15.0 AIR QUALITY

Introduction

15.1 This chapter describes the likely significant effects of the Proposed Development on the environment with respect of air quality, odour and climate change. It has been written by Air Quality Consultants Ltd.

15.2 This chapter describes existing local air quality conditions (2012), and provides an assessment of the likely impacts during all phases of the Proposed Development. Consideration is also given to emissions of carbon dioxide, a climate change gas, released during all phases of the Proposed Development. This chapter has been prepared taking into account all relevant local and national guidance and regulations.

Legislation and Policy Context

Legislation

Air Quality Strategy

15.3 The Air Quality Strategy published by the Department for Environment, Food, and Rural Affairs (Defra) provides the policy framework (Defra, 2007) for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is

not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Clean Air Act 1993

15.4 Small combustion plant of less than 20 MW net rated thermal input are controlled under the Clean Air Act 1993. This requires the local authority to approve the chimney height. Plant which are smaller than 366kW have no such requirement.

The Climate Change Act 2008

15.5 The Climate Change Act (2008) provides a legal framework for ensuring that the Government meets its commitments to tackle climate change. It sets legally binding targets to reduce net UK greenhouse gas emissions by at least 80% by 2050 against a 1990 baseline. This will be done through five-year 'carbon budgets'. Budgets have currently been set covering the periods 2008-2012, 2013-2017, 2018-2022, and 2023-2027. These budgets limited the UK to 3,018 Mt of carbon dioxide equivalent in the period 2008-2012, falling to 1,950 Mt of carbon dioxide equivalent over the period 2023-2027. Further five-year budgets will be set subsequently and it is expected that these will become more stringent as time goes on. Carbon budgets cap the total national emissions over the budget period. They do not require emissions from specific locations, or even specific sectors, to reduce; so long as total emissions from the UK as a whole meet the budget limits.

National Policy

NPPF

15.6 The National Planning Policy Framework (NPPF) (2012) introduced in March 2012 now sets out planning policy for the UK in one place. It replaces previous Planning Policy Statements, including PPS23 on Planning and Pollution Control.

The NPPF contains advice on when air quality should be a material consideration in development control decisions. Existing, and likely future, air quality should be taken into account, as well as the EU limit values or national objectives for pollutants, the presence of any AQMAs and the appropriateness of both the development for the site, and the site for the development.

15.7 The NPPF places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. One of the twelve core planning principles notes that planning should "contribute to…reducing pollution". To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location. The NPPF states that the effects of pollution on health and the sensitivity of the area and the development should be taken into account.

15.8 The need for compliance with any statutory air quality limit values and objectives is stressed, and the presence of AQMAs must be accounted for in terms of the cumulative impacts on air quality from individual sites in local areas. New developments in AQMAs should be consistent with local air quality action plans.

15.9 The NPPF also recognises that "*planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure"*. To support the move to a low carbon future, local planning authorities should… "*plan for new development in locations and ways which reduce greenhouse gas emissions*."

Planning Practice Guidance

15.10 Planning Practice Guidance (PPG) was formally issued in March 2014 (DCLG, 2014). It provides guiding principles on how planning can take account of the

impacts of new development on air quality. The guidance sets out the types of developments for which air quality may be a relevant consideration. It covers the information that may be required in an air quality assessment and how considerations about air quality fit into the development management process. The PPG also provides guidance on options for mitigating air quality impacts, and provides examples of the types of measures to be considered. In particular it notes that: *"mitigation options where necessary, will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact."*

15.11 Where dust emissions are likely to arise, mineral operators are expected to prepare a dust assessment study. There are five key stages to a dust assessment study:

- establish baseline conditions of the existing dust climate around the site of the proposed operations;
- identify site activities that could lead to dust emission without mitigation;
- identify site parameters which may increase potential impacts from dust;
- recommend mitigation measures, including modification of site design
- make proposals to monitor and report dust emissions to ensure compliance with appropriate environmental standards and to enable an effective response to complaints.

It also provides a flowchart method to assist local authorities in determining how considerations of PM_{10} from a mineral site fit into the overall decision making process.

The Carbon Plan

15.12 The Carbon Plan: Delivering our low carbon future (2011) sets out the how the Government will deliver its plans for a low carbon economy, with particular focus on the fourth carbon budget that covers the period 2023-2027. This requires

emissions to be 50% below their 1990 level.

Local Policy

15.13 The West Sussex Minerals Local Plan 2003 (West Sussex County Council, 2003) states that:

"Mineral working can also affect residential amenities and the built environment due to noise, dust and visual impact, and haulage traffic spreads the effect beyond the immediate vicinity of workings. On balance, the benefits will need to outweigh the environmental disadvantages particularly in relation to meeting sustainable development objectives".

15.14 Policy 19 of the document further reinforces this, stating that:

"In considering planning applications for mineral extraction attention will be given to the effect upon residential and other amenity, and measures to mitigate the impact".

15.15 The Chichester District Local Plan (Chichester District Council, 1999), adopted in 1999, states that:

"The District Planning Authority will aim to restrict and control pollution resulting from development insofar as it is able through planning powers. Potentially polluting development should not be located where it will be injurious to the health of local residents or where it will harm the natural environment".

15.16 Sussex Air Quality Partnership has recently published an air quality and emissions mitigation guidance document, which introduces new requirements for air quality assessments for developments in Sussex. The guidance explains what is required when, and why, outlines how to carry out a mitigation assessment, then sets out what is required in an air quality assessment and how to assess the significance of the effect of a development on local air quality and finally sets out planning recommendations for air quality assessments.

Policy for the Protection of Sensitive Ecosystems

European Policies

15.17 European Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the "Habitats Directive") requires member states to introduce a range of measures for the protection habitats and species. The Conservation of Habitats and Species Regulations (The Air Quality Standards Regulations (No. 1001), 2010), transposes the Directive into law in England and Wales. The Regulations require the Secretary of State to provide the European Commission with a list of sites which are important for the habitats or species listed in the Directive. The Commission then designates worthy sites as Special Areas of Conservation (SACs). The Regulations also require the compilation and maintenance of a register of European sites, to include SACs and Special Protection Areas (SPAs); with these classified under the Council Directive 79/409/EEC on the Conservation of Wild Birds (Directive 2009/147/EC of the European Parliament and of the Council, 2009). These sites form a network termed "Natura 2000".

15.18 The Regulations primarily provide measures for the protection of European Sites and European Protected Species, but also require local planning authorities to encourage the management of other features that are of major importance for wild flora and fauna.

15.19 In addition to SACs and SPAs, some internationally important UK sites are designated under the Ramsar Convention. Originally intended to protect waterfowl habitat, the Convention has broadened its scope to cover all aspects of wetland conservation.

15.20 The Habitats Directive (as implemented by the Regulations) requires the competent authority, which in this case will be the planning authority, to firstly evaluate whether the development is likely to give rise to a significant effect on

the European site. Where this is the case, it has to carry out an 'appropriate assessment' in order to determine whether the development will adversely affect the integrity of the site.

National Policies

15.21 Sites of national importance may be designated as Sites of Special Scientific Interest (SSSIs). Originally notified under the National Parks and Access to the Countryside Act (1949), SSSIs have been re-notified under the Wildlife and Countryside Act (1981). Improved provisions for the protection and management of SSSIs (in England and Wales) were introduced by the Countryside and Rights of Way Act (2000) (the "CROW" act). If a development is "*likely to damage*" a SSSI, the CROW act requires that a relevant conservation body (i.e. Natural England) is consulted. The CROW act also provides protection to local nature conservation sites, which can be particularly important in providing 'stepping stones' or 'buffers' to SSSIs and European sites. In addition, the Environment Act (1995) and the Natural Environment and Rural Communities Act (2006) both require the conservation of biodiversity.

15.22 National planning policy on biodiversity and conservation is set out in the NPPF. This emphasises that the planning system should seek to minimise impacts on biodiversity and provide net gains in biodiversity wherever possible as part of the Government's commitment to halting declines in biodiversity and establishing coherent and resilient ecological networks.

15.23 Local planning authorities should set criteria based policies against which proposals for any development on or affecting protected wildlife sites will be judged, making distinctions between different levels of site designation. If significant harm from a development cannot be prevented, adequately mitigated against, or compensated for, then planning permission should be refused.

Assessment Criteria

Health Criteria

15.24 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations, 2000, Statutory Instrument 928 (2000) and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043 (2002).

15.25 The objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded where the annual mean concentration is below 60 $\mu g/m^3$ (Defra, 2009). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level.

15.26 The European Union has also set limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$. Achievement of these values is a national obligation rather than a local one (Directive 2008/50/EC of the European Parliament and of the Council, 2008). The limit values for nitrogen dioxide are the same levels as the UK objectives, but applied from 2010 (The Air Quality Standards Regulations (No. 1001), 2010). The limit values for PM_{10} and $PM_{2.5}$ are also the same level as the UK statutory objectives, but applied from 2005 for PM_{10} and will apply from 2015 for $PM_{2.5}$.

15.27 The relevant air quality criteria for this assessment are provided in Table 15.1.

Table 15.1: Air Quality Criteria for Nitrogen Dioxide, Sulphur Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 μg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 μg/m^3
Sulphur Dioxide	24-hour Mean	125 μg/m^3 not to be exceeded more than 3 times a year
	1-hour Mean	350 μg/m^3 not to be exceeded more than 24 times a year
	15-minute Mean	266 μg/m^3 not to be exceeded more than 35 times a year
Fine Particles (PM_{10})	24-hour Mean	50 μg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 μg/m^3
Fine Particles ($PM_{2.5}$) [a]	Annual Mean	25 μg/m^3

[a] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Climate Change Criteria

15.28 There are no formal assessment criteria to assess the significance of changes in emissions of climate change gases. In the absence of formal criteria, the emissions will be compared with regional emissions.

Vegetation and Ecosystem Criteria

15.29 Objectives for the protection of vegetation and ecosystems have been set by the UK Government and were to have been achieved by 2000. They are summarised in

15.30 Table 15.2 and are the same as the EU limit values. The objectives only strictly

apply a) more than 20 km from an agglomeration (about 250,000 people), and b) more than 5 km from Part A industrial sources, motorways and built up areas of more than 5,000 people. However, Natural England has adopted a more precautionary approach and applies the objective to all internationally designated conservation sites and SSSIs. For the assessment of road schemes, the Highways Agency follows this approach and requires an assessment of the impacts of roads traffic emissions on conservation sites (Designated Sites) within 200 m of a road (Highways Agency, 2007).

Table 15.2: Vegetation and Ecosystem Objectives (Critical Levels)

Pollutant	Time Period	Objective
Nitrogen Oxides (expressed as NO_2)	Annual Mean	30 µg/m3
	24-Hour Mean	75 µg/m3

15.31 Critical loads for nitrogen deposition onto sensitive ecosystems have been specified by the United Nations Economic Commission for Europe (UNECE). They are defined as the amount of pollutant deposited to a given area over a year, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The critical loads for the ecosystems under consideration in this assessment, as defined in the Air Pollution Information System (APIS, 2013), are provided in

15.32 Table 15.3.

Table 15.3: Vegetation and Ecosystem Critical Loads

Ecological Site	Habitat [a]	Nutrient Nitrogen (kgN/ha/yr) [b, c]	Acid Nitrogen (keq/ha/yr) [c]
The Mens SAC/ SSSI	Broadleaved deciduous Woodland	10-20	1.493-3.2
	Fagus Woodland	10-20	1.493-3.2

Ecological Site	Habitat [a]	Nutrient Nitrogen (kgN/ha/yr) [b, c]	Acid Nitrogen (keq/ha/yr) [c]
Ebernoe Common SAC/ SSSI	Broadleaved deciduous woodland	10-20	2.495-3.361
	Fagus Woodland	10-20	2.495-3.361
Dunhurst and Northup Copses SNCI	Acidophilous Quercus-dominated woodland	10-15	2.52
Arun Valley SPA	Standing Open Water and Canals	No critical load estimate available	Not available

[a] Habitat definition based on the UK Biodiversity Action Plan (BAP) habitat.
[b] Critical loads are given as ranges covering all EUNIS habitats within each BAP habitat
[c] Critical load calculated following procedure given on APIS website (APIS, 2013).

Construction Dust Criteria

15.33 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the Institute of Air Quality Management[1] (IAQM) (2014) will therefore be used. Full details of this approach are provided in Appendix 15.1.

Environment Agency Assessment Criteria

15.34 The Environment Agency has considered potential impacts from industrial emissions in its H1 guidance (Environment Agency, 2010). This explains that regardless of what the baseline environmental conditions are, a process can be considered as insignificant if:

- the long-term (annual mean) process contribution is <1% of the long-term environmental standard; and

[1] The IAQM is the professional body for air quality practitioners in the UK.

- the short-term (24-hour mean or shorter) process contribution is <10% of the short-term environmental standard.

15.35 It should be recognised that these criteria determine when an impact can be screened out as insignificant. They do not imply that impacts will necessarily be significant above these levels, merely that above these levels there is a potential for significant impacts that should be assessed using a detailed assessment methodology such as detailed dispersion modelling (as has been carried out for this project in any event).

15.36 It is understood that for Local Nature Reserves (LNR) and Ancient Woodlands, the Environment Agency use a less stringent screening criterion (as quoted in Environment Agency documents Operational Instructions 66_12 and 67_12). This guidance states that if the process contribution is less than 100% of the appropriate environmental criterion, then it can be assumed there will be no significant pollution. This approach has been used for any potential impacts on Dunhurst and Northup Copses.

15.37 In addition, Environment Agency H1 guidance explains that "*As a guide, detailed dispersion modelling of long term emissions may be useful where*:

- *local receptors maybe sensitive to long term emissions;*
- *released substances fall under an Air Quality Management Plan;*
- *the sum of the background concentration and process contribution exceed 70% of the appropriate long term standard";*

and that: "*As a guide, detailed dispersion modelling of short-term emissions may be useful where*:

- *local receptors may be sensitive to short emissions;*
- *the short-term process contribution is more than 20% of the relevant short-term environmental standard minus twice the long term background concentration."*

15.38 This criterion is also used in guidance issued by the Environment Agency and Joint Nature Conservation Committee (JNCC) on applying the Habitats Regulations in relation to air quality impacts (COMAH, 2005). This states that:
"Where the concentration within the emission footprint in any part of the European Site is less than 1% of the relevant benchmark, the emission is unlikely to have a significant effect irrespective of the background levels."

Descriptors for Air Quality Impacts and Assessment of Significance

Construction Dust Significance

15.39 Guidance from the IAQM (Institute of Air Quality Management, 2014) is that, with appropriate mitigation in place, the impacts of construction dust will not be significant. The assessment thus focuses on determining the appropriate level of mitigation so as to ensure that impacts will normally be insignificant.

Operational Significance

Health

15.40 There is no official guidance in the UK on how to describe air quality impacts, nor how to assess their significance. The approach developed by the IAQM (Institute of Air Quality Management, 2009), and incorporated in Environmental Protection UK's (EPUK's) guidance document on planning and air quality (Environmental Protection UK, 2010), will therefore be used. This involves three distinct stages: the application of descriptors for magnitude of change; the description of the impact at each sensitive receptor; and then the assessment of overall significance of the Proposed Development. This approach includes elements of professional judgement, with the overall air quality impact of the Proposed Development described as either insignificant, minor, moderate or major. Full details of this approach are provided in Appendix 15.2.

Ecosystems

15.41 The criteria included in paragraphs 15.34 to 15.38 will be used to define significance.

15.42 For the purposes of this assessment, wherever the detailed modelling shows that concentrations and fluxes are below the critical level or critical load, it is considered that there will be no significant impacts. Furthermore, where the Proposed Development will increase concentrations or fluxes by less than 1% (long-term) or 10% (short-term) of the relevant critical level or critical load, the potential for significant impacts can be discounted at SACs/ SSSIs. Where the Proposed Development will increase concentration or fluxes by less than 100% (long and short term) of the relevant critical level or critical load, the potential for significant impacts can be discounted at Local Nature Reserves and ancient woodlands. Those locations in which the Proposed Development will cause a change of more than 1% or 100% (long-term) or 10% or 100% (short-term) of the critical level or critical load have been highlighted where relevant.

Climate Change Significance

15.43 There is no official or unofficial guidance on how to assess the significance of changes in emissions of climate change gases. The results will therefore be presented without any assessment of their significance.

Assessment Methodology

Existing Conditions

15.44 Existing sources of emissions within the study area have been defined using a number of approaches. Industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer

Register (Defra, 2013c) and the Environment Agency's website 'what's in your backyard' (Environment Agency, 2013). Local sources have also been identified through examination of the Council's Air Quality Review and Assessment reports.

15.45 The background concentrations across the study area have been defined using the national pollution maps published by Defra (2013a). These cover the whole country on a 1x1 km grid.

Construction Impacts

15.46 The construction dust assessment considers the potential for impacts within 350 m of the Application Site boundary during construction; or within 50 m of roads used by construction vehicles. The assessment methodology is that provided by the IAQM (Institute of Air Quality Management, 2014). This is based around a sequence of steps. Step 1 is a basic screening stage, to determine whether the more detailed assessment provided in Step 2 is required. Step 2a determines the potential for dust to be raised from on-site works and by vehicles leaving the site. Step 2b defines the sensitivity of the area to any dust that may be raised. Step 2c combines the information from Steps 2a and 2b to determine the risk of dust impacts without appropriate mitigation. Step 3 uses this information to determine the appropriate level of mitigation required to ensure that there should be no significant impacts. Appendix 15.1 explains the approach in more detail.

Point Source Impacts

Sensitive Locations

15.47 Pollutant impacts have been predicted over a 4km by 4km area centred on the flare with a 25 m resolution. These impacts have been used to define a small grid area where the worst-case impacts will be located. This is defined as the detailed study area. The method for defining this detailed area is set out in Appendix 15.3.

15.48 Worst-case exposure will be located within the 4km by 4km area. Relevant locations include nearby residential properties and public footpaths but the approach taken has been to encompass all potential locations where the public may be present for at least an hour.

15.49 For the ecological impacts on the The Mens, Ebernoe Common and Arun Valley, specific locations have been used to represent the designated area. Figure 7 in Appendix 15.3 shows the locations used.

Modelling Methodology

15.50 The impacts of emissions from the diesel generators, and the gas flare have been modelled using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the-art understanding of the dispersion processes within the atmospheric boundary layer. The parameters within Table 4.1 of Chapter 4A Project Description have been used for the assessment.

Traffic Impacts

Sensitive Locations

15.51 These will be residential properties close to nearby roads that will be used by traffic generated by the Proposed Development.

Modelling Methodology

15.52 Potential impacts due to traffic generated by the Proposed Development will initially be assessed qualitatively against the guidance issued by EPUK (Environmental Protection UK, 2010) and criteria within the Air Quality and emissions mitigation guidance for Sussex Authorities.

15.53 EPUK guidance on Air Quality and Planning (Environmental Protection UK, 2010) sets out the following criteria to help establish when an air quality assessment is likely to be considered necessary, which include:

"Proposals that will give rise to a significant change in either traffic volumes, typically a change in annual average daily traffic (AADT) or peak traffic flows of greater than ±5% or ±10%, depending on local circumstances (a change of ±5% will be appropriate for traffic flows within an AQMA), or in vehicle speed (typically of more than ±10kph), or both, usually on a road with more than 10,000 AADT (5,000 if 'narrow and congested'[2])
Proposals that would significantly alter the traffic composition on local roads, for instance, increase the number of HDVs[3] by say 200 movements or more per day, due to the development of a bus station or an HGV[4] park (professional judgement will be required, taking account of the total vehicle flow as well as the change)."

15.54 These criteria are to some extent reflected in the Air Quality and Emissions Mitigation Guidance for Sussex authorities, which includes the following in the checklist to determine whether an assessment is required:

"For existing roads with >10,000 Annual Average Daily Traffic Flow (AADT) does the development: introduce extra vehicle movements (>5%), change average vehicle speeds (10kph), is it likely to cause congestion or introduce > 15 heavy duty extra vehicle movements per day?"

2 As defined in LAQM.TG(09).
3 HDV is heavy duty vehicle (HGV + buses/coaches)
4 HGV us heavy goods vehicle (>3.5 tonnes)

Climate Change Impacts

Sensitive Locations

15.55 Sensitive locations are not relevant in terms of the impacts of emissions of climate change gases, as impacts are at a global rather than a local level.

Assessment Approach

15.56 Any impacts on climate change will be related to the contributions of additional emissions of climate change gases. The emissions of carbon dioxide during all phases of the Proposed Development have been calculated. Emissions from the generators are based on the amount of fuel that will be used, while emissions from vehicles accessing the Application Site are based on emissions generated over a nominal distance travelled. Due to the uncertainty relating to the quantities of any gas that may be flared, it is not possible to include the flare within the carbon dioxide calculations.

Baseline Conditions

15.57 Chapter 3 Application Site and Surroundings describes the Application Site context and conditions. With respect to sensitive receptors, the area is rural, with agricultural land and woodland surrounding the Application Site. The nearest residential properties to the Application Site are on Kirdford Road, which include Old Helyers Farm which has an equestrian business. The nearest residential receptor is approximately 350 m north west of the Application Site boundary. There are some additional properties along Kirdford Road, which are further from the Application Site.

15.58 The Mens Special Area of Conservation (SAC) lies approximately 0.7 km to the south of the Application Site. The Mens SAC is an extensive area of mature beech woodland rich in lichens, bryophytes, fungi and saproxylic invertebrates. The

Mens SAC is also designated as a Site of Special Scientific Interest (SSSI) as it is one of the most extensive examples of Wealden woodland in West Sussex. It is important for its size, structural diversity and the extremely rich fungal and lichen flora. Ebernoe Common SAC is located approximately 5 km west of the Application Site. It has an extensive block of beech high forest and former wood pasture. The primary reason for designation is the bat species which the woods support. Ebernoe Common is also an SSSI and is of national importance as an example of a large ancient woodland. Dunhurst & Northup Copses Site of Nature Conservation Importance (SNCI) lies approximately 15m north of the Application Site boundary and is an area of ancient woodland dominated by oak, hazel and hawthorn. The Arun Valley is located approximately 9 km south of the Application Site and has been designated for its standing open water and canals. These habitats will be included as receptors where relevant. Further information on the sites is provided within Chapter 7A Ecology.

15.59 Chichester District Council (CDC) has investigated air quality within its area as part of its responsibilities under the LAQM regime. In areas where potential breaches of air quality standards were identified, detailed assessments have been carried out, and where these confirmed an objective exceedence, an AQMA was declared. The District currently has three Air Quality Management Areas for exceedences of the annual mean nitrogen dioxide objective, located in and around Chichester. These are over 20 km south of the Application Site, and the Proposed Development will not impact on these AQMAs. In terms of PM_{10}, the Council concluded that there are no exceedences of the objectives.

15.60 CDC operates 2 automatic and 10 nitrogen dioxide diffusion tube monitoring sites in and around Chichester and an ozone analyser in Lodsworth. None are in close proximity to the Application Site.

15.61 Estimated background concentrations in the study area have been determined for 2013 (

15.62 Table 15.4). The background concentrations are all well below the objectives.

Table 15.4: Estimated Annual Mean Background Pollutant Concentrations in 2013 (µg/m^3)

Year	NOx	NO_2	PM_{10}
2013	**8.4-8.6**[a]	**10.9-11.2**[a]	13.9-14.2
Objectives/Critical Level	**30**	**40**	**40**

n/a = not applicable

[a] This assumes that road vehicle emission factors in 2013 remain the same as in 2010 (See Appendix 15.3)

Background Deposition and Acidity

15.63 The background nitrogen deposition fluxes to the designated sites have been calculated from the APIS website (APIS, 2012), and are presented in Table 15.5. Nutrient nitrogen deposition background levels exceeded the upper and lower bound critical loads at all the sites. Acid nitrogen deposition background levels exceed the lower bound critical level at The Mens.

Table 15.5: Estimated Annual Mean Background Nitrogen Deposition in 2012

Year	Nutrient Nitrogen Deposition (KgN/ha/yr)	Acid Nitrogen Deposition (keq/ha/yr)
The Mens SAC/ SSSI		
2009-2011	31.5	2.3
Critical Load	**10-20**	**1.493-3.2**
Ebernoe Common SAC/ SSSI – Broadleaved Deciduous Woodland/ Fagus Woodland		
2009-2011	28. 6	2.09
Critical Load	**10-20**	**2.495-3.361**
Dunhurst and Northup Copses SNCI		
2009-2011	31.5	2.3
Critical Load	**10-15**	**2.52**

Impact Assessment

15.64 There will be a variety of sources on-site which will generate pollutant emissions to air. These will include diesel generators and a gas flare (refer to Chapter 4A

Project Description). The main air pollutants of concern related to these emissions are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

15.65 The Proposed Development will also lead to an increase in traffic on the local roads, which may impact on air quality at existing residential properties and ecological receptors (e.g. European designated sites within 10 km, and nationally designated sites within 2 km). The main air pollutants of concern related to traffic emissions are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

15.66 Construction activities will potentially impact upon existing residential properties and ecological receptors. The main pollutants of concern related to construction activities are dust and PM_{10}.

15.67 The Proposed Development is not expected to present a significant source of odour emissions, and, given that the nearest receptor lies approximately 350 m away, any odours that are emitted would almost certainly disperse sufficiently as to be undetectable to the human nose by the time they reach any receptors. Odour impacts will not, therefore, be considered further.

Construction Phase Impacts

15.68 The works during Phase 1 Construction will give rise to a risk of dust impacts during earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway. There may also be a risk of dust impacts during the Phase 4a Restoration Works.

Potential Dust Emission Magnitude

15.69 There is no requirement for demolition on-site. There will be minimal earthworks on-site. In order to construct a parking area for contractor's cars and later for the drilling crews, the topsoil will be stripped off using an excavator. Welfare

facilities for the workforce will also be constructed in this area. The parking area will be 'at grade' with no specific excavations or levelling of the area.

15.70 The earthworks will last less than 10 weeks and dust will arise mainly from the vehicles travelling over unpaved ground and from the handling of dusty materials. Any topsoil removed will be placed in a stockpile as close as possible to the point of excavation. In order to supress dust, procedures for dampening down stockpiles will be put in place. The dust emission class for the earthworks is considered to be *small*.

15.71 The construction will involve a small parking area using compacted stone on a geotextile membrane. The main site will be fenced off from the rest of the fields using a 2 m high wire mesh security fence. The access road will remain unfenced except where it passes to the south of a screen of trees, where a 1.2 m high post and wire fence will be erected on the north side of the track to maintain a 15 m clearance of the track from the trees. There will also be some portacabin accommodation for the workforce, which will not require construction. Dust will arise from vehicles travelling over unpaved ground, the handling and storage of dusty material. The construction will take place over a maximum of 10 weeks. The dust emission class for the construction is considered to be *small*.

15.72 The number of vehicles during the Phase 1 construction, which may track out dust and dirt, is expected to be an average of 15 (maximum 25 per day leaving the site). The dust emission class for trackout is considered to be *medium*.

15.73 Table 15.6 summarises the dust emission magnitude for the Proposed Development.

Table 15.6: Summary of Dust Emission Magnitude

Source	Dust Emission Magnitude
Earthworks	Small
Construction	Small
Trackout	Medium

Sensitivity of the Area

15.74 This assessment step combines the sensitivity of individual receptors to dust effects, with the number of receptors in the area and their proximity to the Application Site. It also considers additional site-specific factors such as topography and screening, and in the case of sensitivity to human health effects, baseline PM_{10} concentrations.

Sensitivity of the Area to Effects from Dust Soiling

15.75 The area surrounding the Proposed Development is agricultural land and woodlands which using the IAQM guidance would be 'low' sensitivity receptors (Table A1.2 of Appendix 15.1). There are no residential receptors within 350 m of the Proposed Development. Using the matrix set out in Table A1.3 (Appendix 15.1), the area surrounding the onsite works is of 'low' sensitivity to dust soiling. Table 15.6 shows that dust emission magnitude for trackout is 'medium', thus there is a risk of material being tracked 200m from the site exit (see Table A1.3, Appendix 15.1). There are no properties lying within 50 m of the public highway within 200 m of the site entrance that may be affected by dust, and Table A1.3 (Appendix 15.1) thus indicates that the area is of 'low' sensitivity to dust soiling due to trackout. Taking these points into account, it is judged that the area surrounding the on-site works and the area surrounding roads along which material may be tracked is of 'low' sensitivity to dust soiling (

15.76 Table 15.8).

Sensitivity of the Area to any Human Health Effects

15.77 There are no residential receptors within 350m of the Application Site, nor any within 50 m of the public highway within 50 m of the site entrance. According to the IAQM guidance, there are therefore no receptors sensitive to human health effects that need to be taken into consideration.

Sensitivity of the Area to any Ecological Effects

15.78 The Dunhurst & Northup Copses SNCI lies approximately 15 m north of the Application Site boundary, all other ecological sites are more than 500 m away and therefore do not need to be considered here. The IAQM guidance considers locally designated sites to be of 'low sensitivity' and thus Table A1.3 (Appendix 15.1) shows that the area is of low sensitivity to ecological effects (Table 15.7).

Table 15.7: Summary of the Area Sensitivity

Effects Associated With:	Sensitivity of the Surrounding Area	
	On-site Works	Trackout
Dust Soiling	Low Sensitivity	Low Sensitivity
Human Health	None	None
Ecological	Low Sensitivity	Low Sensitivity

Risk and Significance

15.79 The dust emission magnitudes in Table 15.6 have been combined with the sensitivities of the area in Table 15.7 using the matrix in Table A1.6 in Appendix 15.1, in order to assign a risk category to each activity. The resulting risk categories for the three construction activities, without mitigation, are set out in

15.80 Table 15.8. These risk categories have been used to determine the appropriate level of mitigation required for the Application Site.

Table 15.8: Summary of Risk of Impacts Without Mitigation

Source	Dust Soiling	Human Health	Ecology
Earthworks	Negligible	None	Negligible
Construction	Negligible	None	Negligible
Trackout	Negligible	None	Low

15.81 The IAQM does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be insignificant (Institute of Air Quality Management, 2014).

Traffic– Health Impacts (Phase 1-4)

15.82 The Transport Assessment undertaken for the Proposed Development predicts total daily traffic generation from the Proposed Development in each of the 4 phases. Table 10.3 in Chapter 10A Transport and Access includes baseline traffic flows for 2013 for the roads most likely to carry development traffic. Kirdford Road, adjacent to the Application Site is a single carriageway road and rural in nature. Annual Average Weekday Flow (AAWF)[5] on Kirdford Road is estimated at 1,396 vehicles per day (13.1% HGVs). Kirdford Road meets Durbans Road and Newpound Lane to form a crossroads within Wisborough Green. At this point Kirdford Road ends. The route to the A272 to the south of Wisborough Green continues along Durbans Road and onto the A272. The A272 is the main east-west route through West Sussex, in the local context connecting Petworth, Petersfield, and the A3 with Billingshurst, Haywards Heath and the A23 and A24. This road is not considered canyon-like[6] as it passes through Wisborough Green. Annual Average Weekday Flow (AAWF) on the A272 adjacent to Wisborough Green is estimated at 7,089 vehicles per day (10.0% HGVs). The increases in traffic flow with the Proposed Development are set out in

15.83

15.84

15.85 Table 15.9 and the percentage increases in flow on the local roads are set out in

[5] Annual Average Weekday Flow is likely to be slightly higher than the Annual Average Daily Flow (AADT), which includes lower weekend flows.

[6] Street canyons can generally be defined as narrow streets where the height of buildings on both sides of the road is greater than the road width (paragraph A3.55, TG(09))

15.87 Table 15.10.

15.88 The traffic flows on Kirdford Road and the A272 are less than 10,000 AADT and the percentage increases are less than 5% in relation to the AADT. The screening criteria set out in paragraphs 15.53 and 15.54 are not exceeded and the impacts of emissions from road traffic are therefore judged to be insignificant.

Table 15.9: Forecast Traffic Associated with Each Phase of the Proposed Development

Phase	Maximum timescale[7]	Forecast Two Way Traffic Volumes associated with Phase		
		Total	LV (<1.5te)	HV (>1.5te)
Phase 1: Construction	10 weeks	29	9	20
Phase 2: Main Rig Mobilisation	1 week	62	38	24
Phase 2: Drilling (vertical)	14 weeks	44	38	6
Phase 3: Testing (vertical)	2 weeks	44	38	6
Phase 2 – Lateral	12 weeks	44	38	6
Phase 2: Main Rig De-mobilisation	1 week	62	38	24
Phase 3: Workover Rig mobilisation	1 week	36	16	20
Phase 3: Testing (lateral)	24 weeks	12	8	4
Phase 3: Workover Rig De-mobilisation	2 X 1 week	36	16	20
Phase 4a: Workover Rig Mobilisation	2 X 1 week	36	16	20
Phase 4a: Restoration	10 weeks	29	9	20
Phase 4a: Workover Rig Mobilisation	1 week	36	16	20

[7] Includes contingent horizontal exploration well (up to 12 months after vertical phase 3)

Table 15.10: Forecast Percentage Increases on Local Roads with Each Phase of the Proposed Development

Phase	% change in vehicle movements on A272			% change in vehicle movements on Kirdford Road		
	Total	LV (<1.5te)	HV(>1.5)	Total	LV(<1.5)	HV(>1.5)
Phase 1: Construction	0.41%	0.14%	2.82%	2.08%	0.74%	10.93%
Phase 2: Main Rig Mobilisation	0.87%	0.60%	3.39%	4.44%	3.13%	13.11%
Phase 2: Drilling (vertical)	0.62%	0.60%	0.85%	3.15%	3.13%	3.28%
Phase 3:Testing (vertical)	0.62%	0.60%	0.85%	3.15%	3.13%	3.28%
Phase 2: Lateral	0.62%	0.60%	0.85%	3.15%	3.13%	3.28%
Phase 2: Main Rig De-mobilisation	0.87%	0.60%	3.39%	4.44%	3.13%	13.11%
Phase 3: Workover Rig mobilisation	0.51%	0.25%	2.82%	2.58%	1.32%	10.93%
Phase 3: Testing (lateral)	0.17%	0.13%	0.56%	0.86%	0.66%	2.19%
Phase 3: Workover Rig De-mobilisation	0.51%	0.25%	2.82%	2.58%	1.32%	10.93%
Phase 4a: Workover Rig Mobilisation	0.51%	0.25%	2.82%	2.58%	1.32%	10.93%
Phase 4a: Restoration	0.41%	0.14%	2.82%	2.08%	0.74%	10.93%
Phase 4a: Workover Rig Mobilisation	0.51%	0.25%	2.82%	2.58%	1.32%	10.93%

Traffic– Climate Change Impacts

15.89 The traffic flows associated with the Proposed Development (

15.90

15.91

15.92 Table 15.9) have been used to estimate the transport related CO_2 emissions. The distances travelled have been assumed to be 100 km for HGVs and 20 km for LGVs. These assumptions give CO_2 emissions of 282 te (as CO_2) per annum associated with traffic from the Proposed Development, or 433 te over the full period of the works. This value may be compared with 835,100 te emitted from all activities within the area covered by CDC in 2011 and 4,645,500 te emitted from West Sussex.

Point Source Impacts (Phase 2-4)

On-site Power Generation

Health Impacts

15.93 On-site power generation will occur during all phases. Predicted total (including background) annual mean concentrations of nitrogen dioxide and PM_{10}, and the maximum 1-hour mean nitrogen dioxide and 24-hour mean PM_{10} concentrations are presented for the worst-case location (outside of the Application Site) in Table 15.11. It should be noted that this location is not necessarily representative of relevant exposure, but is being treated as the worst case impact.

15.94 For the 1-hour objective the worst-case location is approximately 30 m South East of the flare. For the 24 hour objective, the worst-case location is approximately 175 m North East of the flare. For the annual mean objectives the worst-case location is approximately 270 m North West of the flare. These concentrations are all well below the objectives.

15.95 It should be noted that these predicted concentrations assume operation of the generators at 70% power for 20 out of 24 hours of each day. The generators are not, in practice, expected to operate at these levels throughout all phases. These predictions will thus overstate any impacts.

Table 15.11: Predicted Worst-Case Total Concentrations from the On-site Generators – Health Receptors

Location	NO_2 (µg/m^3)		PM_{10} (µg/m^3)	
	Annual Man	Max 1hour	Annual Mean	Max 24-hour
Location (X,Y)	11.1 [503938.2, 126927.8]	64.3 [503798.2. 126667.8]	14.8 [503938.2, 126947.8]	35.6 [503858.2, 126867.8]
Objective	**40**	**200** [a]	**40**	**50** [b]

[a] 200 □g/m^3 represents the objective for the 18th highest 1-hour concentration.

[b] 50 □g/m^3 represents the objective for the 35th highest 24-hour concentration.

15.96 The generators would not cause any exceedences of the annual mean or short-term objectives.

15.97 The impacts of emissions from the generators with regards to health impacts are therefore judged to be insignficant, as the worst-case concentrations would be below the objectives.

Ecological Impacts

Nitrogen Oxides Concentrations

15.98 Maximum predicted process contributions of annual and 24-hour mean concentrations of nitrogen oxides at the designated sites, are presented in Table 9.

Table 15.12: Predicted Process Contributions from the On-site Generators on Nearby Designated Sites

Location	Designation	NOx (µg/m^3)	
		Annual Mean	24-hour Mean
The Mens	SAC/ SSSI	**1.1**	**19.6**
Ebernoe Common	SAC/ SSSI	**0.04**	**0.4**
Dunhurst and Northup Copses: **Location (X,Y)**	Local	**14.8 [503938.2, 126927.8]**	**66.6 [503858.2, 126867.8]**
Arun Valley	SPA	**0.02**	**0.4**
Objective/Guideline		**30**	**75**

15.99 The predicted contributions to annual and 24-hour mean concentrations at the nationally designated sites (Ebernoe Common, Arun Valley) are less than the EA's criteria of 1% and 10%, respectively, of the critical level/guideline. The potential for significant effects from this pollutant can be discounted at these sites. At The Mens, the 24-hour mean concentration is more than 10%. This designated site is thus considered more fully when gas flaring is included, in the next section.

15.100 The predicted contributions to annual and 24-hour mean concentrations at the locally designated site (Dunhurst and Northup Copses) are less than the EA's internal guidance criteria of 100% of the critical level/guideline. This site will, however, be considered further using detailed modelling.

Table 15.13: Predicted Nitrogen Deposition and Acidity Process Contributions

Location	Designation	Nitrogen Deposition (KgN/ha/yr)			Nitrogen Acidity (keq/ha/yr)		
		Critical Load	Change	% of Critical Load	Critical Load	Change	% of Critical Load
The Mens	SAC/ SSSI	**10**	**0.0790**	**0.8%**	**1.49**	**0.000561**	**0.04%**
Ebernoe Common	SAC/ SSSI	**10**	**0.0028**	**0.03%**	**2.50**	**0.000020**	**<0.01%**
Dunhurst and Northup Copses **[503938.2, 126927.8]**	Local	**10**	**1.0360**	**10.4%**	**2.52**	**0.007356**	**0.3%**
Arun Valley	SPA	-	-	-	-	-	-

15.101 The nitrogen deposition and nitrogen acidity is less than 1% for The Mens and Ebernoe Common and less than 100% for Dunhurst and Northup Copses. Impacts from nitrogen deposition and nitrogen acidity are therefore judged to be insignificant.

Combined Impacts from On-site Power Generation and Gas Flaring.

Local Emissions

15.102 Gas flaring may occur at any stage during Phase 3 (other than during rig mobilisation and de-mobilisation), which will last for up to 28 weeks, including rig demobilisation and mobilisation. In order to provide a worst-case assessment it has been assumed that this 28-week period may occur at any time during a full year of meteorological conditions. At this stage it is not possible to quantify the amount of gas (if any) that might need to be flared. The approach has thus been to assume a worst-case flaring of 10 tonnes of gas per day and then back calculate the minimum emissions of NOx required before pollutant concentrations, when combined with the (worst-case) estimates from the on-site generators (above) would give rise to any objective exceedences (relevant for nitrogen dioxide). The results are given in Table 15.14 to Table 15.17. These emission rates (given in grammes per second (g/s)) are then compared to emission rates quoted for similar operations elsewhere.

Table 15.14: Emission Rate for Nitrogen Oxides Required Before the Annual Mean Air Quality Objective for Nitrogen Dioxide Would be Breached

Location	"A" Predicted Concentration Without Flaring ($\mu g/m^3$) [a]	"B" Headroom (Objective minus "A") ($\mu g/m^3$)	"C" Emission Rate Required to Fill Headroom and thus Breach Objective (g/s)
503838.2, 126767.8	8.9	31.1	7.8
Objective	**40**	-	-

[a] The annual mean concentration without flaring been calculated by adding the annual mean process contribution from the generators to the background concentrations.

Table 15.15: Emission Rate for Nitrogen Oxides Required Before the Short-Term (1-hour) Mean Air Quality Objective for Nitrogen Dioxide Would be Breached

Location	"A" Predicted Concentration Without Flaring ($\mu g/m^3$) [a]	"B" Headroom (Objective minus "A") ($\mu g/m^3$)	"C" Emission Rate Required to Fill Headroom and thus Breach Critical Level (g/s)
503818.2, 126707.8	49.5	150.5	1.6
Objective	**200**	-	-

[a] The 99.79th percentile concentration without flaring has been calculated using the methodology outlined in Appendix 15.3.

Table 15.16: Emission Rate for Nitrogen Oxides Required Before the Annual Mean Process Contribution Would Breach the Critical Level for Nitrogen Oxides at Ecological Receptors

Location	"A" Process Contribution Without Flaring ($\mu g/m^3$) [a]	"B" Headroom (Objective minus "A") ($\mu g/m^3$)	"C" Emission Rate Required to Fill Headroom and thus Breach Objective (g/s)
503838.2, 126767.8	11.6	18.4	3.2
Critical Level	**30**	-	-

[a] The annual mean concentration without flaring been calculated by adding the annual mean process contribution from the generators to the background concentrations.

Table 15.17: Emission Rate for Nitrogen Oxides Required Before the Short-Term (24-hour) Process Contribution Would Breach the Critical Level for Nitrogen Oxides at Ecological Receptors

Location	"A" Predicted Process Contribution Without Flaring ($\mu g/m^3$) [a]	"B" Headroom (Objective minus "A") ($\mu g/m^3$)	"C" Emission Rate Required to Fill Headroom and thus Breach Critical Level (g/s)
503878.2, 126707.8	60.1	14.9	0.22
Critical Level	**75**	-	-

[a] The 99.79th percentile concentration without flaring has been calculated using the methodology outlined in Appendix 15.3.

15.103 Table 15.14 shows that the emission rate for the flare gas would need to be 7.8 g/s before the nitrogen dioxide annual mean concentration would exceed the objective at the worst-case off-site location.

15.104 Table 15.15 shows that the emission rate for the flare gas would need to be 1.6 g/s before the nitrogen dioxide short-term (1-hour) mean concentration would exceed the objective at the worst-case off-site location.

15.105

15.106 Table 15.16 shows that the emission rate for the flare gas would need to be 3.2 g/s before the nitrogen oxides annual mean process contribution would exceed the critical level at the worst-case off-site location. Table 15.17 shows that the emission rate for the flare gas would need to be 0.22 g/s before the nitrogen oxides short-term (24-hour) mean process contribution would exceed the critical level at the worst-case off-site location.

15.107 The maximum acceptable emission rate of NOx from flaring is thus considered to be 0.22g/s, based on an average-day fuel input of 10 tonnes. Examples of another onshore gas site and the National Atmospheric Emissions Inventory have been referred to in order to predict what the likely emissions could be. The emission rate for flaring quoted within the assessment for the permit for the

drilling and well testing activities in Balcome is 0.118 g/s[8]. The emissions rate derived from the National Atmospheric Emissions Inventory for venting and flaring (oil production) is 0.16 g/s and for venting and flaring (gas production), 0.15 g/s. The emission rate required for a risk of a breach of the objectives or to represent more than 100% of the critical level for the locally designated ecological site is approximately 40% more than that which would occur in practice, even incorporating worst-case assumptions.

15.108 The assessment of the generator impacts identified that further assessment was required of the impact of the combined emissions on the 24-hour concentrations at The Mens designated site. Assuming the worst-case emission rate from flaring of 0.22 g/s, the maximum total 24-hour nitrogen oxides concentration would be 43.0 $\mu g/m^3$, which is well below the critical level of 75 $\mu g/m^3$.

CO_2 Emissions

15.109 CO_2 emissions from the generators have been estimated by using fuel consumption from a Cummins DFHD 880 KW, which would be similar to the actual generators used. Using the scaled fuel consumption for 4.5 MW of electricity generation and the National Atmospheric Emissions Inventory emissions of carbon per million tonnes of fuel, it is estimated that using the worst-case scenario, and assuming both vertical and horizontal exploration well, the Proposed Development would add 23,463 te of CO_2 over the potential 80 week duration of the Proposed Development (equivalent to an annual figure of 15,250 te of CO_2). This figure assumes operation of the generator for 20 out of 24 hours, at 70% loading, which is likely to be an overestimation. This value may be compared with 835,100 te emitted from activities within the area covered by Chichester DC in 2011 and 4,645,500 te emitted from West Sussex.

[8] Atkins (11th June 2013) Technical Note. Balcombe Flare. Initial air dispersion model.

Mitigation Measures

15.110 A Construction Environmental Management Plan (CEMP) would be submitted to WSCC for approval prior to commencement of works on-site. This would describe the mitigation measures to be put in place by the Applicant and contractors throughout the works to minimise impacts on the environment. The CEMP would also define who would be responsible for implementing each mitigation measure and contain a monitoring programme as set out in Chapter 6A Construction Programme & Management. Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses.

15.111 Notwithstanding the relatively low volumes of traffic movements forecast for the Proposed Development, a Traffic Management Plan (TMP) would be prepared with the focus of minimising disturbance which could potentially arise from construction traffic in particular. This includes measures such as ensuring HGVs travel on the Advisory Lorry Network for as long as possible and wheel washing on site and road sweeping carried out to keep the local highway clear of mud and debris.

15.112 The assessment has demonstrated that an emission rate of 0.31 g/s would be required for the flare gas before the nitrogen oxide 24-hour mean process contribution would be greater than 100% of the critical level at the worst case location. This is twice as great as the emission that would occur in practice. No mitigation is therefore required for the flare or for the generators.

Residual Effects

Construction Impacts

15.113 The IAQM guidance is clear that, with appropriate mitigation in place, the residual effect will normally be 'insignificant'. The mitigation measures outlined

in the Construction Environmental Management Plan should include the mitigation measures as set out in Appendix 15.4 which are based on the IAQM guidance. With these measures in place and effectively implemented the residual effects are judged to be *insignificant.*

Traffic Impacts

15.114 The impacts of emissions from road traffic for all phases are *insignificant*.

Point Source Impacts

15.115 The impacts of emissions from the generators and the flare (flaring only takes place during Phase 3 Testing) are *insignificant*.

Odour Impacts

15.116 Overall, there is judged to be an *insignificant* risk of odour effects.

Climate Change Impacts

15.117 There is no basis for judging the significance of the changes in emissions of carbon dioxide.

Cumulative Effects

15.118 As all effects of the Proposed Development are assessed as insignificant, there would be no cumulative effects with the two developments listed in Chapter 2 of the submitted ES.

Summary and Conclusions

15.119 The air quality impacts associated with the siting and development of a

temporary well site compound and access road near Wisborough Green, in West Sussex have been assessed. The Proposed Development involves the temporary use of the Application Site for the drilling of a vertical borehole and a contingent horizontal borehole from the same well, for the purposes of exploring for hydrocarbons, and the testing and evaluation of any discovered. The key sources of emissions, which have been assessed are:

- emissions from the construction of the Proposed Development;
- emissions from traffic associated with the Proposed Development;
- exhaust emissions from the on-site generators; and
- emissions from gas flaring.

15.120 Existing conditions within the study area show acceptable air quality. The impacts of the proposals have been assessed using standard methodologies, making a number of worst-case assumptions regarding on-site activities and emissions.

15.121 It has been shown that emissions from traffic, and from the on-site generators and gas flaring would have an *insignificant* impact on local air quality.

15.122 An estimate of carbon dioxide emissions associated with the Proposed Development has been provided, with 433 te (as CO_2) associated with the vehicle movements and around 23,463 te associate with the use of the generators (as a worst case). These values may be compared with 835,100 te emitted from activities within the area covered by CDC in 2011 and 4,645,500 te emitted from West Sussex. There is no basis for judging the significance of the changes in emissions of carbon dioxide

15.123 There is judged to be an *insignificant* risk of dust effects during the construction period.

15.124 Overall it is concluded that the air quality impacts of the proposals are

insignificant.

Table 15.18 Table of Significance – Air Quality

Potential Effect	Nature of Effect (Permanent/Temporary)	Significance	Mitigation / Enhancement Measures	Geographical Importance*							Residual Effects
				I	UK	E	R	C	D	L	
Phase 1: Construction of access road and well site											
Air quality effects at sensitive receptors	Temporary	Insignificant	Construction Environmental Management Plan. Traffic Management Plan	-	-	-	-	-	-	*	Insignificant
Phase 2: Mobilisation of the drill rig and drilling operations											
Air quality and odour effects at sensitive receptors	Temporary	Insignificant	Traffic Management Plan	-	-	-	-	-	-	*	Insignificant
Phase 3: Testing											
Air quality and odour effects at sensitive receptors	Temporary	Insignificant	Traffic Management Plan	-	-	-	-	-	-	*	Insignificant
Phase 4a: Restoration											
Air quality effects at sensitive receptors	Temporary	Insignificant	Traffic Management Plan	-	-	-	-	-	-	*	Insignificant

*** Geographical Level of Importance**

I = International; UK = United Kingdom; E = England; R = Regional; C = County; D = District; L = Local

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APPENDIX 15.1

CONSTRUCTION DUST ASSESSMENT PROCEDURE

Appendix 15.1 Construction Dust Assessment Procedure

1.1 The criteria developed by IAQM divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

1.2 The assessment procedure is split into four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

1.3 An assessment is required where there is a human receptor within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s), or where there is an ecological receptor within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

1.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is negligible and that any effects will not be significant. No mitigation measures beyond those required by legislation will be required.

STEP 2: Assess the Risk of Dust Impacts

1.5 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- the sensitivity of the area to dust effects (Step 2B).

1.6 These two factors are combined in Step 2C, which is to determine the risk of dust impacts with no mitigation applied. The risk categories assigned to the site may be different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Step 2A – Define the Potential Dust Emission Magnitude

1.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM explains that this classification should be based on professional judgement, but provides the examples in Table A1.1.

Table A1.1: Examples of How the Dust Emission Magnitude Class May be Defined

Class	Examples
Demolition	
Large	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >20 m above ground level
Medium	Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level
Small	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months
Earthworks	
Large	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes
Medium	Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes
Small	Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	
Large	Total building volume >100,000 m^3, piling, on site concrete batching; sandblasting
Medium	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching
Small	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout [a]	
Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m
Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m

[a] These numbers are for vehicles that leave the site after moving over unpaved ground.

STEP 2B: Define the Sensitivity of the Area

1.8 The sensitivity of the area is defined taking account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters to reduce the risk of wind-blown dust.

1.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM recommends that this should be based on professional judgment, taking account of the principles in Table A1.2. These receptor sensitivities are then used in the matrices set out in Table A1.3, Table A1.4 and Table A1.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

STEP 2C: Define the Risk of Impacts

1.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts with no mitigation applied. The IAQM provides the matrix in Table A1.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

1.11 The IAQM provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided by the IAQM has been used as the basis for the requirements set out in Appendix 15.4.

STEP 4: Determine Significant Effects

1.12 The IAQM does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant' (Institute of Air Quality Management, 2014).

1.13 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would

not normally be considered sufficient to change the conclusion that the effects will be 'not significant'.

Table A1.2: Principles to be Used When Defining Receptor Sensitivities

Class	Principles	Examples
Sensitivities of People to Dust Soiling Effects		
High	users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land	dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms
Medium	users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land	parks and places of work
Low	the enjoyment of amenity would not reasonably be expected; or there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land	playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads
Sensitivities of People to the Health Effects of PM_{10}		
High	locations where members of the public may be exposed for eight hours or more in a day	residential properties, hospitals, schools and residential care homes
Medium	locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	may include office and shop workers, but will generally not include workers occupationally exposed to PM10
Low	locations where human exposure is transient	public footpaths, playing fields, parks and shopping streets
Sensitivities of Receptors to Ecological Effects		
High	locations with an international or national designation *and* the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species	Special Areas of Conservation with dust sensitive features
Medium	locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition	Sites of Special Scientific Interest with dust sensitive features
Low	locations with a local designation where the features may be affected by dust deposition	Local Nature Reserves with dust sensitive features

Table A1.3: Sensitivity of the Area to Effects on People and Property from Dust Soiling 1

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Low	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table A1.4: Sensitivity of the Area to Human Health Effects [1]

Receptor Sensitivity	Annual Mean PM_{10}	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

[1] For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table A1.5: Sensitivity of the Area to Ecological Effects [1]

Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table A1.6: Defining the Risk of Dust Impacts

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

APPENDIX 15.2

IMPACT DESCRIPTORS AND ASSESSMENT OF SIGNIFICANCE

Appendix 15.2 Impact Descriptors and Assessment of Significance

1.1 There is no official guidance in the UK on how to describe the nature of air quality impacts, nor how to assess their significance. The approach developed by the Institute of Air Quality Management1 (Institute of Air Quality Management, 2009), and incorporated in Environmental Protection UK's guidance document on planning and air quality (Environmental Protection UK, 2010), has therefore been used. This involves three distinct stages: the application of descriptors for magnitude of change; the description of the impact at each sensitive receptor; and then the assessment of overall significance of the scheme.

Impact Descriptors

1.2 The definition of **impact magnitude** is solely related to the degree of change in pollutant concentrations, expressed in microgrammes per cubic metre, but originally determined as a percentage of the air quality objective. **Impact description** takes account of the impact magnitude and of the absolute concentrations and how they relate to the air quality objectives or other relevant standards. The descriptors for the magnitude of change due to the scheme are set out Table A0.1, while

[1] The IAQM is the professional body for air quality practitioners in the UK.

1.4 Table A0.2 sets out the impact descriptors. These tables have been designed to assist with describing air quality impacts at each specific receptor. They apply to the pollutants relevant to this scheme and the objectives against which they are being assessed.

Table A0.1: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2/PM_{10}	No. days with PM_{10} concentration greater than 50 $\mu g/m^3$	Annual Mean $PM_{2.5}$
Large	Increase/decrease ≥4 $\mu g/m^3$	Increase/decrease >4 days	Increase/decrease ≥2.5 $\mu g/m^3$
Medium	Increase/decrease 2 - <4 $\mu g/m^3$	Increase/decrease 3 or 4 days	Increase/decrease 1.25 - <2.5 $\mu g/m^3$
Small	Increase/decrease 0.4 - <2 $\mu g/m^3$	Increase/decrease 1 or 2 days	Increase/decrease 0.25 - <1.25 $\mu g/m^3$
Imperceptible	Increase/decrease <0.4 $\mu g/m^3$	Increase/decrease <1 day	Increase/decrease <0.25 $\mu g/m^3$

Table A0.2: Air Quality Impact Descriptors for Changes to Annual Mean Nitrogen Dioxide, PM_{10} and $PM_{2.5}$ Concentrations and Changes to Number of Days with PM_{10} Concentration Greater than 50 µg/m^3 at a Receptor [a]

Absolute Concentration [b] in Relation to Objective	Change in Concentration/day [c]		
	Small	Medium	Large
Above Objective [d]	Slight	Moderate	Substantial
Just Below Objective [e]	Slight	Moderate	Moderate
Below Objective [f]	Negligible	Slight	Slight
Well Below Objective [g]	Negligible	Negligible	Slight

[a] Criteria have been adapted from the published criteria to remove overlaps at transitions.

[b] The 'Absolute Concentration' relates to the 'With-Scheme' air quality where there is an increase in concentrations and to the 'Without-Scheme' air quality where there is a decrease in concentrations.

[c] Where the Impact Magnitude is *Imperceptible*, then the Impact Description is *Negligible*.

[d] 'Above': >40 µg/m^3 annual mean NO_2 or PM_{10}, >25 µg/m^3 annual mean $PM_{2.5}$, or >35 days with PM_{10} > 50 µg/m^3.

[e] 'Just below': >36 – ≤40 µg/m^3 of annual mean NO_2 or PM_{10}, >22.5 - ≤25 µg/m^3 annual mean $PM_{2.5,}$ or >32 – ≤35 days with PM_{10} >50 µg/m^3.

[f] 'Below': >30 – ≤36 µg/m^3 of annual mean NO_2 or PM_{10}, >18.75 - ≤22.5 µg/m^3 annual mean $PM_{2.5,}$ or >26 – ≤32 days with PM_{10} >50 µg/m^3.

[g] 'Well below': ≤30 µg/m^3 annual mean NO_2 or PM_{10}, ≤18.75 µg/m^3 annual mean $PM_{2.5,}$ or ≤26 days with PM_{10} >50 µg/m^3.

Assessment of Significance

1.5 The IAQM (Institute of Air Quality Management, 2009) guidance is that the assessment of significance should be based on professional judgement, with the overall air quality impact of the scheme described as either insignificant, minor, moderate or major. In drawing these conclusions, the factors set out in Table A0.3 should be taken into account.

Table A0.3: Factors Taken into Account in Determining Air Quality Significance

Factors
Number of people affected by increases and/or decreases in concentrations and a judgement on the overall balance.
The number of people exposed to levels above the objective or limit value, where new exposure is being introduced.
The magnitude of the changes and the descriptions of the impacts at the receptors using the criteria set out in Table A0.1 and Table A0.2.
Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased.
Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced.
Uncertainty, including the extent to which worst-case assumptions have been made.
The extent to which an objective or limit value is exceeded, e.g. an annual mean NO_2 of 41 $\mu g/m^3$ should attract less significance than an annual mean of 51 $\mu g/m^3$.

APPENDIX 15.3

MODELLING METHODOLOGY

15.3 Modelling Methodology

Background Concentrations

1.1 The background concentrations across the study area have been defined using the national pollution maps published by Defra (2013a). These cover the whole country on a 1x1 km grid and are published for each year from 2010 until 2025. The maps include the influence of emissions from a range of different sources; one of which is road traffic. There are some concerns that Defra may have over-predicted the rate at which road traffic emissions of nitrogen oxides will fall in the future. The maps currently in use were verified against measurements made during 2010 at a large number of automatic monitoring stations and so there can be reasonable confidence that the maps are representative of conditions during 2010. Similarly, there is reasonable confidence that the reductions which Defra predicts from other sectors (e.g. rail) will be achieved.

1.2 In order to calculate background nitrogen dioxide and nitrogen oxides concentrations in 2013, it is assumed that there was no reduction in the road traffic component of backgrounds between 2010[1] and 2013. This has been done using the source-specific background nitrogen oxides maps provided by Defra (2013a). For each grid square, the road traffic component has been held constant at 2010 levels, while 2013 values have been taken for the other components. Nitrogen dioxide concentrations have then been calculated using the background nitrogen dioxide calculator which Defra (2013a) publishes to accompany the maps. The result is a set of 'adjusted 2013 background' concentrations.

1.3 For PM_{10} and $PM_{2.5}$, there is no strong evidence that Defra's predictions are unrealistic and so the year-specific mapped concentrations have been used in this assessment.

Model Inputs

Point Sources

1.4 The impacts of emissions from the on-site generators and flare stack have been predicted using the ADMS-5 dispersion model. ADMS-5 is a new generation model that incorporates a state-of-the art understanding of the dispersion processes within the atmospheric boundary layer. The model was run to predict the contribution of the proposed generator and flare stack emissions to 1-hour concentrations of nitrogen oxides throughout the year (using 2012 meteorological data) and for the generators the emissions of PM_{10} to the 1-hour concentrations for every hour of the year. These hour-

[1] This approach assumes that has been no reduction in emissions per vehicle but also that traffic volumes have remained constant. This is not the same as the assumption made for dispersion modelling, in which emissions per vehicle are held constant while traffic volumes are assumed to change year on year. Overall, this discrepancy is unlikely to influence the overall conclusions of the assessment.

by-hour concentrations have been used to calculate annual mean concentrations for both nitrogen dioxide and PM_{10}.

The model input parameters were agreed with Celtique Energie.

Assumptions

1.5 The model has been run using hourly sequential meteorological data from Farnborough meteorological station for 2012. This station is considered suitable for this area and 2012 is the most recent year with a full dataset. A surface roughness length of 0.3 m has been used, which is considered suitable for the study area. Terrain effects have not been included. Given the worst-case assumptions that have been made regarding operating conditions, the conclusions of the assessment will not be sensitive to these parameters.

1.6 Three on-site generators have been modelled with a total output of 4.5 MW. Emissions and exhaust gas temperature and flow have been based on a Cummins 880DFHD generator (similar specification to the KTA50-G3), as the exact specification of the generators is currently unknown. The exhaust exit height is assumed to be 3 m with the exhaust exit diameter of 100 mm.

1.7 In order to provide a worst-case assessment, it has been assumed that the generators would run at 70% power for 20 out of 24 hours of the day[2]. Impacts from the generators will thus have been significantly over-predicted.

1.8 At this stage it is not known precisely where on the site the generators will be positioned, although an indication of the likely locations has been provided. Modelling has thus been carried out assuming these likely locations (see Figure A3.1 for the modelled locations of the generators).

1.9 Gas flaring would only occur during the testing phase of up to 28 weeks. However, in order to provide a worst-case assessment, it has been assumed that there is the potential for gas to be flared at any time during a full calendar year. At this stage it is not possible to quantify the amount of gas (if any) that might need to be flared. The assessment thus assumes a maximum fuel consumption of the flare of 10 tonnes per day and calculates the maximum nitrogen oxides emission rate (on top of the other worst-case emissions assumptions for the generator) before there would be an exceedence of any nitrogen dioxide / nitrogen oxides.

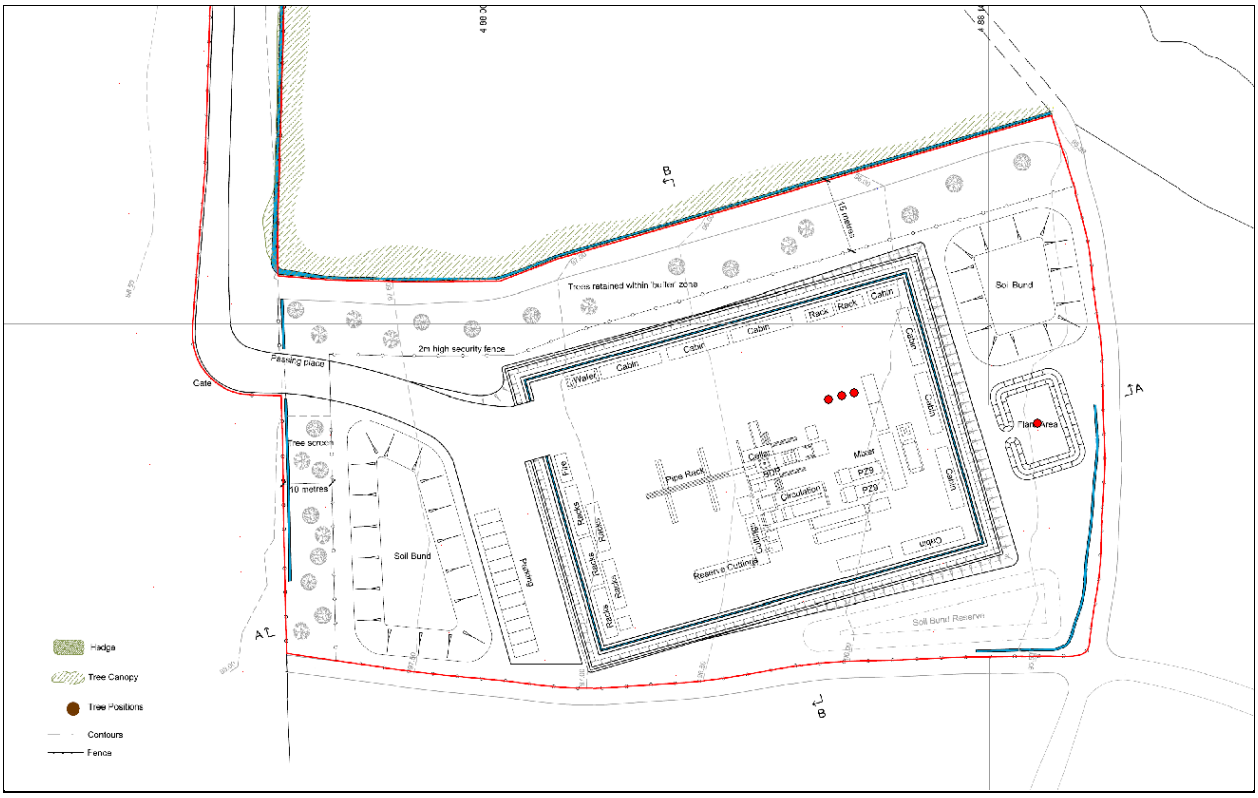
1.10 The exhaust flow rate has been calculated based on the assumed fuel burnt. It is assumed that: there will be a maximum of 10 tonnes of fuels burnt per day; the fuel will comprise the following composition; and with fuel will undergo 98% combustion in air:

[2] The construction, testing and restoration phase would require significantly less power.

- Methane: 88.35%
- Ethane:4.02%
- Propane:4.88%
- i-butane: 0.30%
- n-butane: 2.45%

generating an exhaust gas volume of 14.7 m^3 per second. For the purpose of modelling it is assumed that the flare stack will be located in the middle of the flare area on site (See Figure 1).

Figure 1: Modelled Point Sources.



1.11 The input parameters for the on-site generator and flare stack, entered into the model, are shown in Table A3.1. The generators were run separately to the flare so that the flare concentrations could be scaled in order to calculate the emission rate that would lead to a breach of the air quality assessment level.

Table A3.1: ADMS-5 Model Input Parameters

Parameter	Generators	Flare
Height	3 m	5 m
Exhaust Temperature	520 ^{o}C	1200 ^{o}C

Parameter	Generators	Flare
Flow rate	3.73 m^3/s	12.9 m/s
Flue diameter	100 mm	1 m
Emission rate NOx	2.16 g/s	1 g/s [a]
Emission rate PM_{10}	0.36 g/s	n/a

[a] 1 g/s was modelled so that the emission rate can be scaled to calculate the real emission rate that would lead to a breach of the air quality objectives.

Study Area

1.12 The model has been run to calculate concentrations from the generators and the flare independently based on long-term calculations for the 4km by 4km grid using an arbitrary value for the emission rate. Figure 2 to Figure 5 show the outputs from the model for the two sources (Generators and Flare) and the long-term and short-term averages for the objectives. The figures highlight the areas where the greatest impacts will be. A single area has then been selected and a detailed study area defined, see Figure 6. Furthermore three specific receptors have also been defined for the ecological sites: The Mens, Ebernoe Common and Arun Valley, see Figure 7 for locations.

1.13 The model was subsequently run to generate short-term outputs for the smaller detailed study area and the three specific ecological locations and analysis carried out.

Figure 2: Representation of impacts from the Generator Emissions to the Annual Mean Concentration. Worst-case Impacts will be to the Northeast of the Site Point Sources (Red Star). Blue – Minimum impacts to Red – Maximum Impact.

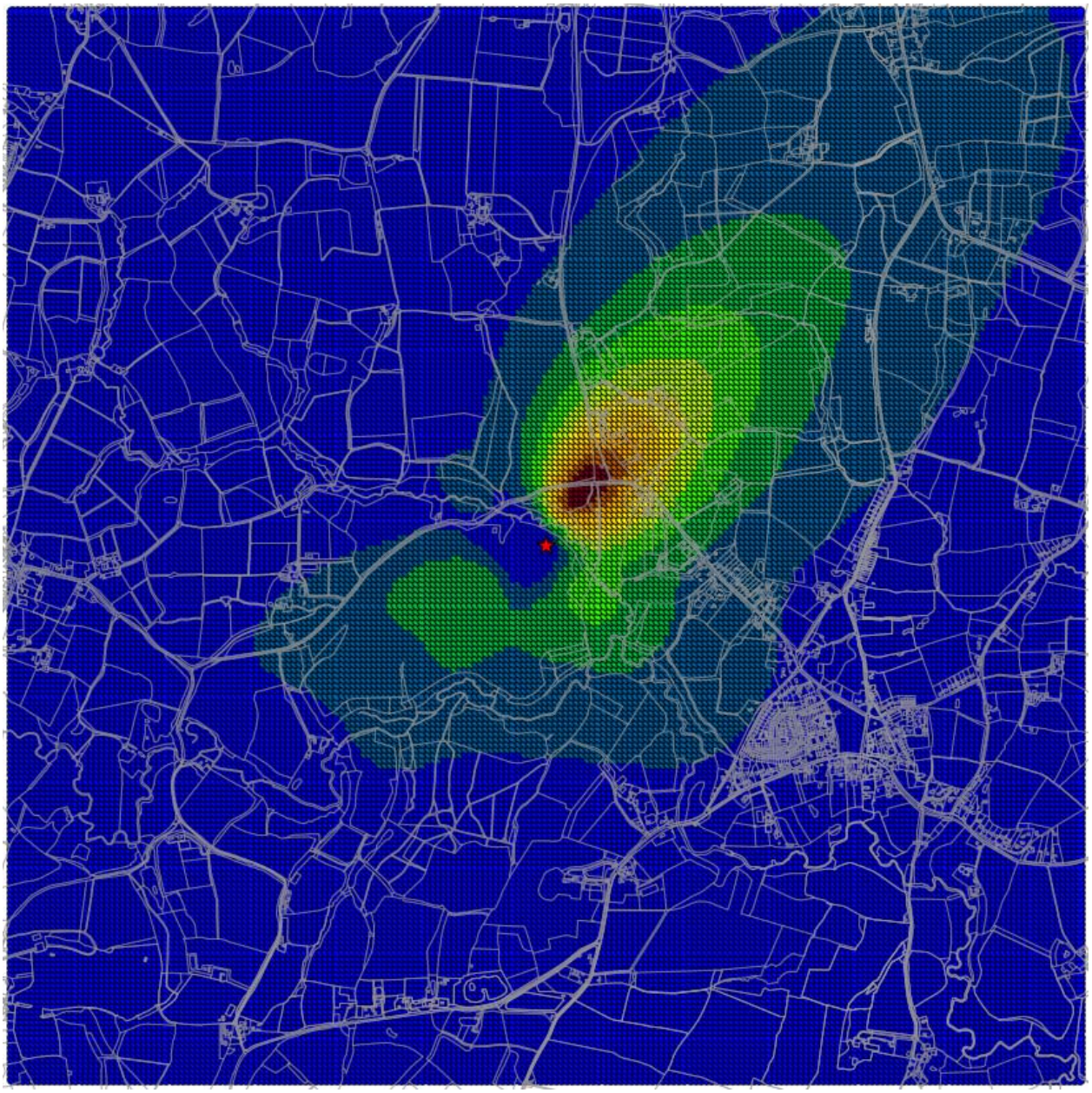


Figure 3: Representation of impacts from the Generator Emissions to the Short-term Mean (1-hour) Concentration. Worst-case Impacts will be to the East of the Site Point Sources (Red Star). Blue – Minimum impacts to Red – Maximum Impact.

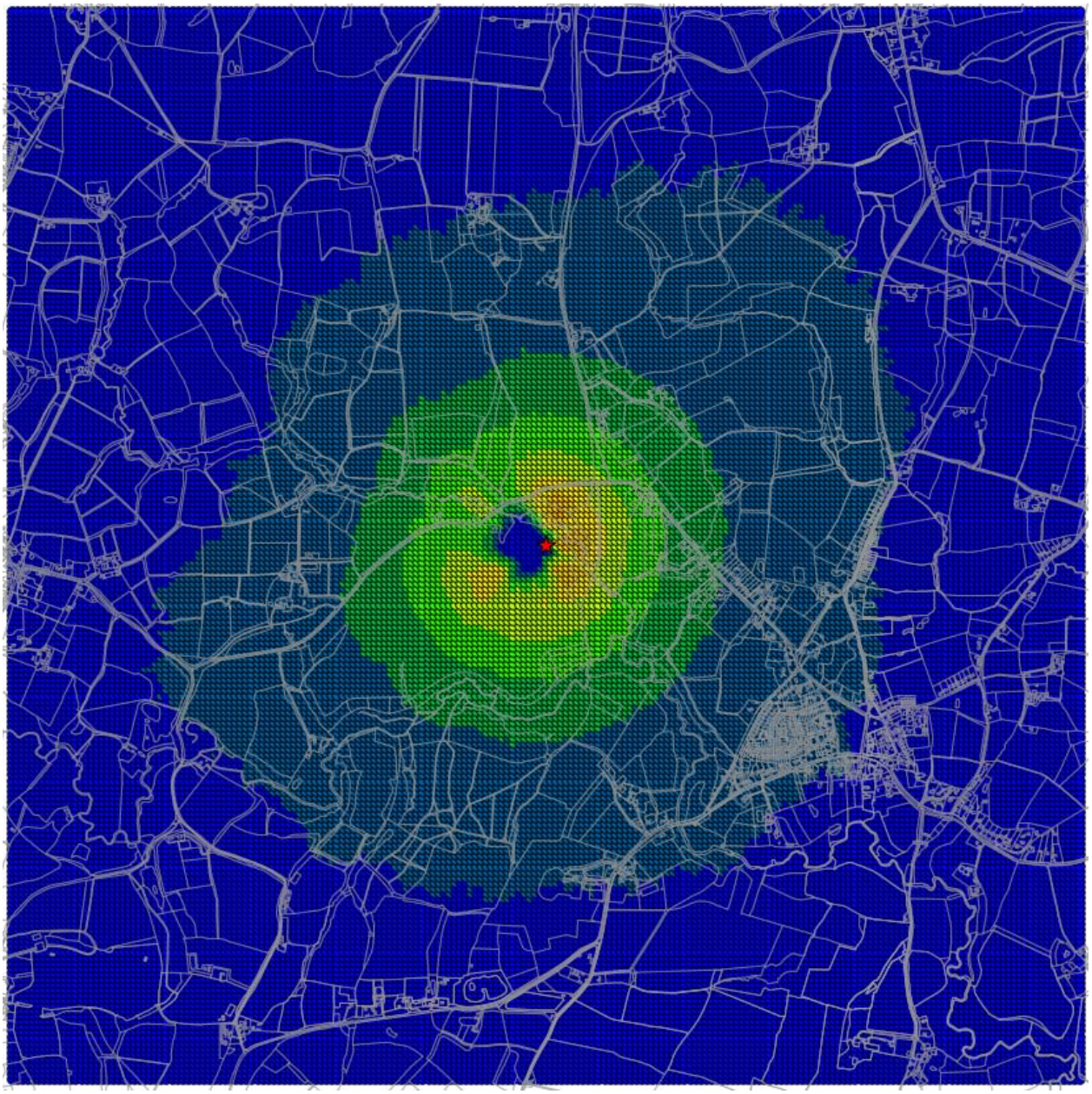


Figure 4: Representation of impacts from the Flare Emissions to the Annual Mean Concentration. Worst-case Impacts will be to the Northeast of the Site Point Sources (Red Star). Blue – Minimum impacts to Red – Maximum Impact.

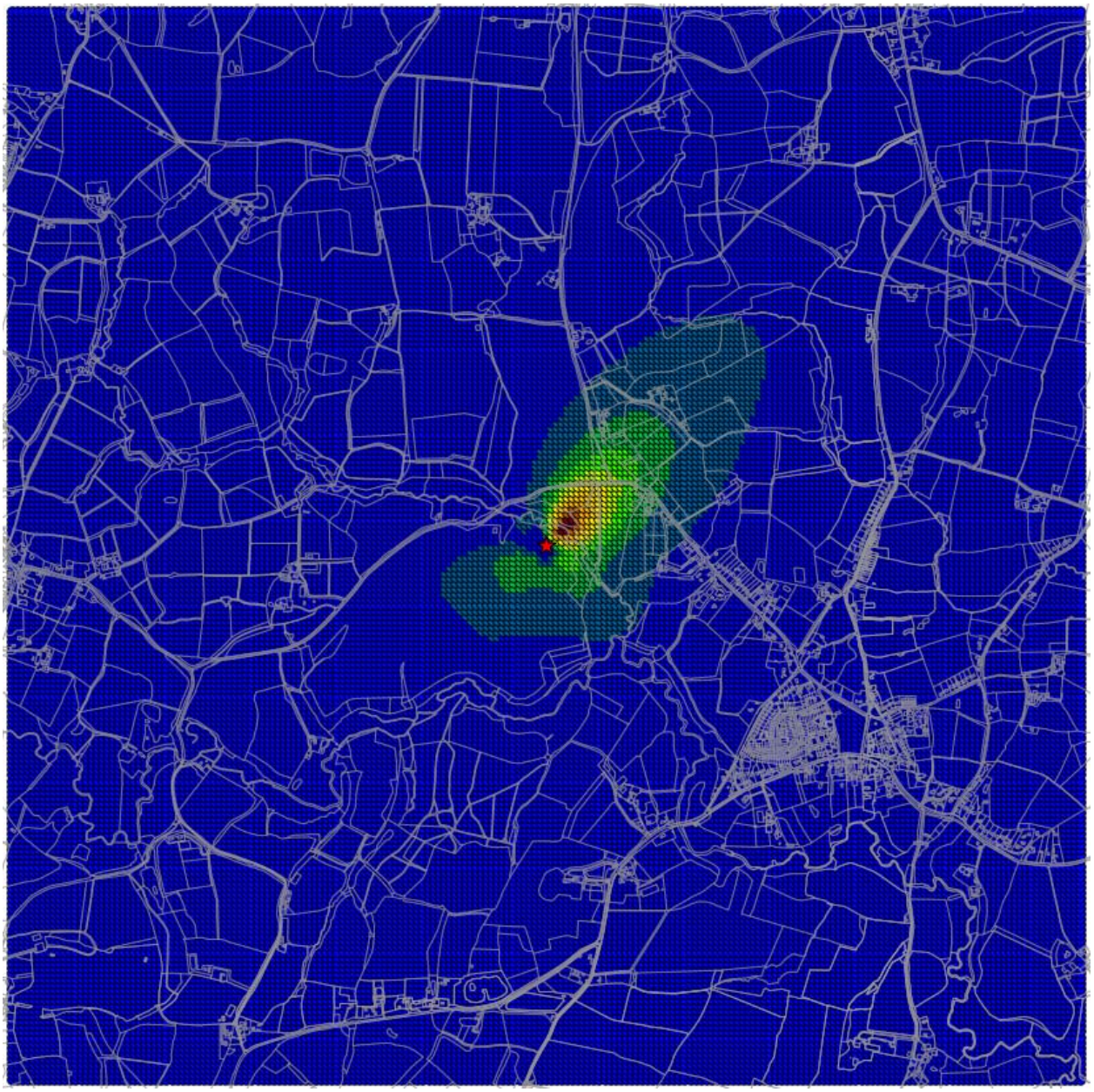


Figure 5: Representation of impacts from the Flare Emissions to the Short-term Mean (1-hour) Concentration. Worst-case Impacts will be to the East of the Site Point Sources (Red Star). Blue – Minimum impacts to Red – Maximum Impact.

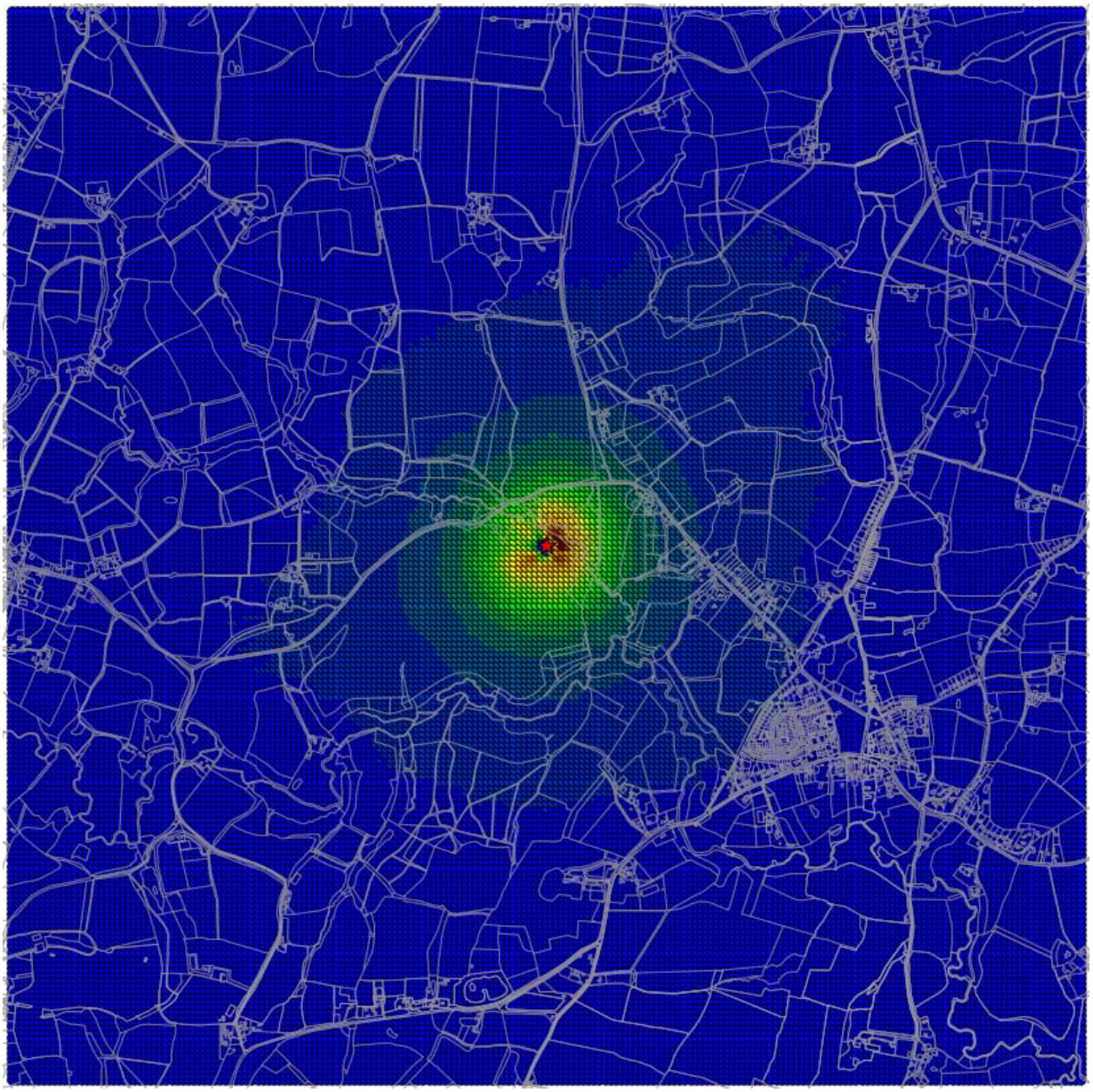


Figure 6: Detailed study area (Green) which Encompasses all the Possible Worst-case Impact Locations.

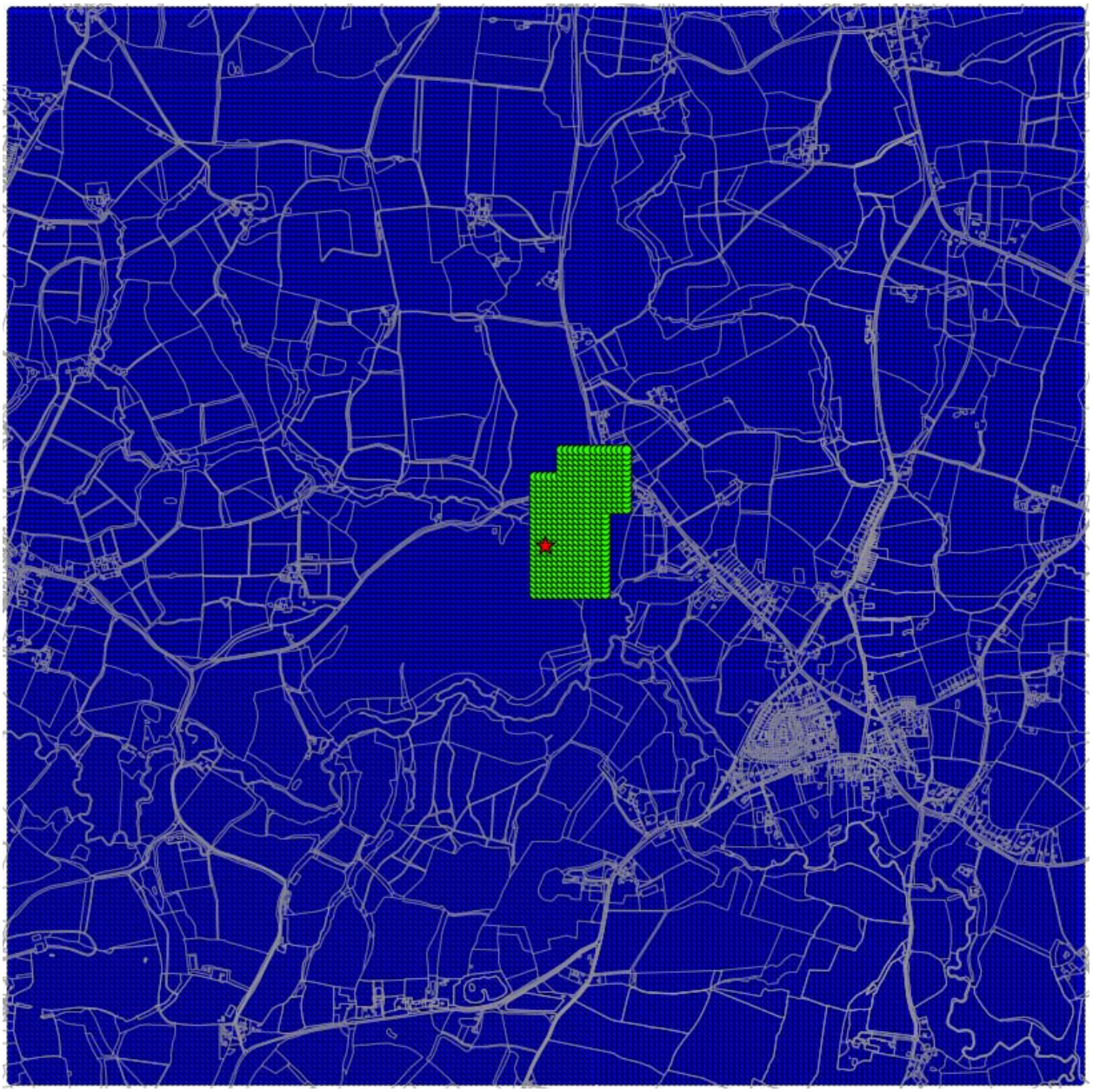
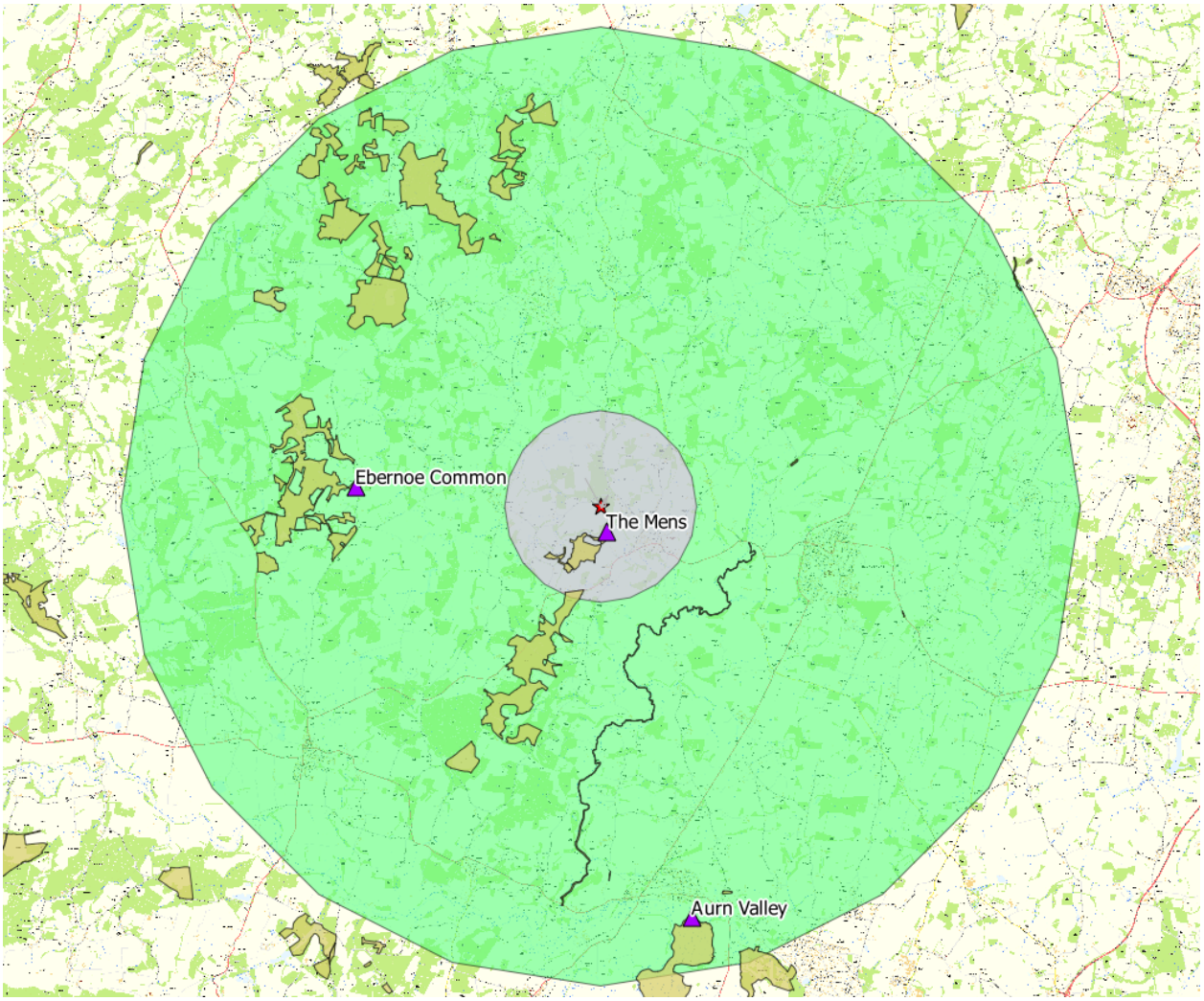


Figure 7: Specific Ecological Locations Showing the 2 km and 10 km buffer.



Post-Processing

Generators

1.14 Emissions from the generators will be predominantly in the form of nitrogen oxides (NOx) and PM.

1.15 ADMS-5 has been run to predict the contribution of the proposed generator emissions to 1-hour mean concentrations of nitrogen oxides and 24-hour mean concentrations of PM_{10} for every hour of the year (based on 2012). This hour-by-hour dataset has been used to calculate the short-term maximum 1-hour concentration (nitrogen dioxide) and maximum 24-hour concentration (PM_{10}) and long-term (annual mean) concentration of both nitrogen dioxide and $PM_{10.}$ While the maximum 1-hour concentrations are not strictly applicable for the short-term objectives, assessing against the objective will provide a worst-case assessment.

1.16 The approach recommended by the Environment Agency (Environment Agency, 2005) has been used to predict annual mean nitrogen dioxide concentrations and short-term

(1-hour) mean nitrogen dioxide concentrations. Long-term process contributions have been calculated from the hour-by-hour modelled concentrations.

1.17 Where long-term (annual mean) concentrations need to be assessed the following post-processing has been carried out:

- the local nitrogen dioxide background concentration has been added to the nitrogen dioxide process contribution, where the approach recommended by the Environment Agency (Environment Agency, 2005) has been used to predict annual mean nitrogen dioxide process concentration = *annual mean nitrogen oxides x 0.7.*
- the local PM_{10} background concentration has been added to the PM_{10} process contribution.

1.18 Where short-term objectives need to be assessed the following post-processing has been carried out:

1.19 In order to predict total 1-hour mean nitrogen dioxide concentrations, an approach derived from that recommended by the Environment Agency (Environment Agency, 2005) has been followed:

1-hour mean nitrogen dioxide = (1-hour process contribution NOx x 0.35) + (2 x 'background' annual mean nitrogen dioxide concentration)

1.20 In order to predict total 24-hour mean PM_{10} concentrations:

24-hour mean PM_{10} = (a daily average of 1-hour process contribution PM_{10}) + (2 x 'background' annual mean PM_{10} concentration)

Flare

1.21 Nitrogen oxides (NOx) are the emissions of concern from the flare.

1.22 ADMS-5 has been run to predict the contribution of the proposed flare emissions to 1-hour mean concentrations of nitrogen oxides based on an emission rate of 1 g/s for every hour of the year (based on 2012 meteorological data). The objective headroom has been calculated as the difference between the objective/critical level and the combined background concentration and process contribution from the generators (as calculated earlier). The 1-hour and annual mean nitrogen dioxide process contribution from the flare has been derived from the predicted concentration of nitrogen oxides using the approach recommended by the Environment Agency (detailed earlier for the generators). This process contribution based on an emission rate of 1 g/s has been compared to the headroom at each receptor location for each hour of the year (for the short-term 1-hour objective), for each day of the year (for the short-term 24-hour critical level) and for the annual mean (for the long-term objective/critical level) to calculate an emission rate that would be required to cause a breach of the air quality objectives.

Model Verification

1.23 It is not practical, nor usual, to verify the ADMS-5 model. Predictions made using ADMS-5 have thus not been verified.

APPENDIX 15.4

CONSTRUCTION MITIGATION

Appendix 15.4 Construction Mitigation

1.1 The following is a set of measures that should be incorporated into the specification for the works:

Communications

- display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager; and
- display the head or regional office contact information.

Dust Management Plan

- Develop and implement a Dust Management Plan (DMP) approved by the Local Authority which documents the mitigation measures to be applied, and the procedures for their implementation and management.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- make the complaints log available to the local authority when asked; and
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site, and the action taken to resolve the situation in the log book.

Monitoring

- Undertake daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary, with cleaning to be provided if necessary; carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the Local Authority when asked;
- increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust area being carried out and during prolonged dry or windy conditions; and

Preparing and Maintaining the Site

- Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible;

- erect solid screens or barriers around dusty activities or the site boundary that are as at least as high as any stockpiles on site; and
- avoid site runoff of water or mud.

Operating Vehicle/Machinery and Sustainable Travel

- ensure all vehicles switch off their engines when stationary – no idling vehicles;

Operations

- ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate; and
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- record all inspections of haul routes and any subsequent action in a site log book;
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).