process emissions from the Facility upon nitrogen or acid deposition is greater than 1% of the Critical Load, further assessment has been undertaken.

8.1.3 Nitrogen deposition – eutrophication

Annex C summarises the Critical Loads for nitrogen deposition and background deposition rates as detailed in APIS for each identified receptor. The impact has been assessed against these Critical Loads for nitrogen deposition.

8.1.4 Acidification

The APIS Database contains a maximum critical load for sulphur (CLmaxS), a minimum Critical Load for nitrogen (CLminN) and a maximum Critical Load for nitrogen (CLmaxN). These components define the Critical Load function. Where the acid deposition flux falls within the area under the Critical Load function, no exceedances are predicted.

A search has been undertaken for each of the ecological receptors identified. Each site contains a number of habitat types, each with different Critical Loads. Annex C summaries the Critical Loads for acidification and background deposition rates as detailed in APIS for each identified habitat. The lowest Critical Loads for each designated site have been used to ensure a robust assessment, except where stated. The impact has been assessed against these Critical Load functions. Where a Critical Load function for acid deposition is not available, the total nitrogen and sulphur deposition has been presented.

8.1.5 Calculation methodology – nitrogen deposition

The impact of deposition has been assessed using the methodology detailed within the Habitats Directive AQTAG 6 (March 2014). The steps to this method are as follows.

1. Determine the annual mean ground level concentrations of nitrogen dioxide and ammonia at each site.
2. Calculate the dry deposition flux (µg/m^2/s) at each site by multiplying the annual mean ground level concentration by the relevant deposition velocity presented in Table 20.
3. Convert the dry deposition flux into units of kgN/ha/yr using the conversion factors presented in Table 20.
4. Compare this result to the nitrogen deposition Critical Load.

Table 20: Deposition factors

Pollutant	Deposition velocity (m/s)		Conversion factor (µg/m^2/s to kg/ha/year)
	Grassland	Woodland	
Nitrogen dioxide	0.0015	0.003	96.0
Sulphur dioxide	0.0120	0.024	157.7
Ammonia	0.0200	0.030	259.7
Hydrogen chloride	0.0250	0.060	306.7

Source: AQTAG 6 (March 2014)

8.1.5.1 Acidification

Deposition of nitrogen, sulphur, hydrogen chloride and ammonia can cause acidification and should be taken into consideration when assessing the impact of the Facility.

The steps to determine the acid deposition flux are as follows.

1. Determine the dry deposition rate in kg/ha/yr of nitrogen, sulphur, hydrogen chloride and ammonia using the methodology outlined in Section 8.1.5.
2. Apply the conversion factor for N outlined in Table 20 to the nitrogen and ammonia deposition rate in kg/ha/year to determine the total keq N/ha/year.
3. Apply the conversion factor for S to the sulphur deposition rate in kg/ha/year to determine the total keq S/ha/year.
4. Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the dry keq Cl/ha/year.
5. Determine the wet deposition rate of HCl in kg/ha/yr by multiplying the model output by the factors presented in Table 21.
6. Apply the conversion factor for HCl to the hydrogen chloride deposition rate in kg/ha/year to determine the wet keq Cl/ha/year.
7. Add the contribution from S to HCl dry and wet and treat this sum as the total contribution from S.
8. Plot the results against the Critical Load functions.

Table 21: Conversion factors

Pollutant	Conversion factor (kg/ha/year to keq/ha/year)
Nitrogen	Divide by 14
Sulphur	Divide by 16
Hydrogen chloride	Divide by 35.5

Source: AQTAG 6 (March 2014)

The March 2014 version of the AQTAG 6 document states that, for installations with an HCl emission, the PC of HCl, in addition to S and N, should be considered in the acidity Critical Load assessment. The H+ from HCl should be added to the S contribution (and treated as S in APIS tool). This should include the contribution of HCl from wet deposition.

Consultation with AQMAU confirmed that the maximum of the wet or dry deposition rate for HCl should be included in the calculation. For the purpose of this analysis it has been assumed that wet deposition of HCl is double dry deposition.

The contribution from the process emissions has been calculated using APIS formula:

Where PEC N Deposition < CLminN:

PC as % of CL function = PC S deposition / CLmaxS

Where PEC N Deposition > CLminN:

PC as % of CL function = (PC S + N deposition) / CLmaxN

8.2 Results

The impact of process emissions has been compared to the Critical Levels and Critical Loads. For the purpose of the ecological assessment, the mapped background dataset from APIS has been used. The PC has been calculated based on the maximum predicted using all five years of weather data. The predicted impact is based on the maximum across the ecological site.

Detailed results tables showing the impact of the Facility are provided in Annex B.

8.2.1 Analysis at European and UK designated sites

As shown in Annex B, the PC is less than 1% of the long term and less than 10% of the short term Critical Levels, and less than 1% of the Critical Loads at all European and UK designated sites with the exception of:

- Annual mean oxides of nitrogen impacts at Isle of Portland to Studland Cliffs (SAC and SSSI);
- Daily mean oxides of nitrogen impacts at Isle of Portland to Studland Cliffs (SAC and SSSI);
- Annual mean ammonia impacts at Isle of Portland to Studland Cliffs (SAC and SSSI) and Nicodemus Heights (SSSI);
- N deposition impacts at calcareous grasslands and broadleaved deciduous woodland at the Isle of Portland to Studland Cliffs (SAC and SSSI); and
- Acid deposition impacts at calcareous grasslands at the Isle of Portland to Studland Cliffs (SAC and SSSI) and acid grassland at Chesil and The Fleet (SAC and SSSI).

However, at all sites where the impact exceeds 1% of the long term or 10% of the short term Critical Level or Load the PEC is less than 70%. Further discussion of these impacts are provided in ES chapter 10.

8.2.2 Analysis at local sites

The impact at each local wildlife site is set out in Annex B. As shown, the PC is less than 1% of the long term and less than 10% of the short term Critical Levels, and less than 1% of the Critical Loads at all sites with the exception of:

- Annual mean and daily mean oxides of nitrogen impacts at Verne Yeates;
- Annual mean ammonia impacts all sites with the exception of Grove Quarry and East Weare Rifle Range assuming that the Critical Level for lichen sensitive communities applies at all sites; and
- Nitrogen and acid deposition at coastal stable dune grassland, and calcareous grassland at the Osprey Quay Bunds.

Further discussion of these impacts is contained in ES chapter 10.

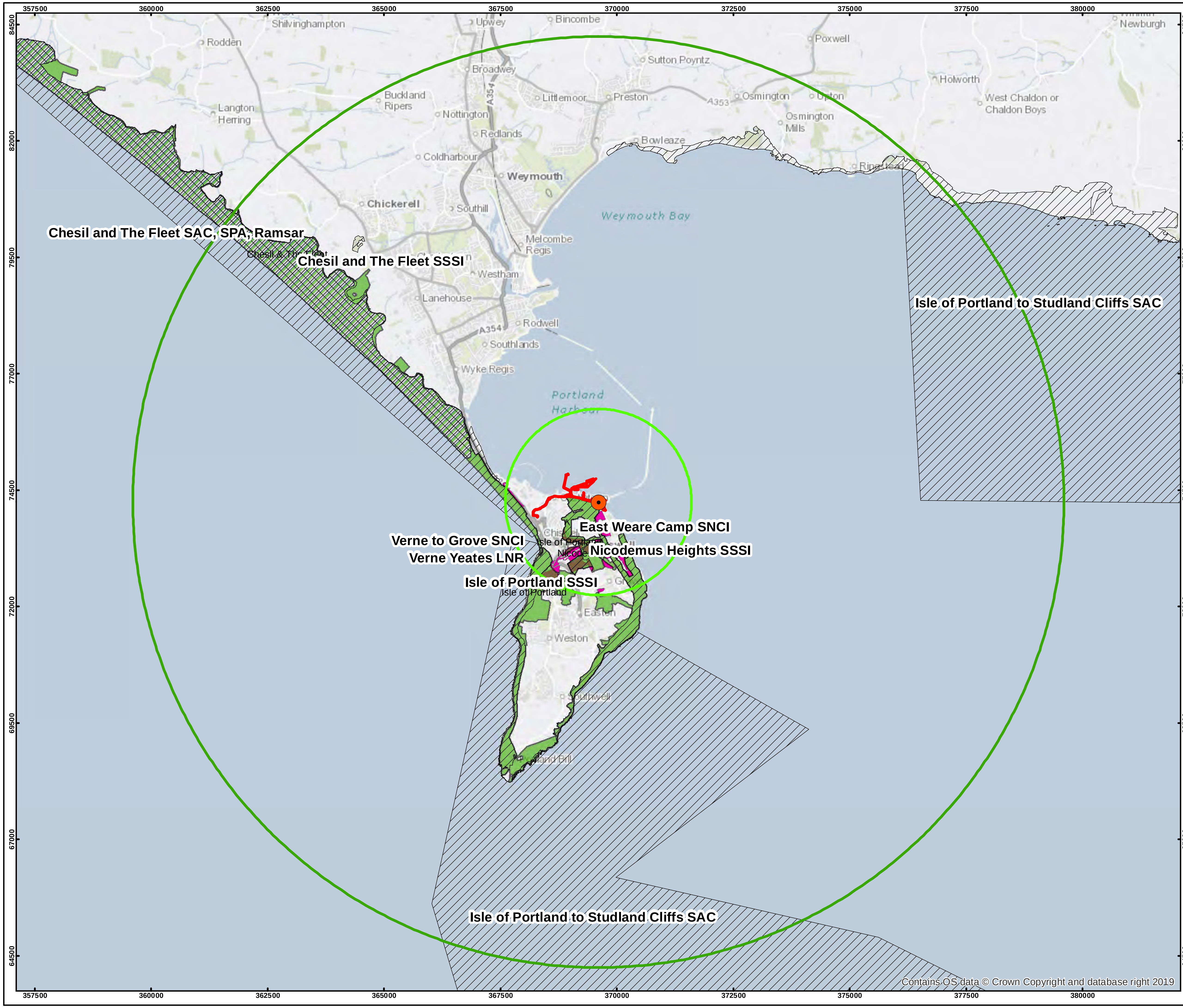
8.2.3 Spatial analysis of impacts at ecological sites

The following plot files have been produced to show the distribution of emissions across local area:

- Figure 11 - Annual mean oxides of nitrogen;
- Figure 12 - Daily mean oxides of nitrogen;
- Figure 13 - Annual mean sulphur dioxide;
- Figure 14 - Annual mean ammonia;
- Figure 15 - Weekly mean hydrogen fluoride;
- Figure 16 - Daily mean hydrogen fluoride; and
- Figure 17 - N deposition
- Figure 18 - Acid deposition

Annexes

A Figures



Legend

- Stack
- Site Boundary
- 10km stack buffer
- 2km stack buffer
- SAC within 10km
- Ramsar within 10km
- SPA within 10km
- SSSi within 2km
- Local Sites within 2km

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	

Figure 1 - Ecological Sensitive Receptors

Drawn by: Hannah Lederer | Date: 17/08/2020

0 0.75 1.5 3 km

Scale: 1:75,000

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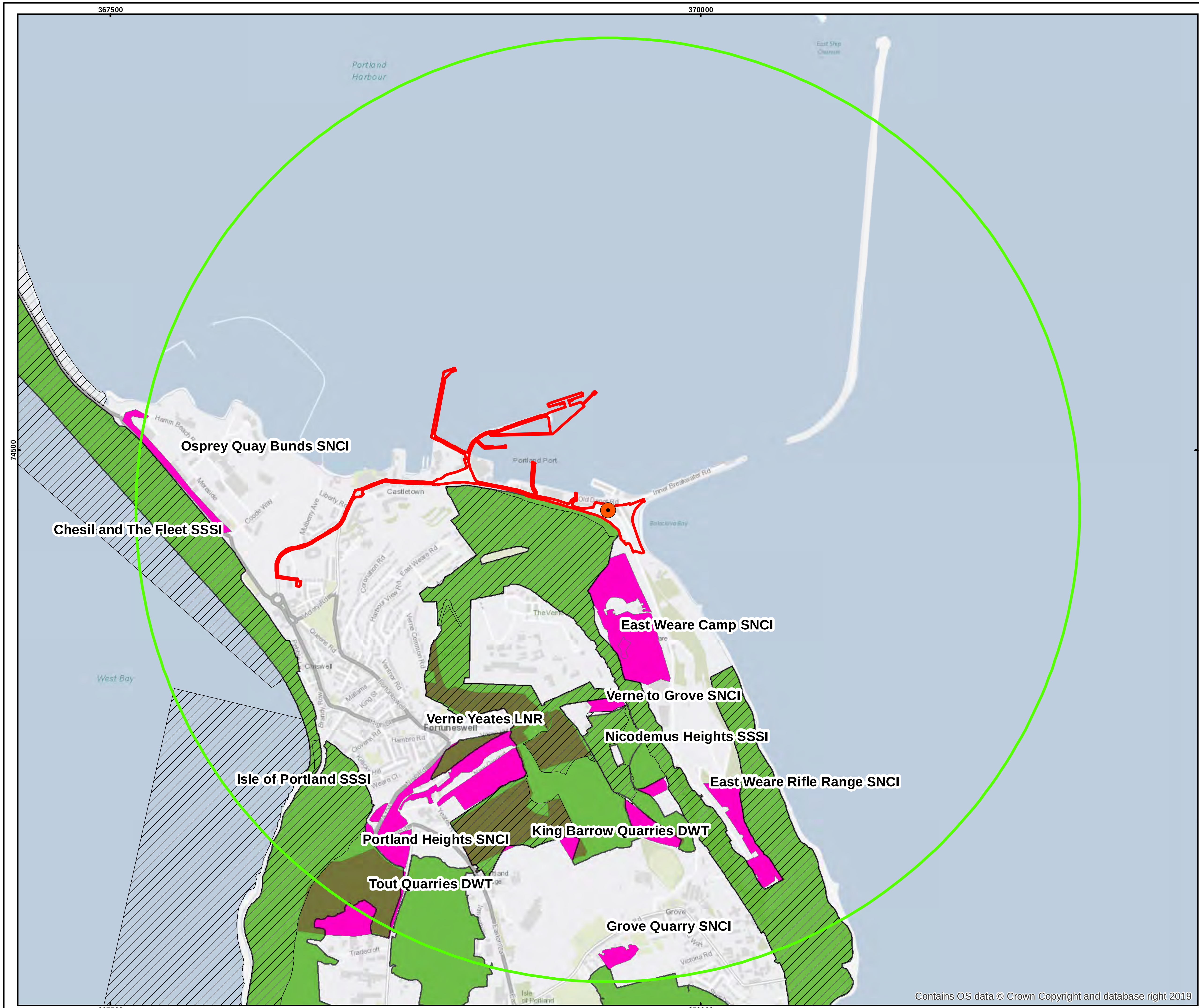
Kingsgate, Wellington Road North,
Stockport, Cheshire, SK4 1LW
Tel: 0161 476 0032
Fax: 0161 474 0618



Legend

- Stack
- Site Boundary
- 2km stack buffer
- SAC within 10km
- Ramsar within 10km
- SPA within 10km
- SSSis within 2km
- Local Sites within 2km

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 1A - Ecological Sensitive Receptors zoomed: SSSIs and Local sites within 2 km

Drawn by: Hannah Lederer | Date: 17/08/2020

0 0.15 0.3 0.6 km

Scale: 1:15,000

N

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Kingsgate, Wellington Road North,
Stockport, Cheshire, SK4 1LW
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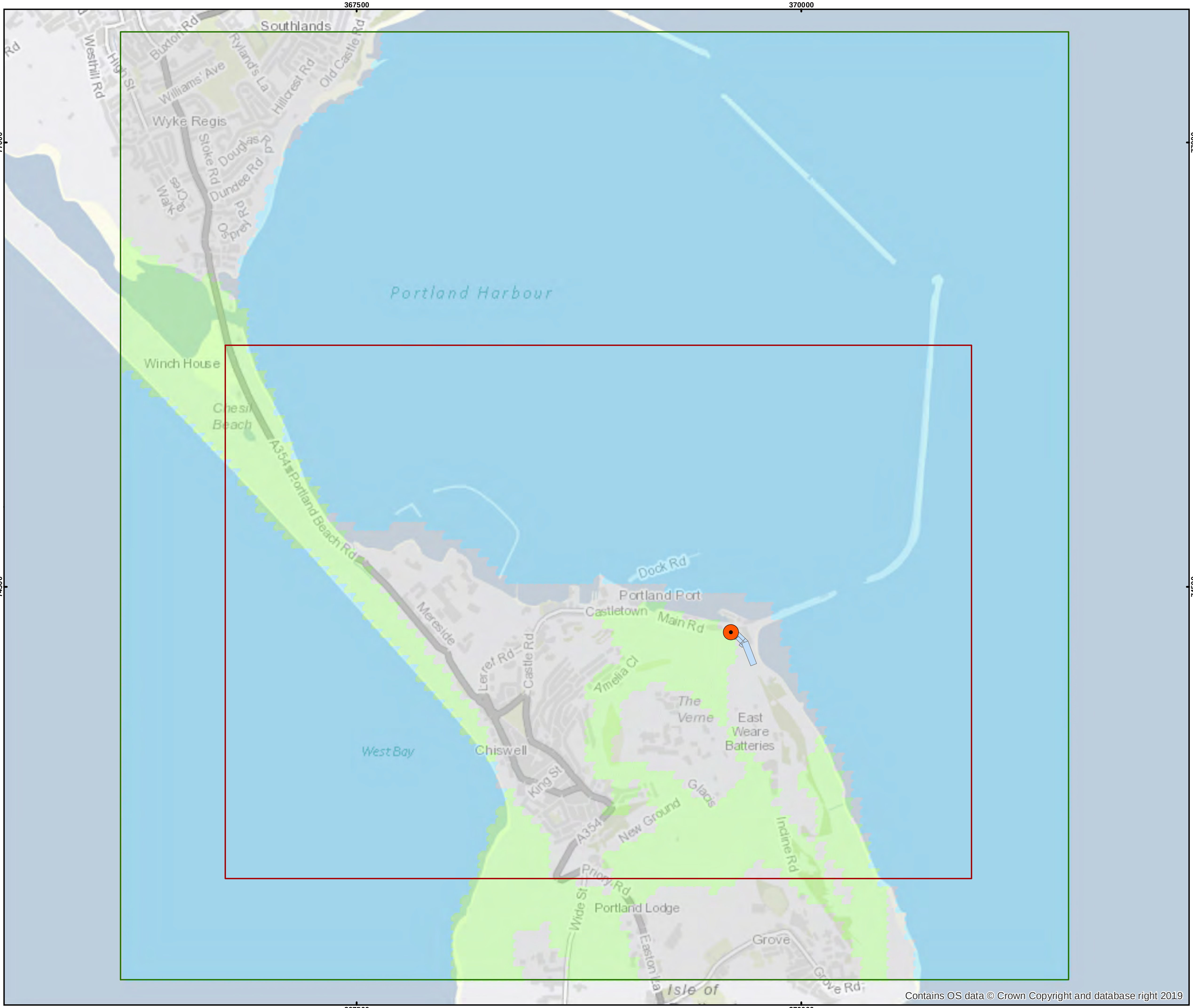
Fax: 0161 474 0618



Legend

- Stack
- Buildings
- Modelling Domain
- Extent of terrain and roughness files

Surface Roughness

- 0.0001
- 0.02
- 0.5

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 2 - Dispersion Model Inputs
Drawn by: Hannah Lederer	Date: 07/08/2020

0 0.2 0.4 0.8 km

Scale: 1:20,000

N

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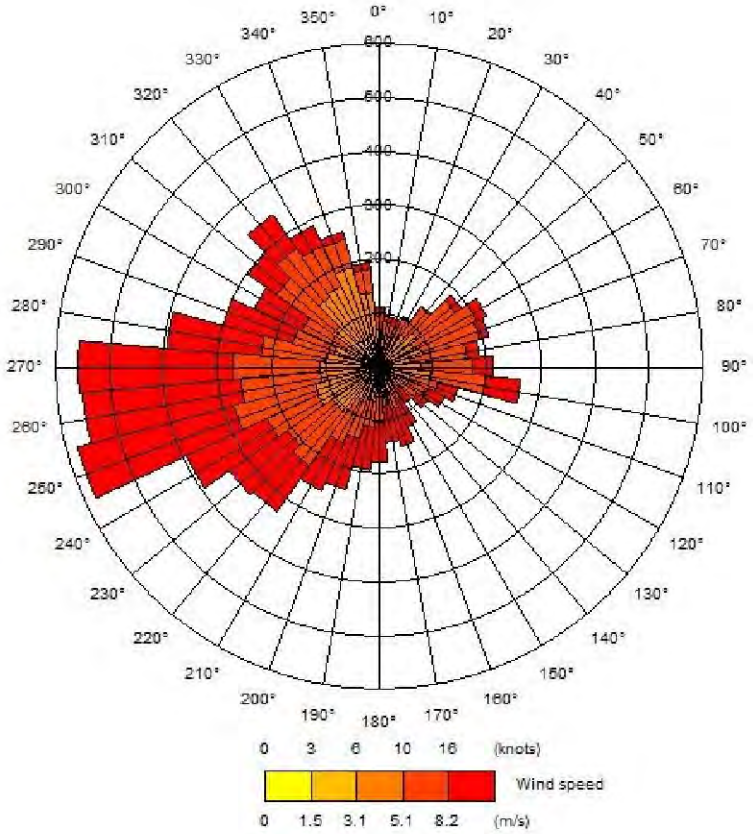
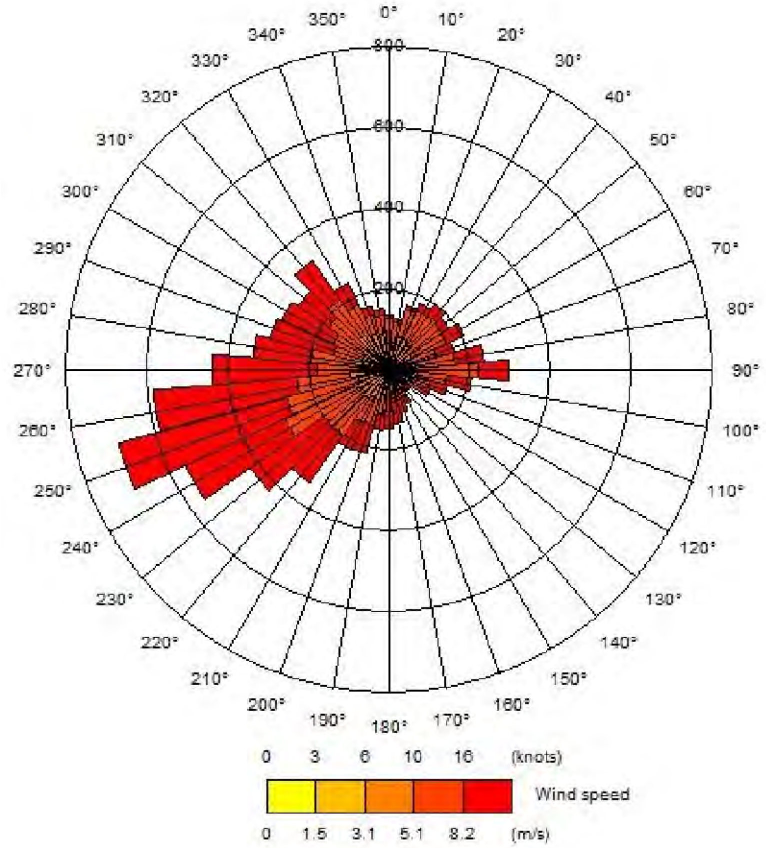
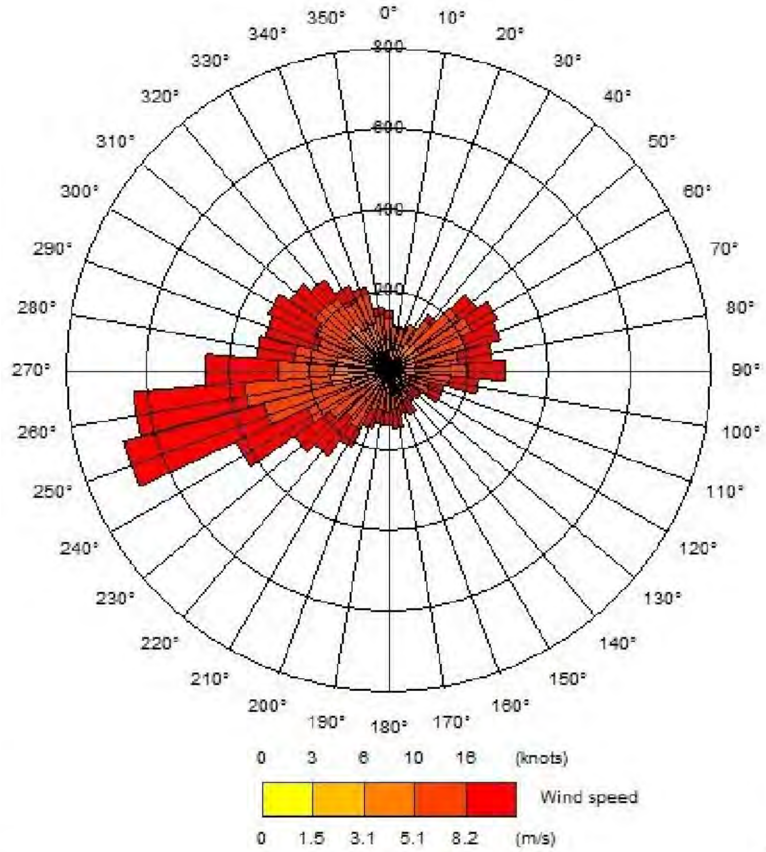
2014



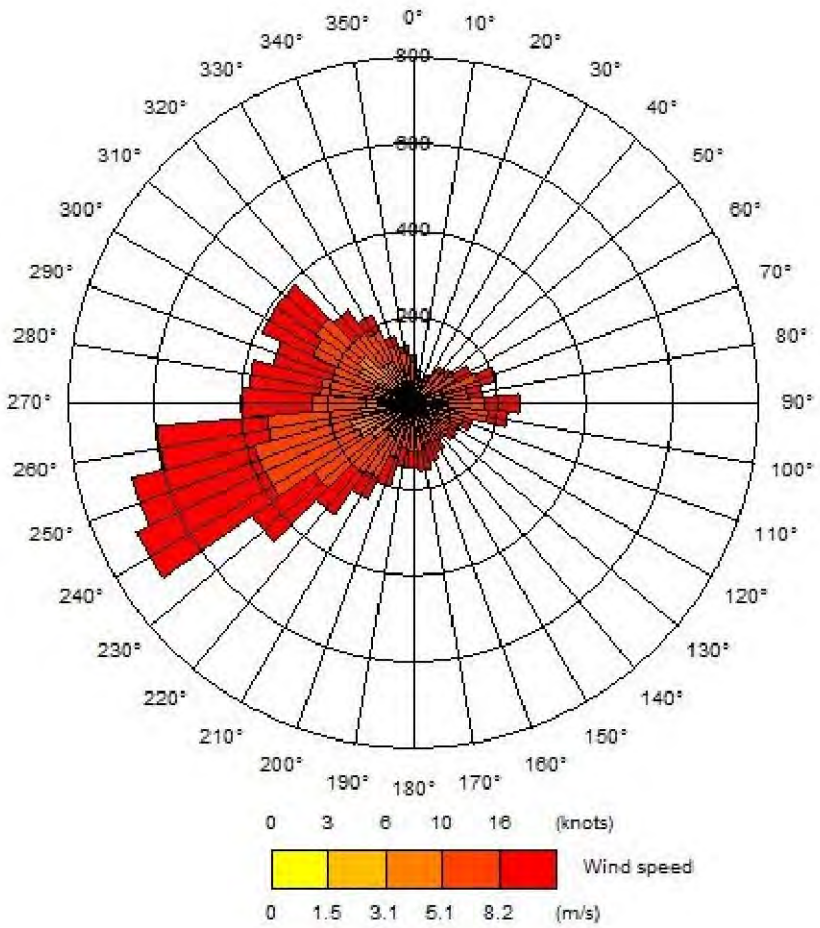
2015



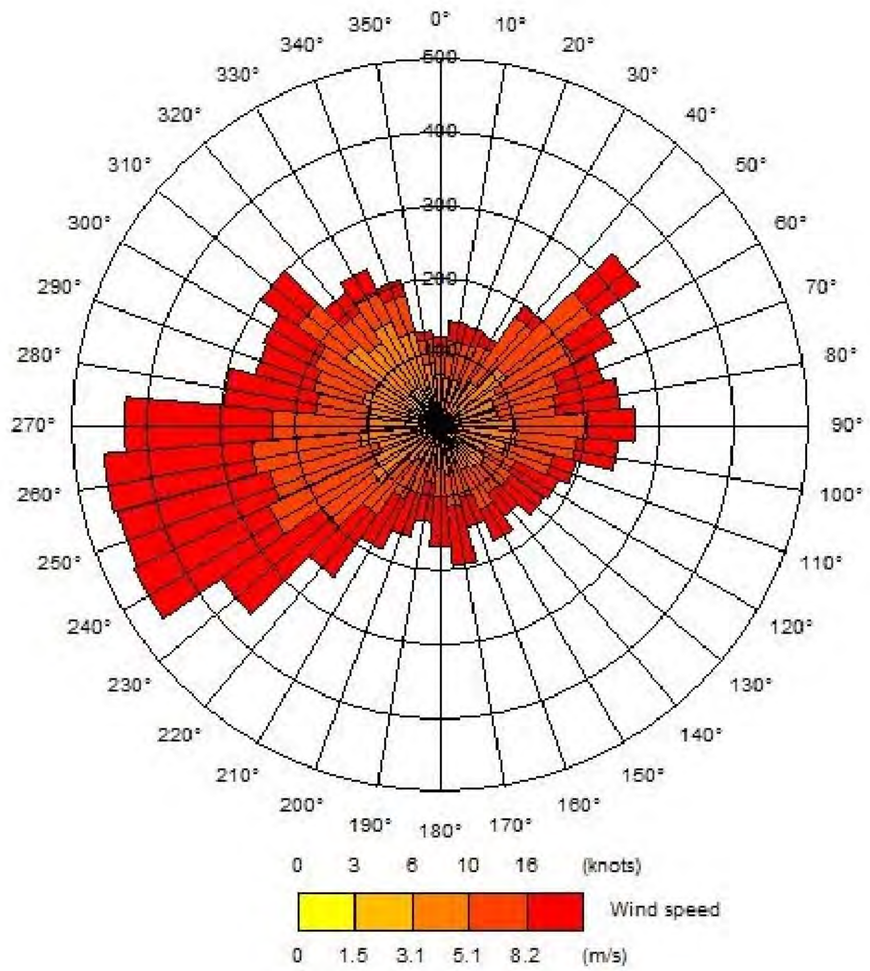
2016



2017



2018



Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 3 - Portland Wind Roses 2014-2018

Drawn by: Hannah Lederer	Date: 31/07/2020

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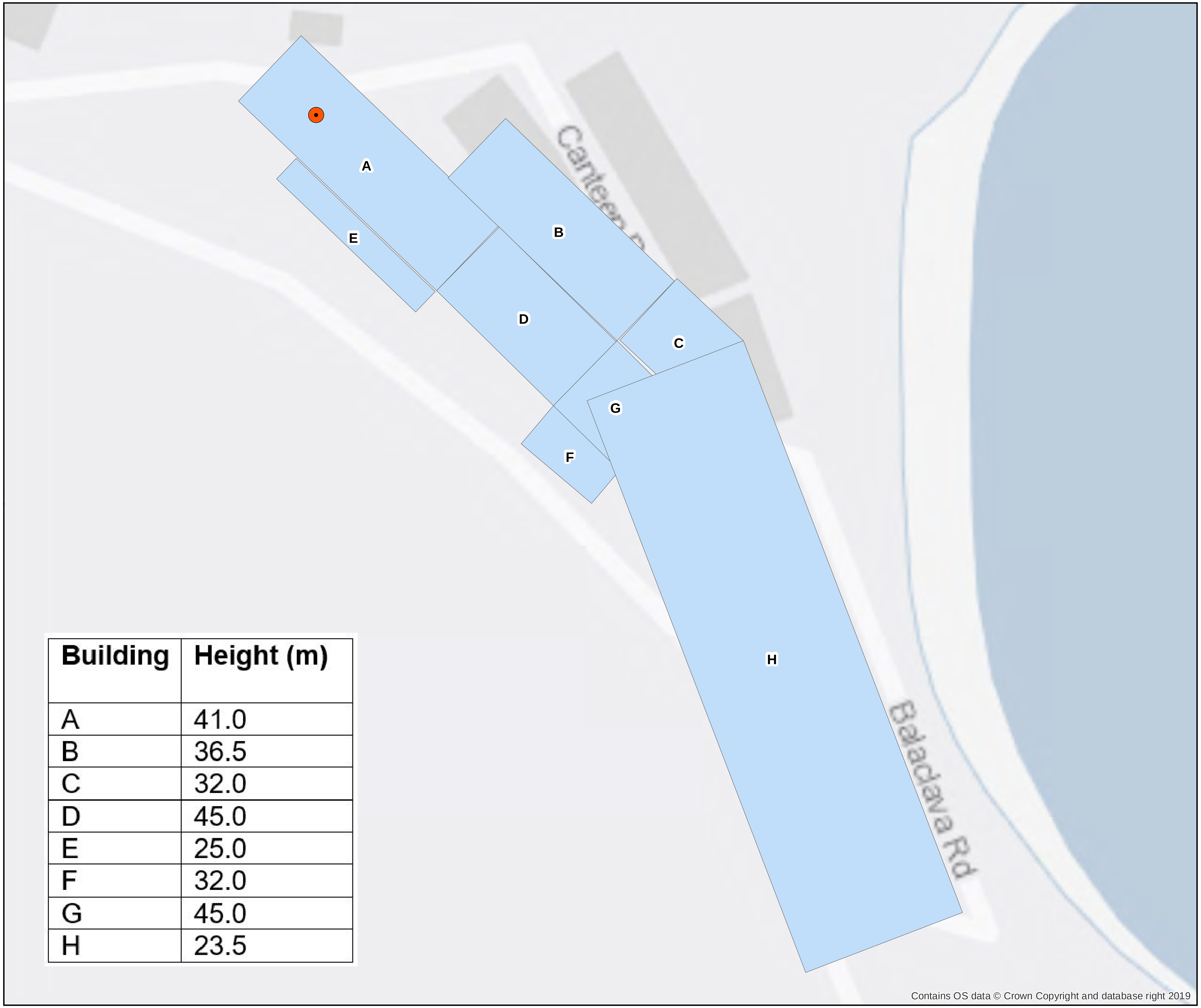


Building	Height (m)
A	41.0
B	36.5
C	32.0
D	45.0
E	25.0
F	32.0
G	45.0
H	23.5

Legend

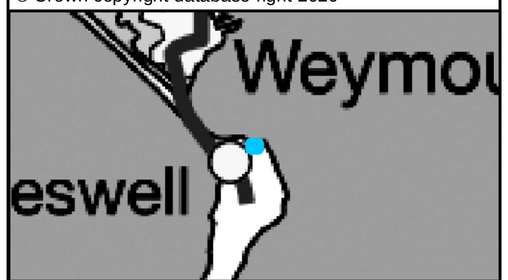
Stack

Buildings

Client: Powerfuel Ltd
Site: Portland EfW
Project: 2953
Title:

Figure 4 - Buildings Modelled

Drawn by: Hannah Lederer
Date: 07/08/2020



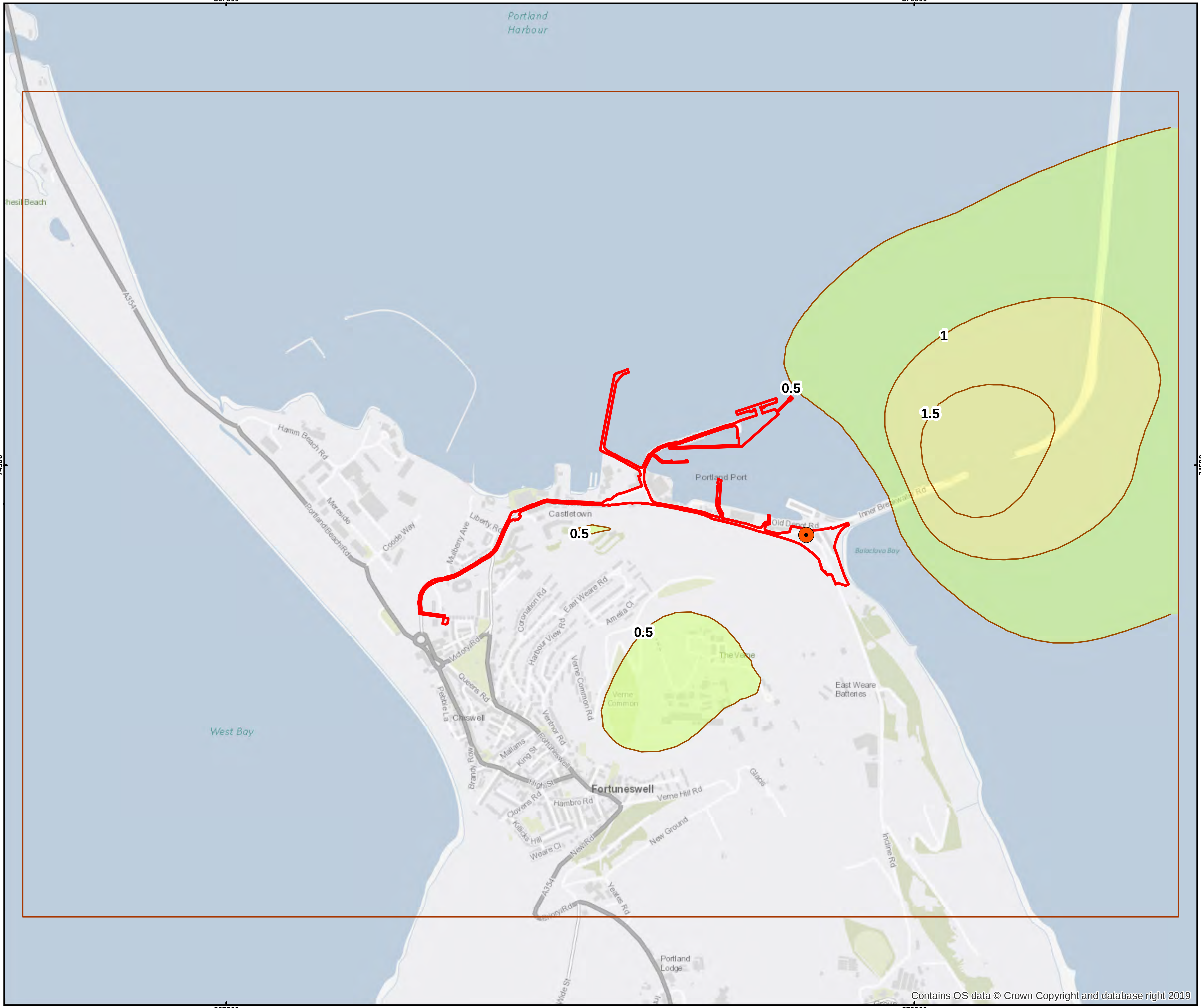
0 0.0075 0.015 0.03 km

Scale: 1:800

N

FICHTNER
Consulting Engineers Limited

Kingsgate, Wellington Road North,
Stockport, Cheshire, SK4 1LW
Tel: 0161 476 0032
Fax: 0161 474 0618

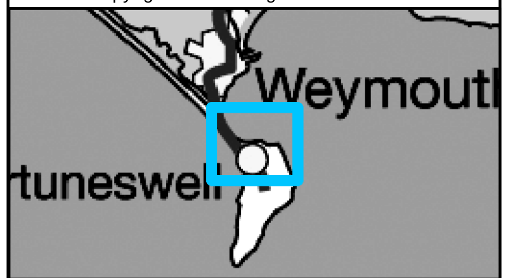


Legend

- Stack
- Site Boundary
- Modelling Domain
- PC of NO2 (as a % of AQAL)
- <1 % of AQAL
- 0.5 - 1% of AQAL
- >1 % of AQAL

Note: Based on 70% conversion of NOx to NO2

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	6.4 - Annual Mean Nitrogen Dioxide Analysis
Drawn by: Hannah Lederer	Date: 07/08/2020



0 0.125 0.25 0.5 km

Scale: 1:13,000

N

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Stockport, Cheshire, SK4 1LW
Tel: 0161 476 0032
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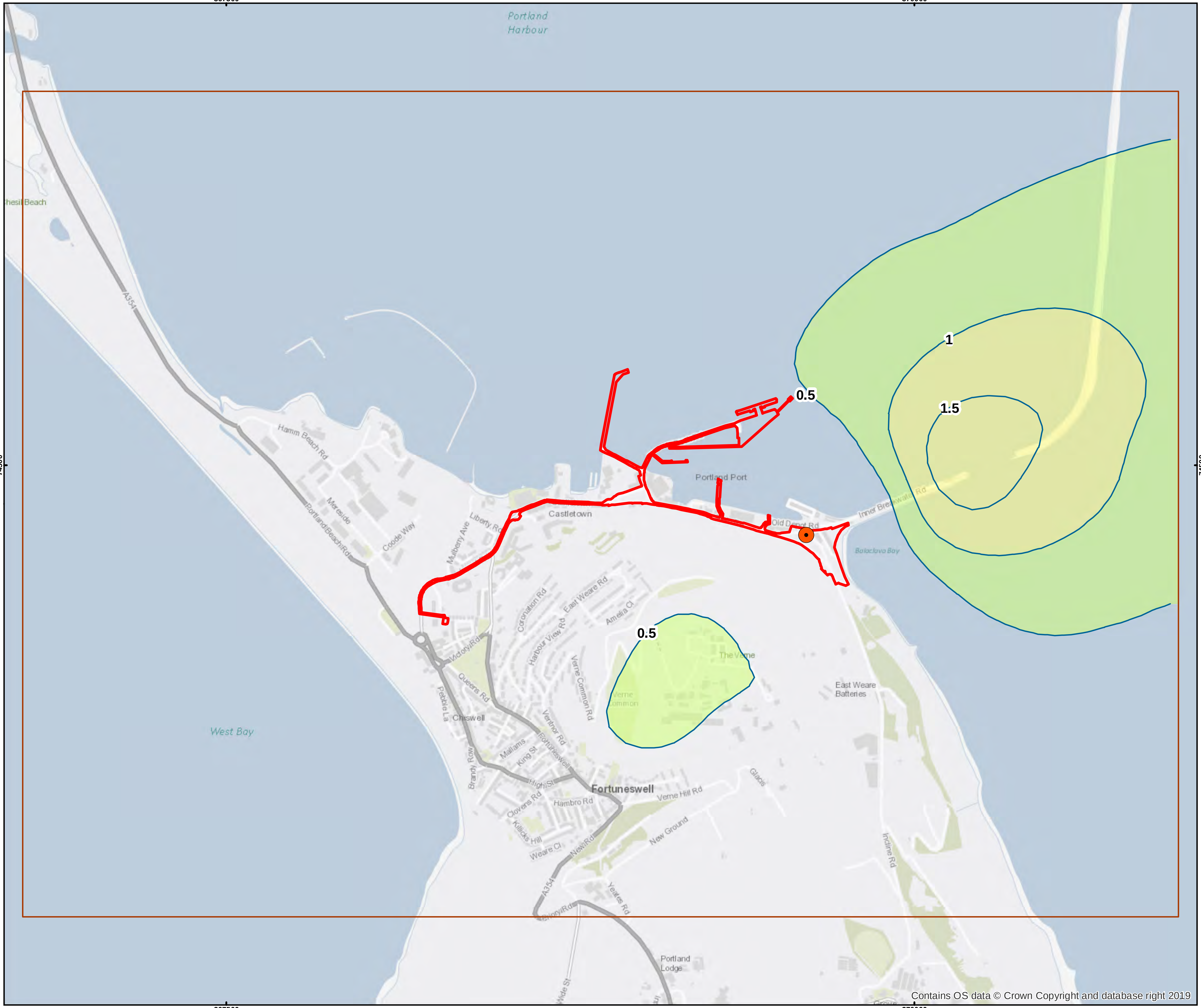


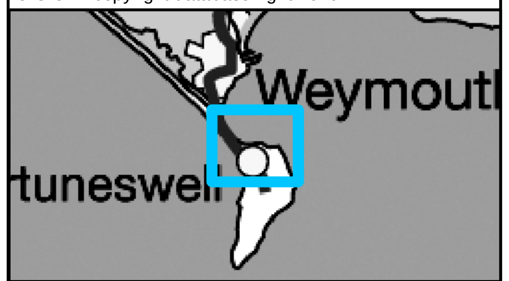
Legend

- Stack
- Site Boundary
- Modelling Domain
- Benzene as a % of AQAL
- <0.5 % of AQAL
- 0.5 - 1% of AQAL
- >1 % of AQAL

Note: Assumes 100% of VOCs emitted as benzene

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 6 - Annual Mean VOCs as Benzene Analysis

Drawn by: Hannah Lederer | Date: 07/08/2020



0 0.125 0.25 0.5 km

N

Scale: 1:13,000

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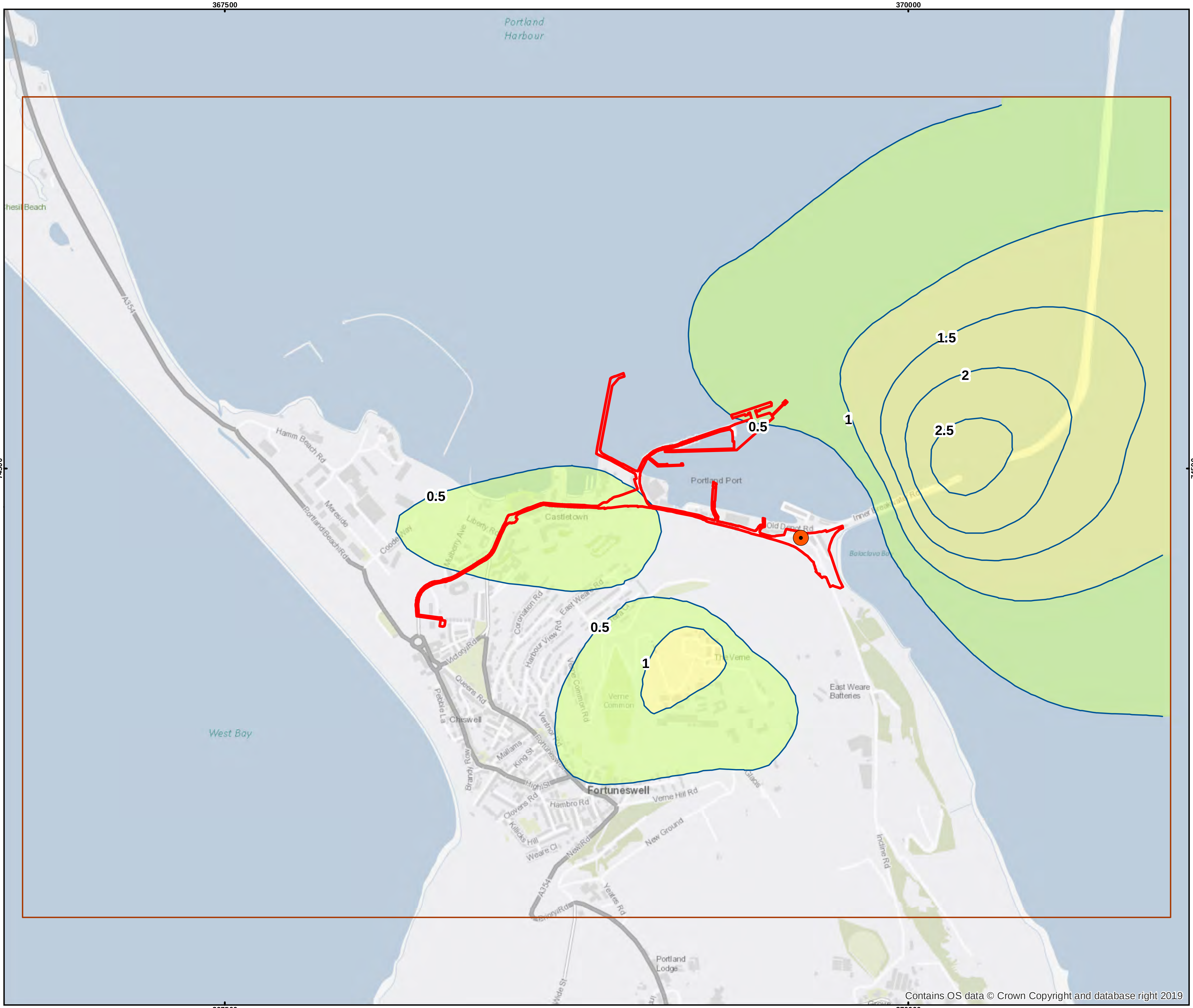


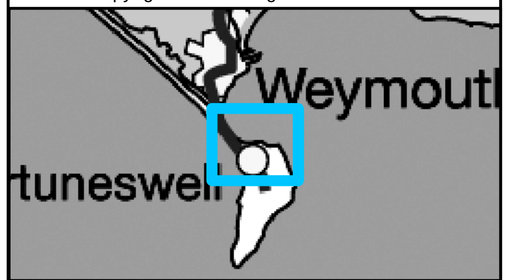
Legend

- Stack
- Site Boundary
- Modelling Domain
- PC of VOCs as 1,3-butadiene (as % of AQAL)
- <0.5% of AQAL
- 0.5 - 1% of AQAL
- >1% of AQAL

Note: Assumes 100% of VOCs emitted as 1,3-butadiene

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 7 - Annual Mean VOCs as 1,3-butadiene Analysis

Drawn by: Hannah Lederer | Date: 07/08/2020



0 0.125 0.25 0.5 km

N

Scale: 1:13,000

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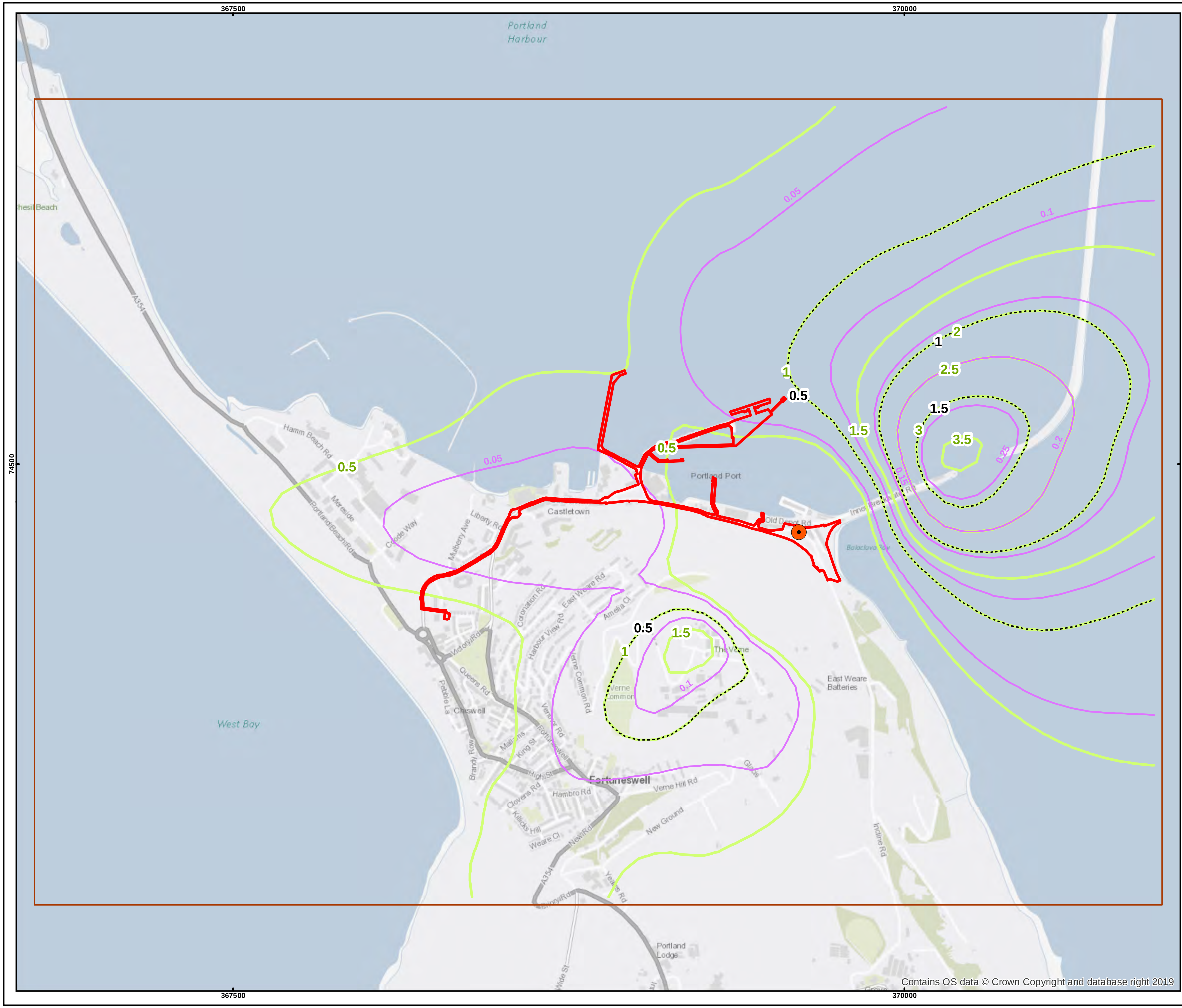
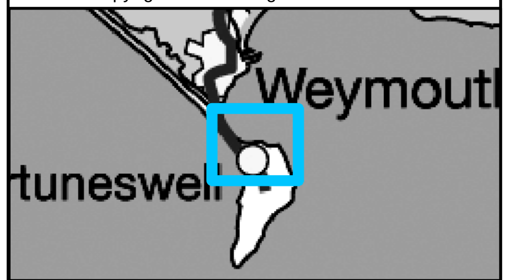


Legend

- Stack
- Site Boundary
- Modelling Domain
- Typical (8% of ELV) Cadmium as a % of AQAL
- Worst case (50% of ELV) Cadmium as a % of AQAL
- Screening (100% of ELV) Cadmium as a % of AQAL

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 8 - Annual Mean Cadmium Analysis
Drawn by: Hannah Lederer	Date: 07/08/2020



0 0.125 0.25 0.5 km

N

Scale: 1:13,000

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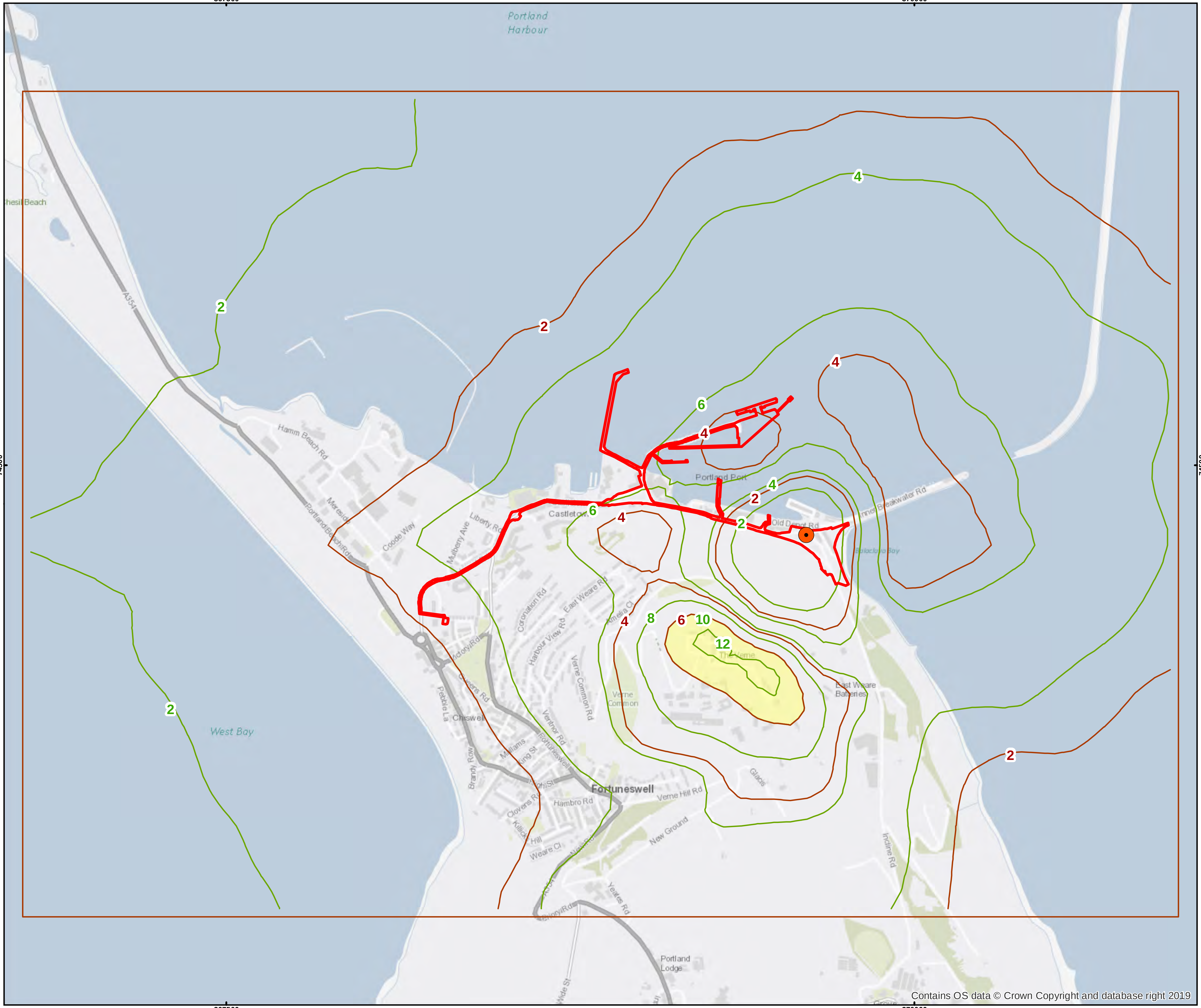


Legend

- Stack
- Site Boundary
- Modelling Domain
- NO2 assuming BAT AEL ratio (as a % of AQAL)
- NO2 assuming IED limits (as a % of AQAL)
- <10 % of AQAL (assuming IED limits)
- >10 % of AQAL (assuming IED limits)

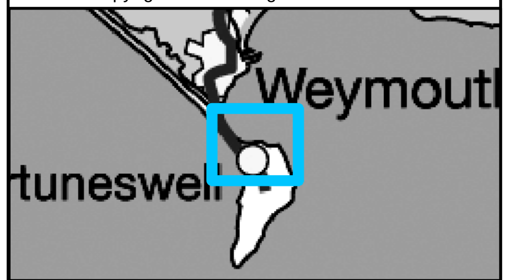
Note: Based on 35% conversion of NOx to NO2

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953

Title:

Figure 9 - 99.97%ile of 1 hour Nitrogen Dioxide Analysis

Drawn by: Hannah Lederer	Date: 07/08/2020



0 0.125 0.25 0.5 km

Scale: 1:13,000

N

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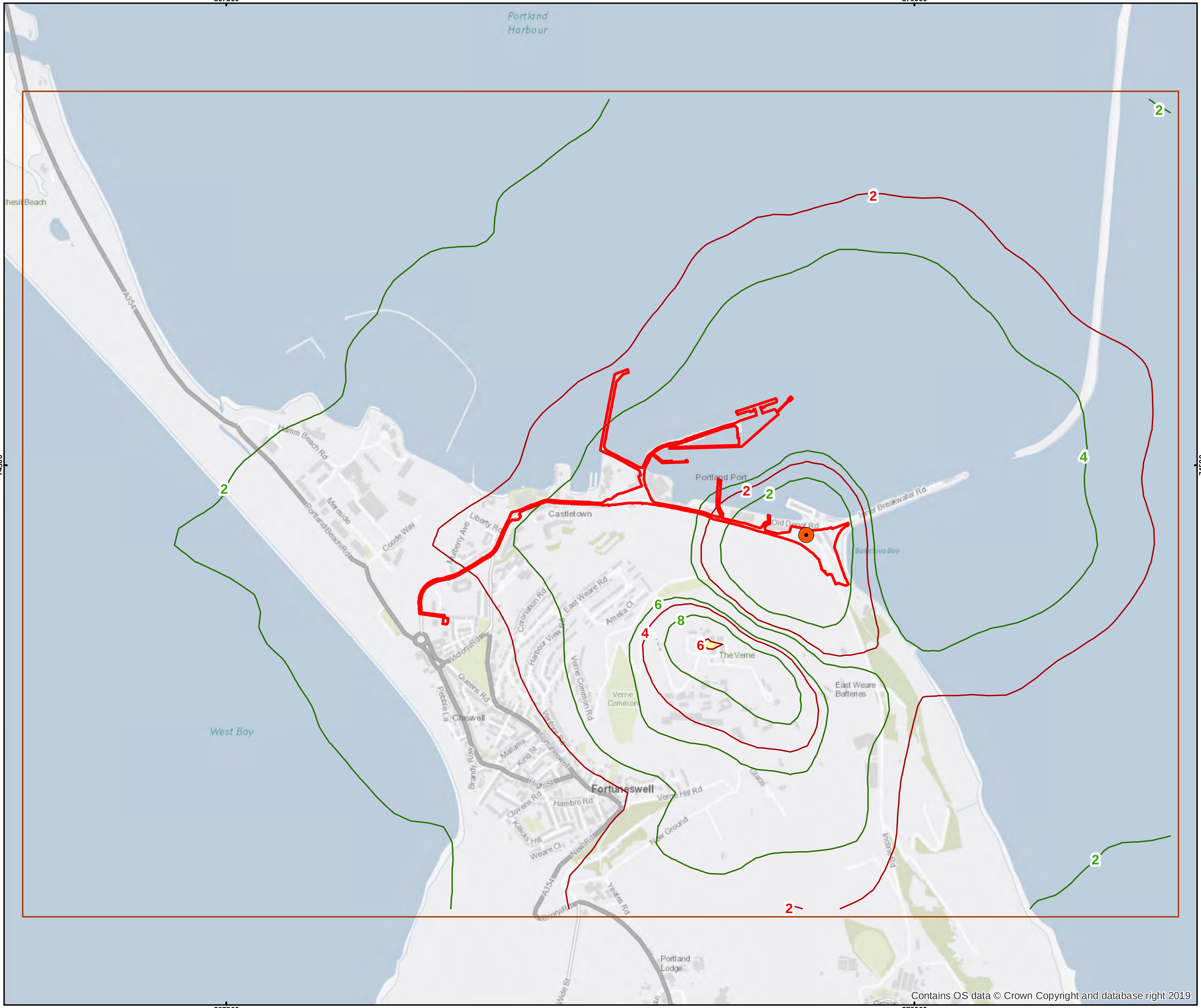
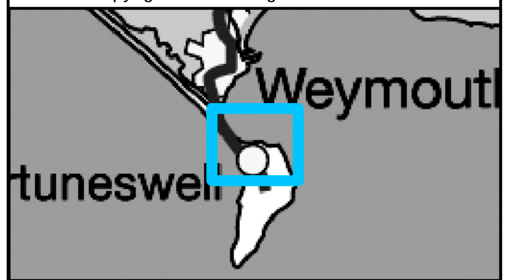


Legend

- Stack
- Site Boundary
- Modelling Domain
- SO2 assuming BAT AEL ratio (as a % of AQAL)
- SO2 assuming IED limits (as a % of AQAL)
- <10 % of AQAL (assuming IED limits)
- >10 % of AQAL (assuming IED limits)

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 10 - 99.73%ile 1-hour Sulphur Dioxide Analysis

Drawn by: Hannah Lederer | Date: 07/08/2020



0 0.125 0.25 0.5 km

Scale: 1:13,000

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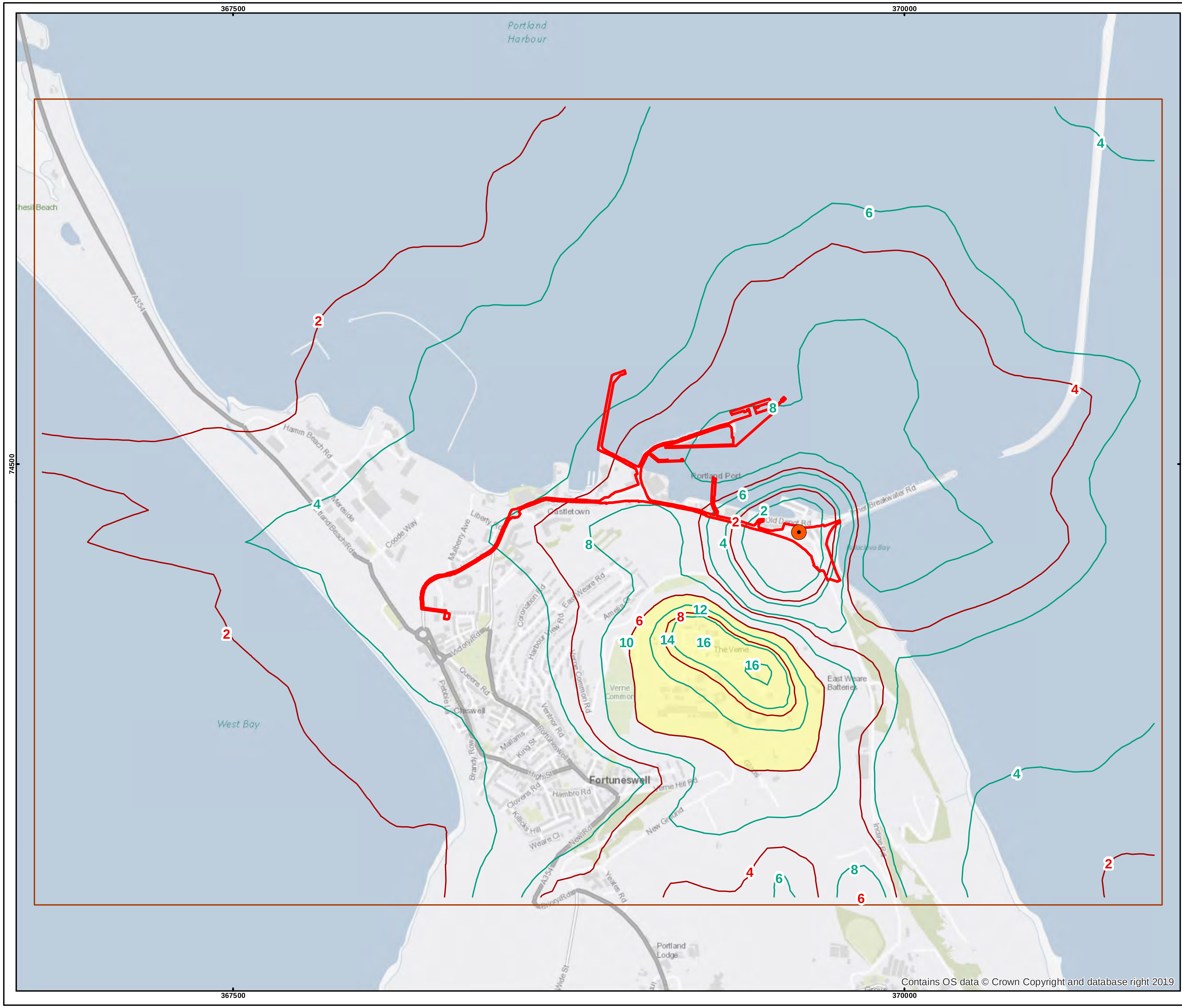
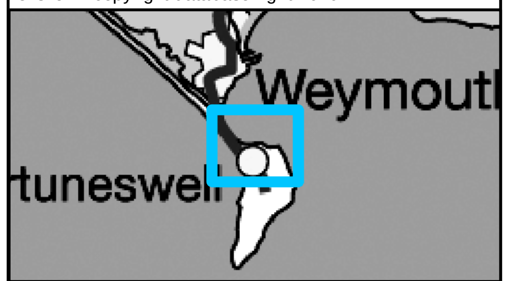


Legend

- Stack
- Site Boundary
- Modelling Domain
- SO2 assuming BAT AEL ratio (as a % of AQAL)
- SO2 assuming IED limits (as a % of AQAL)
- <10 % of AQAL
- >10 % of AQAL

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 11 - 99.9%ile 15-min Sulphur Dioxide Analysis
Drawn by: Hannah Lederer	Date: 07/08/2020



0 0.125 0.25 0.5 km

N

Scale: 1:13,000

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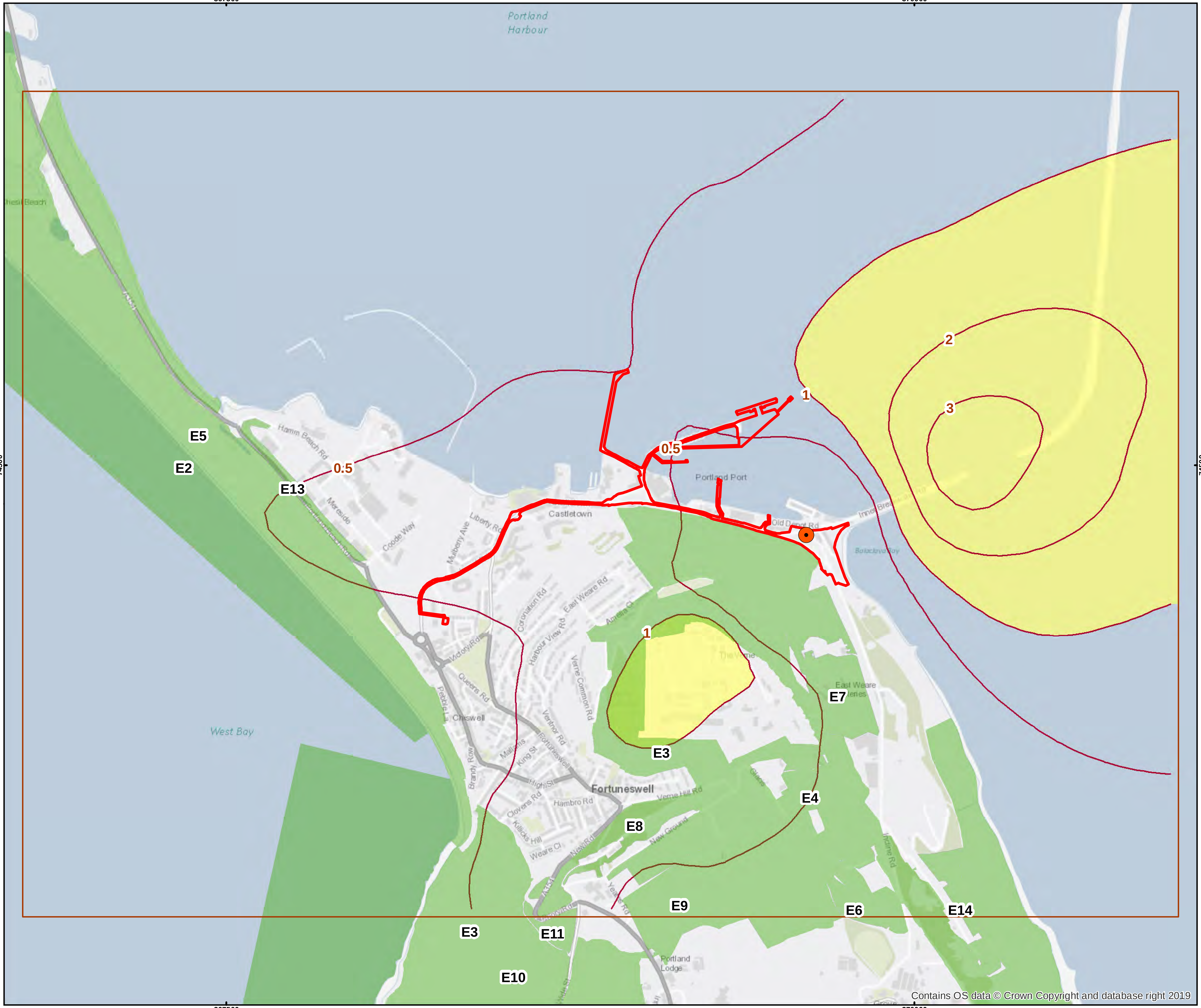

Legend

- Stack
- Site Boundary
- Modelling Domain
- Ecological sites
- PC of NOx (as a % of critical level)
- <1 % of critical level
- >1 % of critical level

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 12 - Annual Mean Oxides of Nitrogen Analysis

Drawn by: Hannah Lederer | Date: 07/08/2020

0 0.125 0.25 0.5 km

N

Scale: 1:13,000

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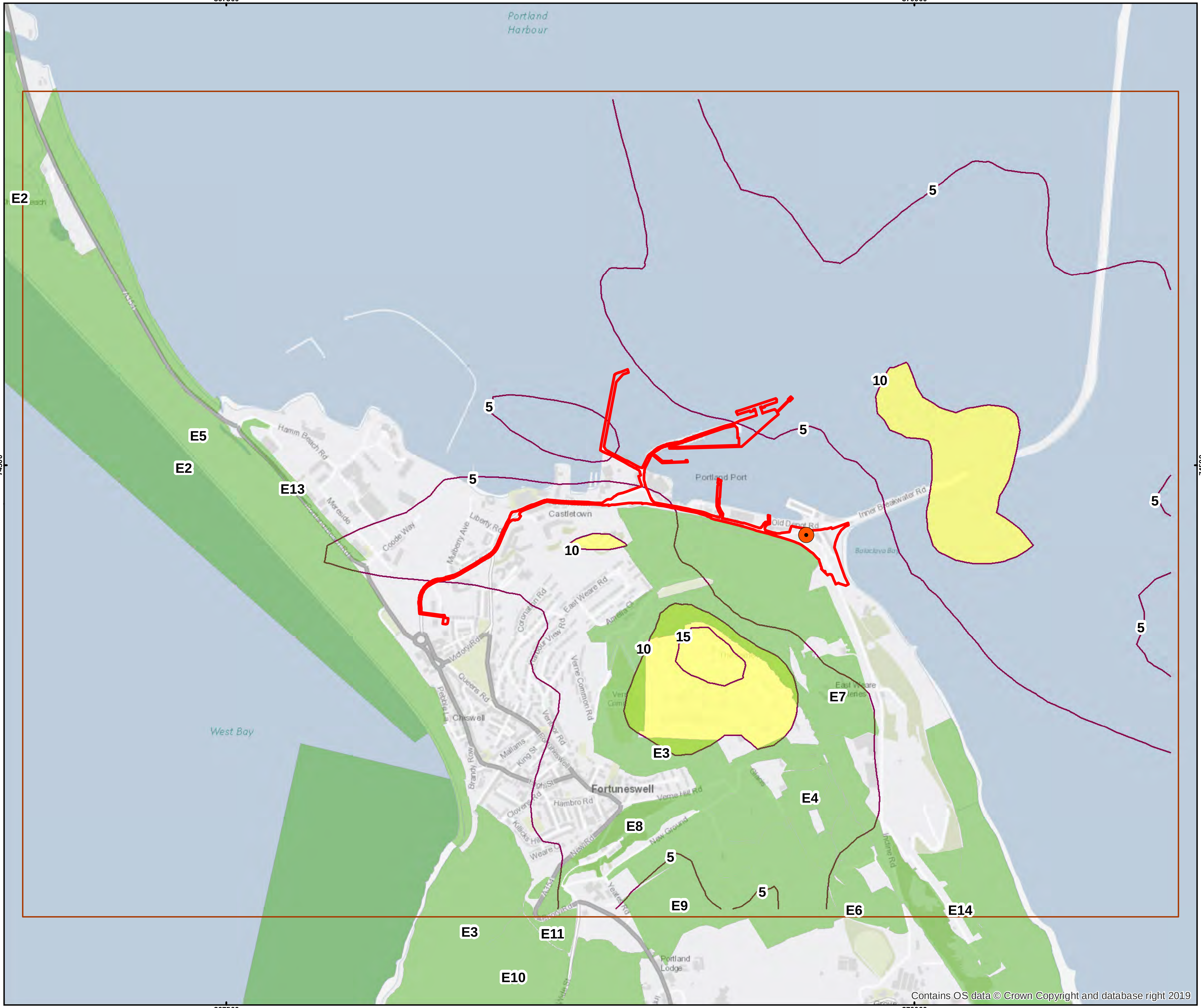


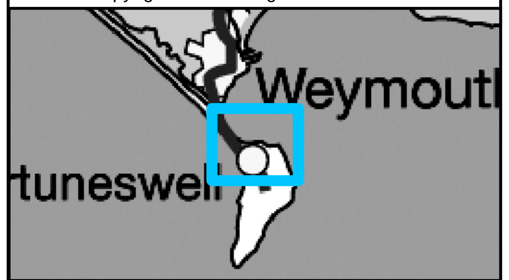
Legend

- Stack
- Site Boundary
- Modelling Domain
- Ecological Sites
- PC of NOx (as a % of critical level)
- <10 % of critical level
- >10 % of critical level

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	

Figure 13 - Daily Mean Oxides of Nitrogen Analysis

Drawn by: Hannah Lederer | Date: 07/08/2020



0 0.125 0.25 0.5 km

Scale: 1:13,000

N

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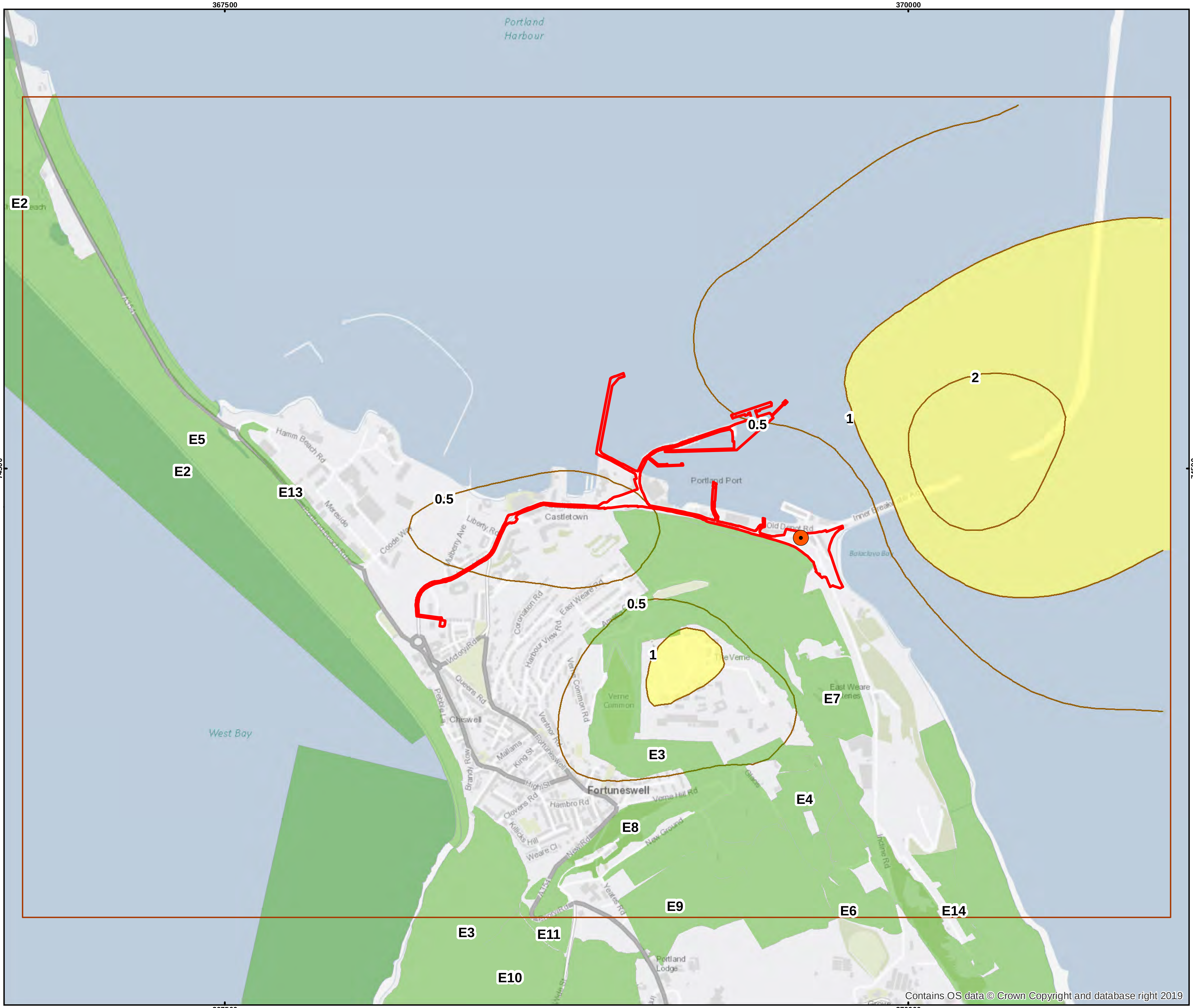
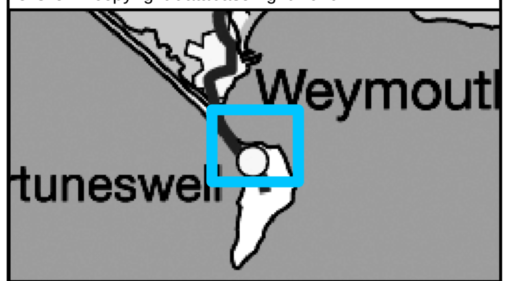


Legend

- Stack
- Site Boundary
- Modelling Domain
- Ecological Sites
- PC of SO2 (as a % of critical level)
- <1 % of critical level
- >1 % of critical level

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 14 - Annual Mean Sulphur Dioxide Analysis
Drawn by: Hannah Lederer	Date: 07/08/2020



0 0.125 0.25 0.5 km

Scale: 1:13,000

N

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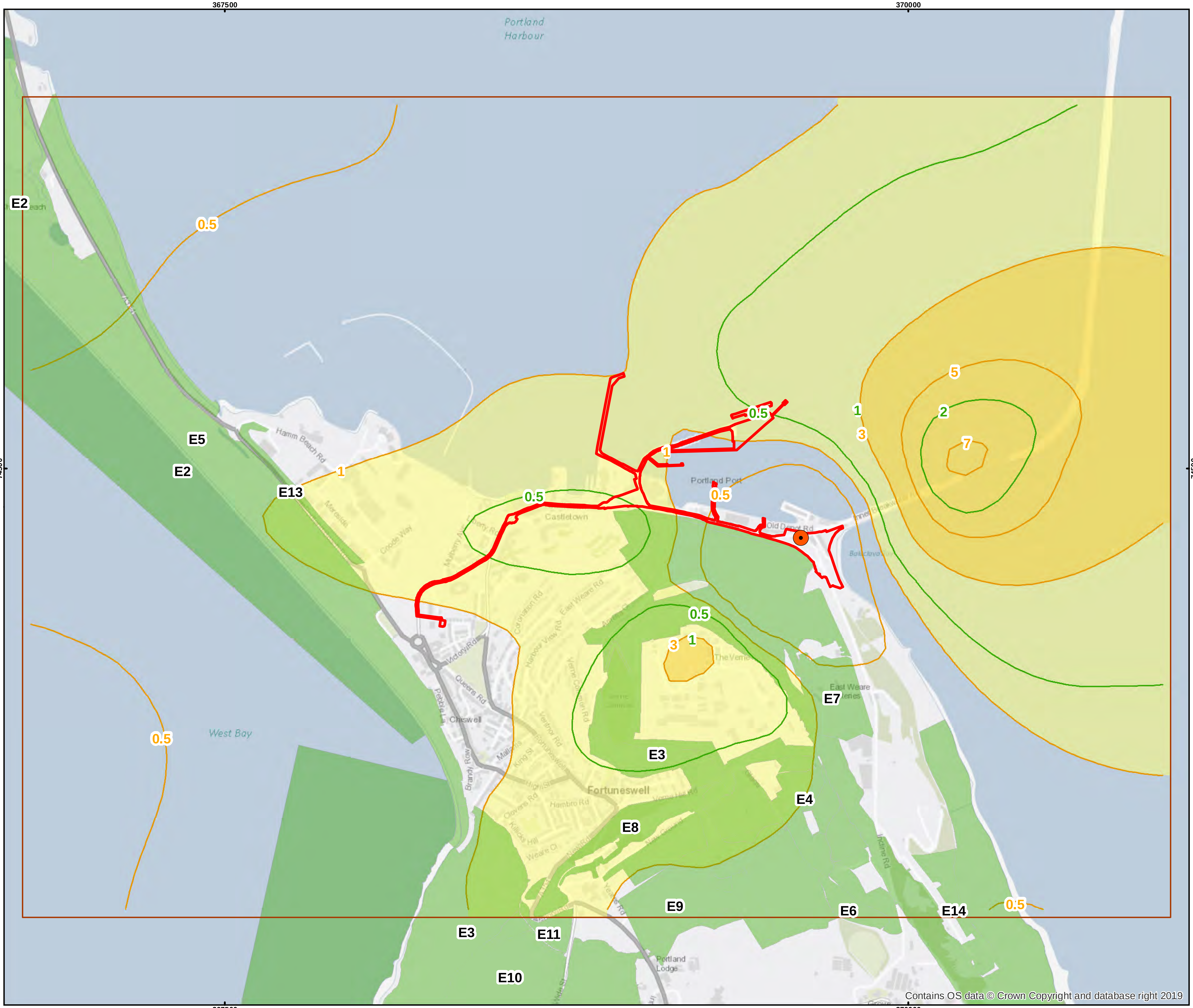
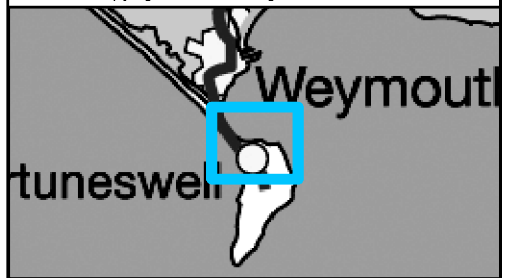


Legend

- Stack
- Site Boundary
- Modelling Domain
- Ecological Sites
- PC of NH3 (as a % of critical level 1 ug/m3 (lichen sensitive))
- PC of NH3 (as a % of critical level 3 ug/m3)
- <1 % of critical level 1 ug/m3
- >1 % of critical level 1 ug/m3
- <1 % of critical level 3 ug/m3
- >1 % of critical level 3 ug/m3

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 14 - Annual Mean Ammonia Analysis
Drawn by: Hannah Lederer	Date: 07/08/2020



0 0.125 0.25 0.5 km

N

Scale: 1:13,000

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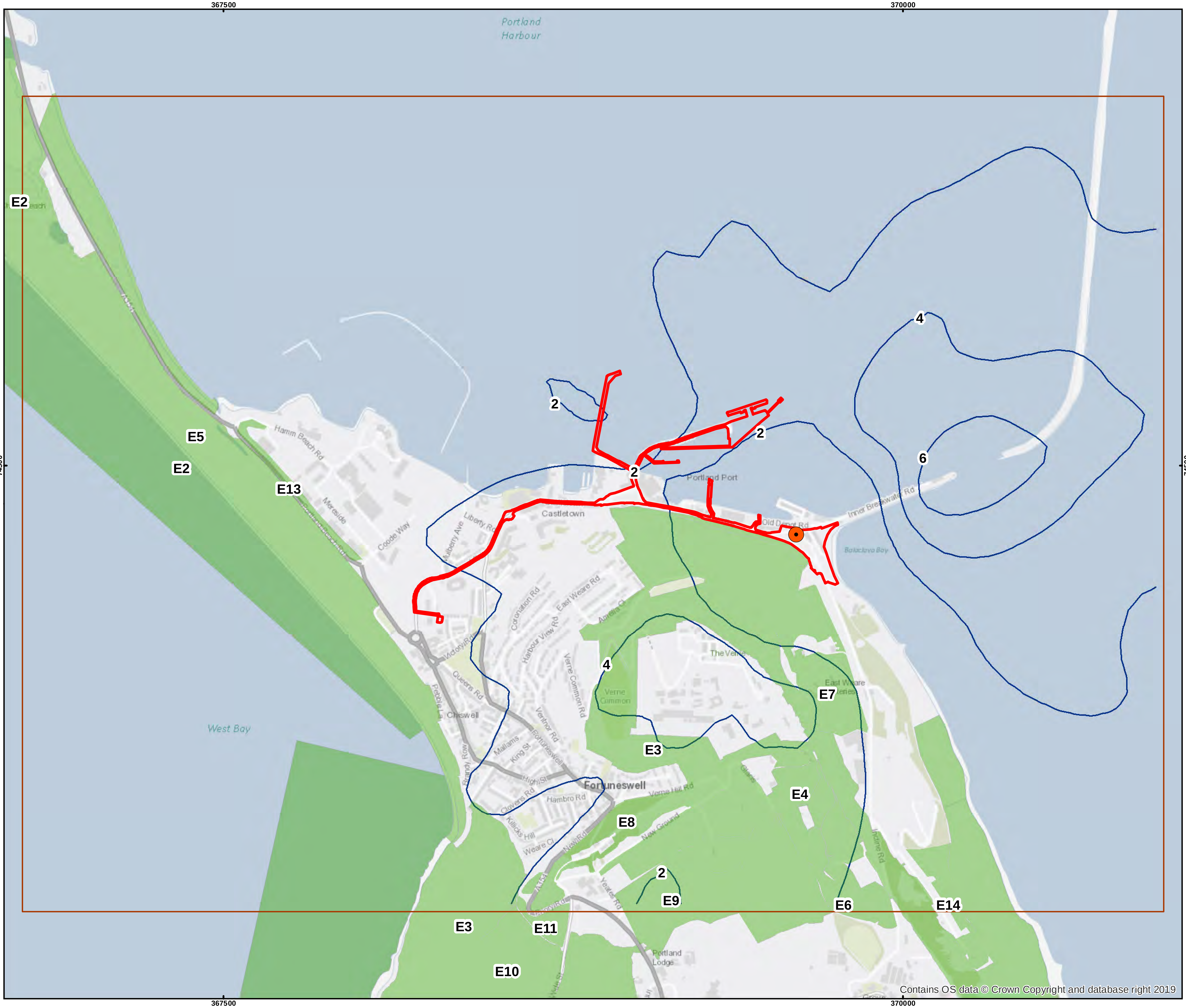
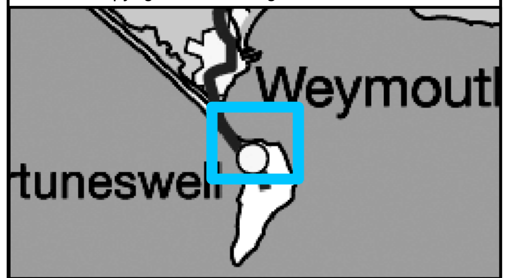


Legend

- Stack
- Site Boundary
- Modelling Domain
- Ecological Sites
- PC of HF (as a % of critical level)
- <10 % of critical level
- >10 % of critical level

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 16 - Weekly Mean Hydrogen Fluoride Analysis

Drawn by: Hannah Lederer | Date: 07/08/2020



0 0.125 0.25 0.5 km

Scale: 1:13,000

N

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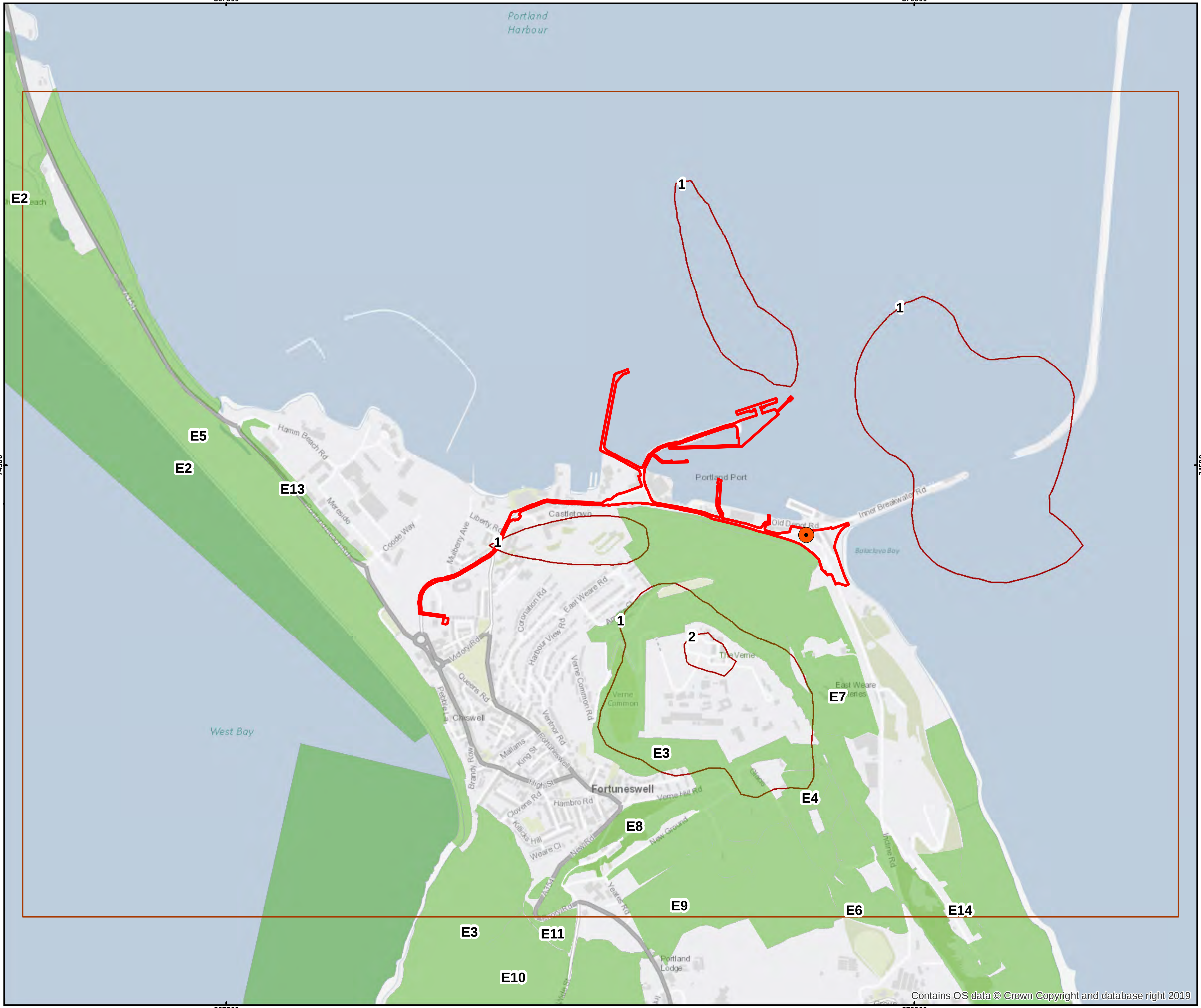


Legend

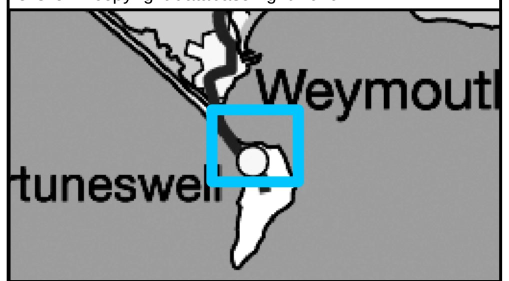
- Stack
- Site Boundary
- Modelling Domain
- Ecological Sites
- PC of HF (as a % of critical level)
- <10 % of critical level
- >10 % of critical level

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953

Title:

Figure 17 - Daily Mean Hydrogen Fluoride Analysis

Drawn by: Hannah Lederer | Date: 07/08/2020



0 0.125 0.25 0.5 km

Scale: 1:13,000

N

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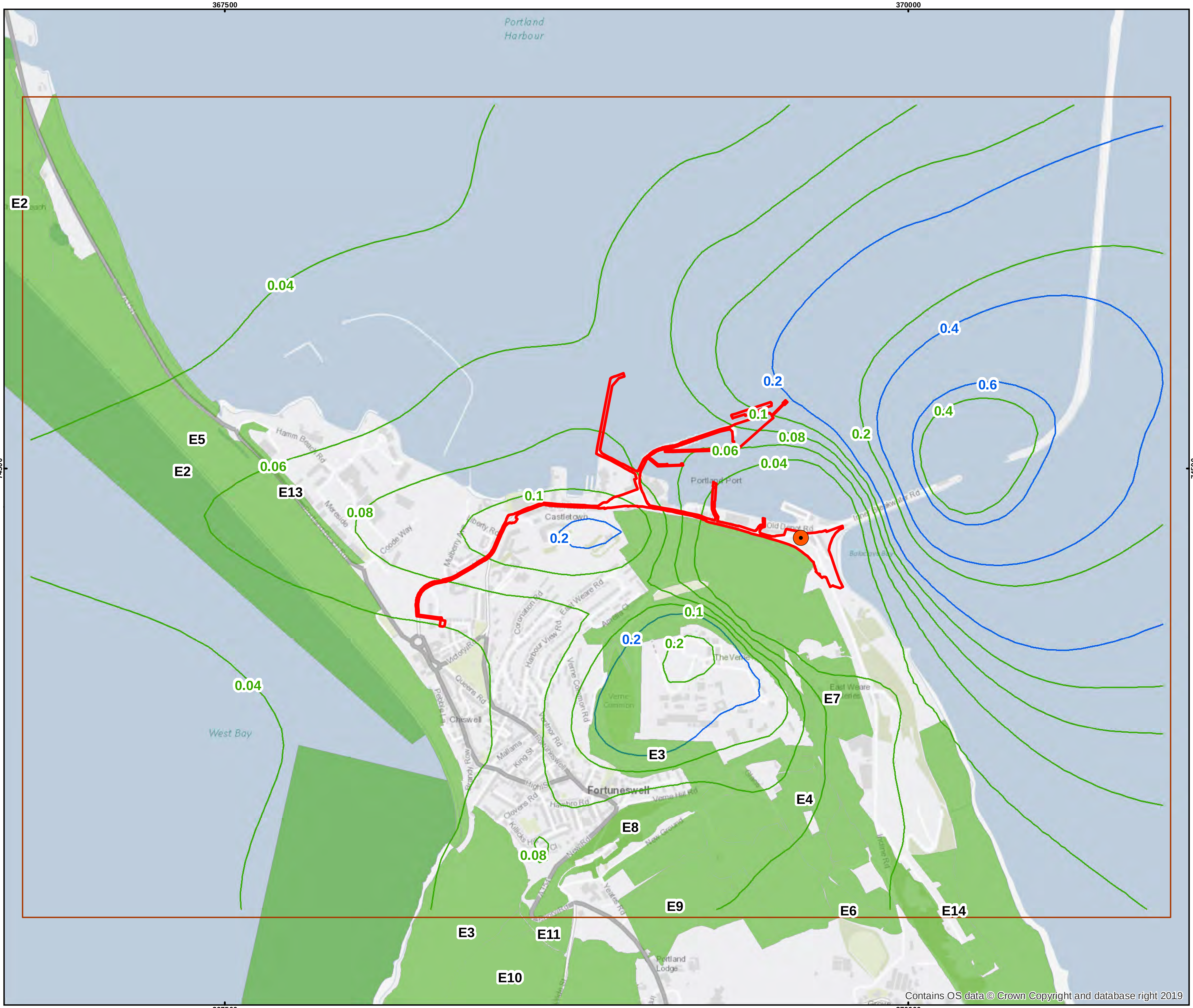


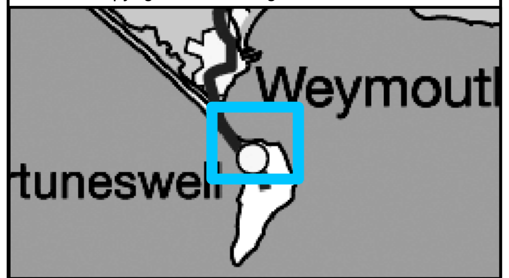
Legend

- Stack
- Site Boundary
- Modelling Domain
- Ecological Sites
- PC of Nitrogen Deposition- Grasslands (kgN/ha/yr)
- PC of Nitrogen Deposition - Woodlands (kgN/ha/yr)

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	

Figure 18 - Nitrogen Deposition Analysis

Drawn by: Hannah Lederer | Date: 07/08/2020



0 0.125 0.25 0.5 km

N

Scale: 1:13,000

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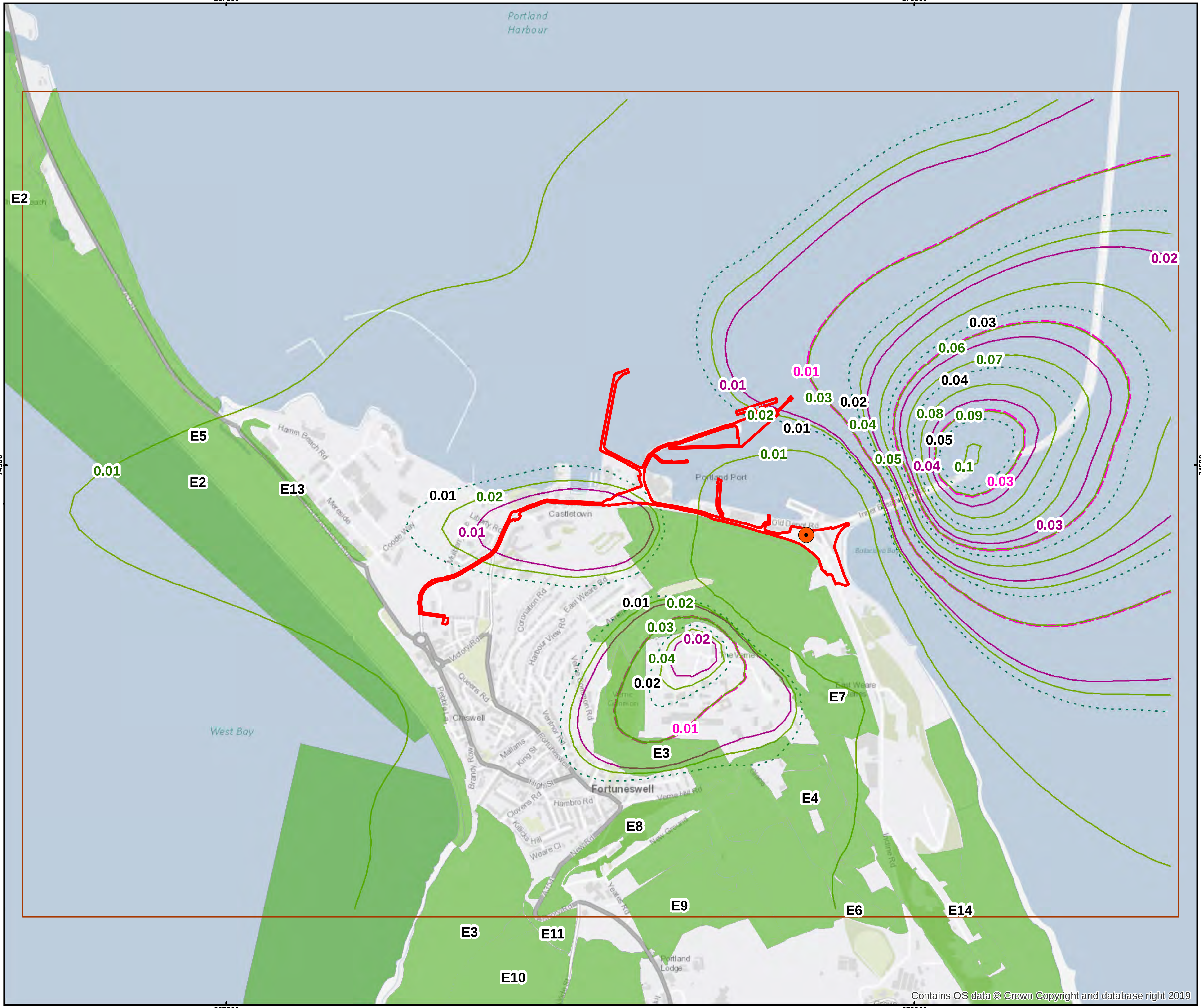
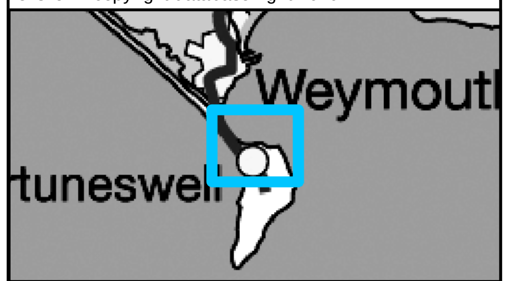


Legend

- Stack
- Site Boundary
- Modelling Domain
- Ecological Sites
- PC of A Dep (S) - Woodland (keq/ha/yr)
- PC of A Dep (N) - Woodland (keq/ha/yr)
- PC of A Dep (S) - Grassland (keq/ha/yr)
- PC of A Dep (N) - Grassland (keq/ha/yr)

Client:	Powerfuel Ltd
Site:	Portland EfW
Project:	2953
Title:	Figure 19 - Acid Deposition Analysis

Drawn by: Hannah Lederer | Date: 07/08/2020



0 0.125 0.25 0.5 km

Scale: 1:13,000

N

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B Detailed Results Tables

Table 22: Process contribution at ecological sites

Site	Oxides of nitrogen				Sulphur dioxide		Hydrogen fluoride				Ammonia	
	Annual mean		Daily mean		Annual mean		Weekly mean		Daily mean		Annual mean	
	µg/m³	% of CL	µg/m³	% of CL	ng/m³	% of CL	ng/m³	% of CL	ng/m³	% of CL	ng/m³	% of CL
European designated sites (within 10 km)												
Isle of Portland to Studland Cliffs	0.38	1.3%	11.47	15.3%	0.09	0.9%	0.02	5.0%	0.10	1.9%	0.03	2.5%
Chesil and The Fleet	0.16	0.5%	4.02	5.4%	0.09	0.5%	0.02	5.0%	0.03	0.7%	0.01	0.4%
UK designated sites (within 2 km)												
Isle of Portland	0.38	1.3%	11.47	15.3%	0.04	0.4%	0.01	2.0%	0.03	0.7%	0.03	2.5%
Nicodemus Heights	0.17	0.6%	6.33	8.4%	0.04	0.4%	0.02	3.6%	0.05	1.1%	0.01	1.1%
Chesil and The Fleet	0.16	0.5%	4.02	5.4%	0.09	0.5%	0.02	5.0%	0.03	0.7%	0.01	0.4%
Local sites												
Verne to Grove	0.19	0.6%	6.87	9.2%	0.05	0.5%	0.02	4.0%	0.06	1.1%	0.01	1.3%
East Wearne Camp	0.16	0.5%	6.09	8.1%	0.04	0.4%	0.02	4.6%	0.05	1.0%	0.01	1.1%
Verne Yeates	0.31	1.0%	8.27	11.0%	0.08	0.8%	0.02	4.3%	0.07	1.4%	0.02	2.1%
King Barrow Quarries	0.16	0.5%	4.61	6.2%	0.04	0.4%	0.01	2.6%	0.04	0.8%	0.01	1.0%
Tout Quarries	0.16	0.5%	3.76	5.0%	0.04	0.4%	0.01	2.6%	0.03	0.6%	0.01	1.1%
Portland Heights	0.18	0.6%	3.86	5.1%	0.04	0.4%	0.01	2.7%	0.03	0.6%	0.01	1.2%
Grove Quarry	0.12	0.4%	4.10	5.5%	0.03	0.3%	0.01	2.1%	0.03	0.7%	0.01	0.8%
Osprey Quay Bunds	0.17	0.6%	4.24	5.7%	0.04	0.4%	0.01	1.7%	0.04	0.7%	0.01	1.1%
East Wearne Rifle Range	0.09	0.3%	3.02	4.0%	0.02	0.2%	0.01	1.2%	0.03	0.5%	0.01	0.6%

Table 23: Annual mean process contribution used for deposition analysis

Site	Annual mean PC (ng/m³)			
	Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia
European designated sites (within 10 km)				
Isle of Portland to Studland Cliffs	263.9	94.3	18.9	25.1
Chesil and The Fleet	115.0	41.1	8.2	10.9
UK designated sites (within 2 km)				
Isle of Portland	263.9	94.3	18.9	25.1
Nicodemus Heights	117.2	41.8	8.4	11.2
Chesil and The Fleet	115.0	41.1	8.2	10.9
Local sites				
Verne to Grove	135.4	48.4	9.7	12.9
East Wearne Camp	112.8	40.3	8.1	10.7
Verne Yeates	218.7	78.1	15.6	20.8
King Barrow Quarries	109.5	39.1	7.8	10.4
Tout Quarries	115.4	41.2	8.2	11.0
Portland Heights	123.1	44.0	8.8	11.7
Grove Quarry	83.5	29.8	6.0	8.0
Osprey Quay Bunds	119.2	42.6	8.5	11.3
East Wearne Rifle Range	61.2	21.9	4.4	5.8

Table 24: Deposition calculation - grassland

Site	Deposition velocity	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
European designated sites (within 10 km)								
Isle of Portland to Studland Cliffs	Grassland	0.038	0.178	0.145	0.131	0.169	0.012	0.019
Chesil and The Fleet	Grassland	0.017	0.078	0.063	0.057	0.073	0.005	0.008
UK designated sites (within 2 km)								
Isle of Portland	Grassland	0.038	0.178	0.145	0.131	0.169	0.012	0.019
Nicodemus Heights	Grassland	0.017	0.079	0.064	0.058	0.075	0.005	0.009
Chesil and The Fleet	Grassland	0.017	0.078	0.063	0.057	0.073	0.005	0.008
Local sites (within 2 km)								
Verne to Grove	Grassland	0.019	0.092	0.074	0.067	0.086	0.006	0.010
East Wearne Camp	Grassland	0.016	0.076	0.062	0.056	0.072	0.005	0.008
Verne Yeates	Grassland	0.031	0.148	0.120	0.108	0.140	0.010	0.016
King Barrow Quarries	Grassland	0.016	0.074	0.060	0.054	0.070	0.005	0.008
Tout Quarries	Grassland	0.017	0.078	0.063	0.057	0.074	0.005	0.008
Portland Heights	Grassland	0.018	0.083	0.067	0.061	0.079	0.006	0.009
Grove Quarry	Grassland	0.012	0.056	0.046	0.041	0.053	0.004	0.006
Osprey Quay Bunds	Grassland	0.017	0.081	0.065	0.059	0.076	0.005	0.009
East Wearne Rifle Range	Grassland	0.009	0.041	0.034	0.030	0.039	0.003	0.004

Table 25: Deposition calculation – woodland

Site	Deposition velocity	Deposition (kg/ha/yr)				N Deposition (kgN/ha/yr)	Acid Deposition (keq/ha/yr)	
		Nitrogen dioxide	Sulphur dioxide	Hydrogen chloride	Ammonia		N	S
European designated sites (within 10 km)								
Isle of Portland to Studland Cliffs	Woodland	0.076	0.357	0.347	0.196	0.272	0.019	0.042
Chesil and The Fleet	Woodland	0.033	0.155	0.151	0.085	0.118	0.008	0.018
UK designated sites (within 2 km)								
Isle of Portland	Woodland	0.076	0.357	0.347	0.196	0.272	0.019	0.042
Nicodemus Heights	Woodland	0.034	0.158	0.154	0.087	0.121	0.009	0.019
Chesil and The Fleet	Woodland	0.033	0.155	0.151	0.085	0.118	0.008	0.018
Local sites (within 2 km)								
Verne to Grove	Woodland	0.039	0.183	0.178	0.100	0.139	0.010	0.021
East Wearne Camp	Woodland	0.032	0.153	0.148	0.084	0.116	0.008	0.018
Verne Yeates	Woodland	0.063	0.296	0.287	0.162	0.225	0.016	0.035
King Barrow Quarries	Woodland	0.032	0.148	0.144	0.081	0.113	0.008	0.017
Tout Quarries	Woodland	0.033	0.156	0.152	0.086	0.119	0.008	0.018
Portland Heights	Woodland	0.035	0.166	0.162	0.091	0.127	0.009	0.020
Grove Quarry	Woodland	0.024	0.113	0.110	0.062	0.086	0.006	0.013
Osprey Quay Bunds	Woodland	0.034	0.161	0.157	0.088	0.123	0.009	0.019
East Wearne Rifle Range	Woodland	0.018	0.083	0.080	0.045	0.063	0.005	0.010

Table 26: Detailed results – nitrogen deposition

Site	NCL Class	Deposition velocity	Process Contribution			Predicted Environmental Concentration		
			PC N dep (kgN/ha/yr)	% of Lower CL	% of Upper CL	PEC N dep (kgN/ha/yr)	% of Lower CL	% of Upper CL
European designated sites (within 10 km)								
Isle of Portland to Studland Cliffs	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.169	1.1%	0.7%	8.3	55.3%	33.2%
Chesil and The Fleet	Coastal stable dune grasslands	Grassland	0.073	0.9%	0.5%	8.2	102.5%	54.7%
Chesil and The Fleet	Pioneer, low-mid, mid-upper saltmarshes	Grassland	0.073	0.4%	0.2%	8.2	41.0%	27.3%
UK designated sites (within 2 km)								
Isle of Portland	Broadleaved deciduous woodland	Woodland	0.272	2.7%	1.4%	13.9	138.9%	69.5%
Isle of Portland	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.169	1.1%	0.7%	8.3	55.3%	33.2%
Nicodemus Heights	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.075	0.5%	0.3%	8.2	54.7%	32.8%
Chesil and The Fleet	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.073	0.5%	0.3%	8.2	54.7%	32.8%
Local sites (within 2 km)								
Verne to Grove	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.086	0.6%	0.3%	8.2	54.8%	32.9%
East Wearne Camp	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.072	0.5%	0.3%	8.2	54.7%	32.8%
Verne Yeates	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.140	0.9%	0.6%	8.3	55.1%	33.1%
King Barrow Quarries	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.070	0.5%	0.3%	8.2	54.7%	32.8%
Tout Quarries	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.074	0.5%	0.3%	8.2	54.7%	32.8%
Portland Heights	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.079	0.5%	0.3%	8.2	54.7%	32.8%
Grove Quarry	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.053	0.4%	0.2%	8.2	54.5%	32.7%
Osprey Quay Bunds	Coastal stable dune grasslands	Grassland	0.076	1.0%	0.5%	8.2	102.6%	54.7%

Site	NCL Class	Deposition velocity	Process Contribution			Predicted Environmental Concentration		
			PC N dep (kgN/ha/yr)	% of Lower CL	% of Upper CL	PEC N dep (kgN/ha/yr)	% of Lower CL	% of Upper CL
East Wearne Rifle Range	Sub-Atlantic semi-dry calcareous grassland	Grassland	0.039	0.3%	0.2%	8.2	54.4%	32.7%

Table 27: Detailed results – acid deposition

Site	Acidity Class	Deposition velocity	Process Contribution			Predicted Environmental Concentration		
			N (keq/ ha/yr)	S (keq/ ha/yr)	% of CL Function	N (keq/ ha/yr)	S (keq/ ha/yr)	% of CL Function
European designated sites (within 10 km)								
Isle of Portland to Studland Cliffs	Calcareous grassland	Grassland	0.019	0.042	1.0%	0.60	0.15	3.8%
Chesil and The Fleet	Acid grassland	Grassland	0.008	0.018	1.3%	0.59	0.13	35.6%
Chesil and The Fleet	Calcareous grassland	Grassland	0.008	0.018	0.5%	0.59	0.13	3.2%
UK designated sites (within 2 km)								
Isle of Portland	Calcareous grassland (using base cation)	Grassland	0.019	0.042	1.0%	0.60	0.15	3.8%
Isle of Portland	Broadleaved deciduous woodland	Woodland	0.019	0.042	0.6%	0.99	0.18	10.9%
Nicodemus Heights	Calcareous grassland (using base cation)	Grassland	0.009	0.019	0.5%	0.59	0.13	3.2%
Chesil and The Fleet	Acid grassland	Grassland	0.008	0.018	1.3%	0.59	0.13	35.6%
Chesil and The Fleet	Calcareous grassland	Grassland	0.008	0.018	0.5%	0.59	0.13	3.2%
Local sites (within 2 km)								
Verne to Grove	Calcareous grassland	Grassland	0.010	0.021	0.5%	0.59	0.13	3.3%
East Wearne Camp	Calcareous grassland	Grassland	0.008	0.018	0.4%	0.59	0.13	3.2%
Verne Yeates	Calcareous grassland	Grassland	0.016	0.035	0.9%	0.60	0.15	3.6%
King Barrow Quarries	Calcareous grassland	Grassland	0.008	0.017	0.4%	0.59	0.13	3.2%
Tout Quarries	Calcareous grassland	Grassland	0.008	0.018	0.5%	0.59	0.13	3.2%
Portland Heights	Calcareous grassland	Grassland	0.009	0.020	0.5%	0.59	0.13	3.3%
Grove Quarry	Calcareous grassland	Grassland	0.006	0.013	0.3%	0.59	0.12	3.1%

Site	Acidity Class	Deposition velocity	Process Contribution			Predicted Environmental Concentration		
			N (keq/ ha/yr)	S (keq/ ha/yr)	% of CL Function	N (keq/ ha/yr)	S (keq/ ha/yr)	% of CL Function
Osprey Quay Bunds	Calcareous grassland	Grassland	0.009	0.019	1.4%	0.59	0.13	35.7%
East Wearne Rifle Range	Acid grassland	Grassland	0.005	0.010	0.2%	0.59	0.12	3.0%

C APIS Critical Loads

Table 28: Nitrogen deposition critical loads

Site	Species/habitat type	NCL Class	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Maximum Background (kgN/ha/yr)
European designated sites (within 10 km)					
Isle of Portland to Studland Cliffs	Semi-natural dry grasslands and scrubland facies on calcareous substrates	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128
Chesil and The Fleet	Perennial vegetation of stony banks	Coastal stable dune grasslands	8	15	8.128
Chesil and The Fleet	Atlantic salt meadows	Pioneer, low-mid, mid-upper saltmarshes	20	30	8.128
UK designated sites (within 2 km)					
Isle of Portland	-	Broadleaved deciduous woodland	10	20	13.622
Isle of Portland	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128
Nicodemus Heights	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128
Chesil and The Fleet	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128
Local sites					
Verne to Grove	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128
East Wearne Camp	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128
Verne Yeates	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128

Site	Species/habitat type	NCL Class	Lower Critical Load (kgN/ha/yr)	Upper Critical Load (kgN/ha/yr)	Maximum Background (kgN/ha/yr)
King Barrow Quarries	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128
Tout Quarries	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128
Portland Heights	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128
Grove Quarry	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128
Osprey Quay Bunds	-	Coastal stable dune grasslands	8	15	8.128
East Wearne Rifle Range	-	Sub-Atlantic semi-dry calcareous grassland	15	25	8.128

Source: APIS

Table 29: Acid deposition critical loads

Site	Species/habitat type	Acidity Class	Critical Load function (keq/ha/yr)			Maximum background (keq/ha/yr)	
			CLminN	CLmaxN	CLmaxS	N	S
European designated sites (within 10 km)							
Isle of Portland to Studland Cliffs	Semi-natural dry grasslands and scrubland facies on calcareous substrates	Calcareous grassland	0.856	4.856	4	0.581	0.111
Chesil and The Fleet	Perennial vegetation of stony banks	Acid grassland	0.223	2.018	1.58	0.581	0.111
Chesil and The Fleet	Sterna albifrons (Eastern Atlantic - breeding) - Little tern	Calcareous grassland	0.856	4.856	4	0.581	0.111
UK designated sites (within 2 km)							
Isle of Portland	-	Calcareous grassland (using base cation)	0.856	4.856	4	0.581	0.111
Isle of Portland	-	Broadleaved deciduous woodland	0.142	10.807	10.665	0.973	0.141
Nicodemus Heights	-	Calcareous grassland (using base cation)	0.856	4.856	4	0.581	0.111
Chesil and The Fleet	-	Acid grassland	0.223	2.018	1.58	0.581	0.111
Chesil and The Fleet	-	Calcareous grassland	0.856	4.856	4	0.581	0.111
Local sites							
Verne to Grove	-	Calcareous grassland	0.856	4.856	4	0.581	0.111
East Wearne Camp	-	Calcareous grassland	0.856	4.856	4	0.581	0.111
Verne Yeates	-	Calcareous grassland	0.856	4.856	4	0.581	0.111
King Barrow Quarries	-	Calcareous grassland	0.856	4.856	4	0.581	0.111

Site	Species/habitat type	Acidity Class	Critical Load function (keq/ha/yr)			Maximum background (keq/ha/yr)	
			CLminN	CLmaxN	CLmaxS	N	S
Tout Quarries	-	Calcareous grassland	0.856	4.856	4	0.581	0.111
Portland Heights	-	Calcareous grassland	0.856	4.856	4	0.581	0.111
Grove Quarry	-	Calcareous grassland	0.856	4.856	4	0.581	0.111
Osprey Quay Bunds	-	Acid grassland	0.223	2.018	1.58	0.581	0.111
East Wearne Rifle Range	-	Calcareous grassland	0.856	4.856	4	0.581	0.111

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