LAND AT UPPER COSMESTON FARM, LAVERNOCK ROAD, PENARTH

ENVIRONMENTAL STATEMENT

VOLUME 2
CHAPTER 11: AIR QUALITY

11.0 AIR QUALITY

INTRODUCTION

11.1.1 This chapter describes the potential air quality impacts associated with the proposed mixed-use development of land at Upper Cosmeston Farm. The assessment has been carried out by Air Quality Consultants Ltd on behalf of Austin Smith:Lord on behalf of the Welsh Government.

11.1.2 The planning application is an outline application with all matters reserved, except for site access. The proposed development will consist of approximately 576 new dwellings/homes, a new two form entry primary school, 1 hectare of public open space and a new community facility. The development will lead to changes in vehicle flows on local roads, which may impact on air quality at existing residential properties. The new residential properties will also be subject to the impacts of road traffic emissions from the adjacent road network. The main air pollutants of concern related to road traffic emissions are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$).

11.1.3 There is also the potential for the construction activities to impact upon both existing and new properties, as well as nearby ecological sites. The main pollutants of concern related to construction activities are dust and PM_{10}.

11.1.4 This chapter describes existing local air quality conditions (base year 2018), and the predicted air quality in the future assuming that the proposed development does, or does not proceed. The assessment of traffic-related impacts focuses on 2022, which is the anticipated year of first occupation of any of the new homes, and includes the full development-generated traffic from 2029, which is the anticipated year of completion. The assessment of construction dust impacts focuses on the anticipated duration of the works.

11.1.5 This chapter has been prepared taking into account all relevant local and national guidance and regulations, and follows a methodology agreed with Vale of Glamorgan Council.

ASSESSMENT METHODOLOGY

Consultation

11.2.1 The assessment follows a methodology agreed with Vale of Glamorgan Council via email correspondence between Craig Lewis (Specialist Services Officer at Vale of Glamorgan Council) and Dr Denise Evans (Air Quality Consultants) between 16 and 29 April 2019.

Existing Conditions

11.2.2 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, 2019a). Local sources have also been identified through examination of the Council's Air Quality Review and Assessment reports.

11.2.3 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. Background concentrations have been defined using the

2017-based national pollution maps published by Defra (2019b). These cover the whole of the UK on a 1x1 km grid.

11.2.4 Exceedances of the annual mean EU limit value for nitrogen dioxide in the study area have been identified using the maps of roadside concentrations published by Defra (2019c). These maps are used by the UK Government, together with the results from national Automatic Urban and Rural Network (AURN) monitoring sites that operate to EU data quality standards to report exceedances of the limit value to the EU. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations (Defra, 2019d), which are available for the years 2009 to 2017, show no exceedances of the limit values anywhere in the UK in 2017.

Construction Impacts

11.2.5 The construction dust assessment considers the potential for impacts within 350 m of the site boundary; or within 50 m of roads used by construction vehicles. The assessment methodology is that provided by IAQM (2016). This follows 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 A11.3 explains the approach in more detail.

Road Traffic Impacts

Screening

11.2.6 The first step in considering the road traffic impacts of the proposed development has been to screen the development and its traffic generation against the criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017), as described in Paragraph 11.3.23 and detailed further in Appendix A11.4. Where impacts can be screened out there is no need to progress to a more detailed assessment. The following sections describe the approach to dispersion modelling of road traffic emissions, which has been required for this project.

Sensitive Locations

11.2.7 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of locations both within, and close to, the proposed development. Receptors have been identified to represent a range of exposure within the development, including the worst-case locations (these being at the façades of the residential properties closest to the sources). When selecting receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested and where there is a combined effect of several road links, and close to those roads where the traffic increases as a result of the proposed development will be greatest.

11.2.8 Twenty-five existing residential properties have been identified as receptors for the assessment. Six additional receptor locations have been identified within the new development, which represent exposure to existing sources. These locations are described in Table 11.1 and shown in Figure 11.1. In addition, concentrations have been modelled at the

Penarth Windsor Road automatic monitoring site and diffusion tube monitoring sites 55, 56, 51, 52, 57, 58, 70, 89, 90, 91, 92 and 111, in order to verify the model outputs (see Appendix A11.6 for verification method).

11.2.9 It should be noted that the receptor locations were chosen based on a previous version of the masterplan layout, in which the location of the northern site access road was slightly offset to that shown in Figure 11.1. However, it is considered that the impact of the difference in road location on pollutant concentrations at receptors closest to the access road would be negligible, and the conclusions of the assessment would remain the same.

Table 11.1: Description of Receptor Locations

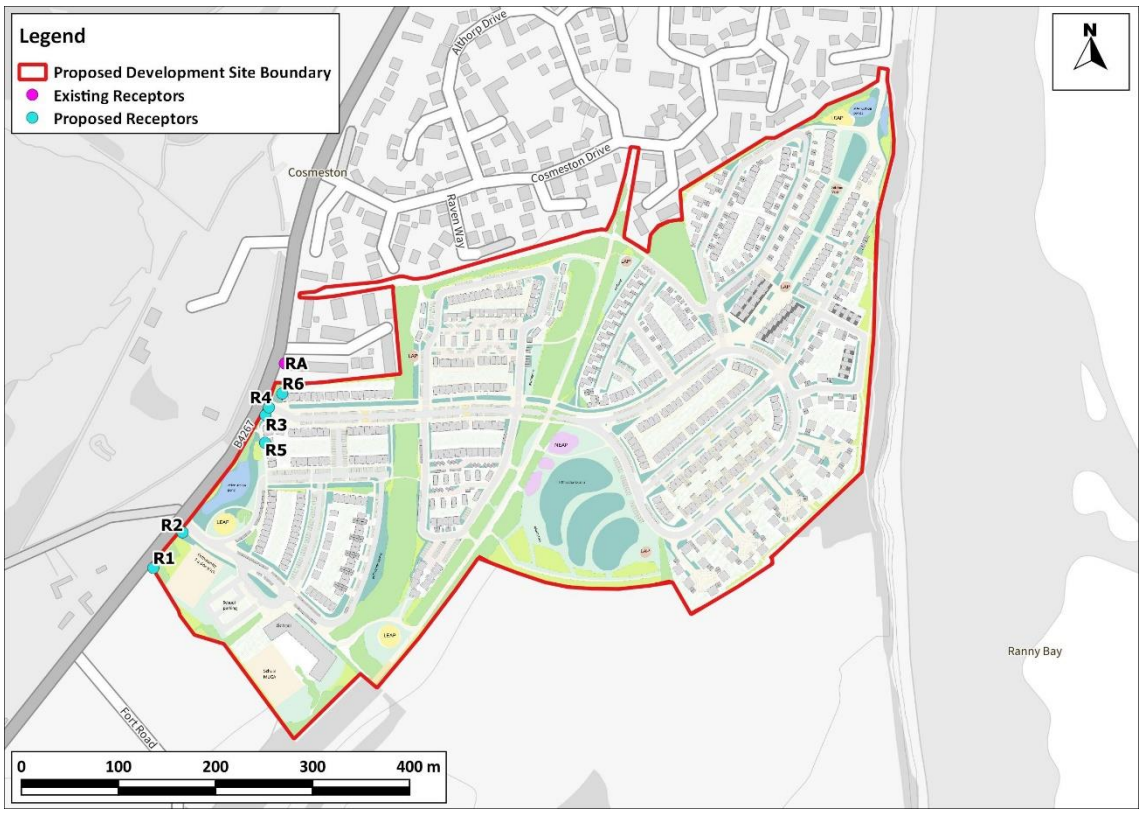
Receptor	Height(s)	Description
Existing properties		
RA	1.5 m	Residential property at Upper Cosmeston Farm
RB	1.5 m	Residential property at Lavernock Road
RC	1.5 m	Residential property at Westbourne Road
RD	1.5 m	Residential property at Lavernock Road
RE	1.5 m	Residential property at Wesbourne Road
RF	1.5 m	Residential property at Wesbourne Road
RG	1.5 m	Residential property at Lavernock Road
RH	1.5 m	Residential property at Lavernock Road
RI	1.5 m	Residential property at Victoria Road
RJ	1.5 m	Residential property at Lavernock Road
RK	1.5 m	Residential property at Stanwell Road
RL	1.5 m	Residential property at Redlands Road
RM	1.5 m	Residential property at Redlands Road
RN	1.5 m	Residential property at Redlands Road
RO	1.5 m	Residential property at Redlands Road
RP	1.5 m	Residential property at A4055
RQ	1.5 m	Llandough Baptist Church [a]
RR	1.5 m	Residential property at Andrew Road
RS	1.5 m	Residential property at Redland Road / A4055
RT	1.5 m	Residential property at Andrew Road / A4055
RU	1.5 m, 4.0 m	Merrie Harrier Pub [b]
RV	4.0 m	Residential property at Old Barrie Road [c]
RW	1.5 m	Residential property at Elizabeth Court, Windsor Road
RX	5.0 m	Residential property at Penarth Road [c]

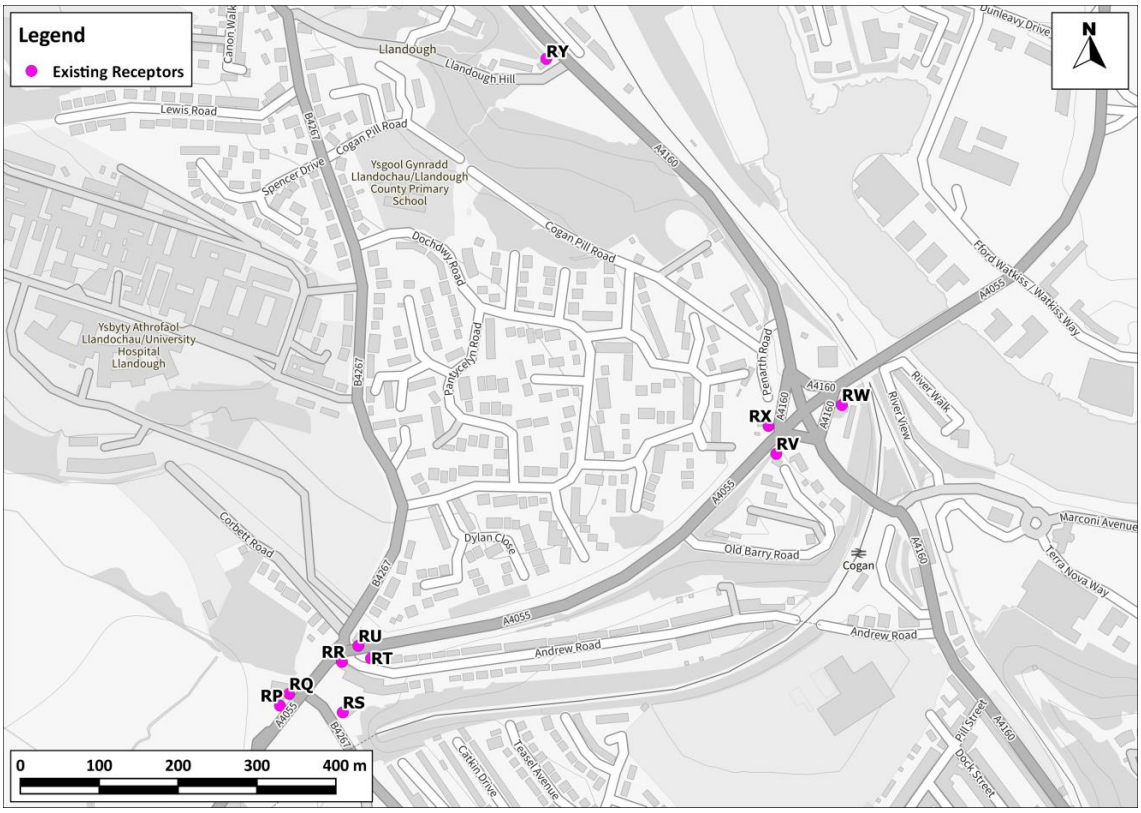
Receptor	Height(s)	Description
RY	1.5 m	Residential property at Penarth Road / Llandough Hill
New properties		
R1	1.5 m	School within the proposed development site
R2	1.5 m	School within the proposed development site
R3	1.5 m	Location adjacent to site access and proposed development site boundary
R4	1.5 m	Location adjacent to site access and proposed development site boundary
R5	1.5 m	Residential property within the proposed development site
R6	1.5 m	Residential property within the proposed development site

[a] Receptor is a church and relevant for the 1-hour mean nitrogen dioxide objective only.

[b] Receptors modelled at heights of 1.5 m and 4.0 m to represent ground and first floor levels. Ground floor level is a pub and relevant or the 1-hour mean nitrogen dioxide objective only.

[c] Receptors modelled at heights of 4.0m and 5.0 m, respectively, to represent ground floor levels, which are elevated from the road.


Legend
Proposed Development Site Boundary
Existing Receptors
Proposed Receptors
N
Cosmeston
Ashorp Drive
Cosmeston Drive
Raven Way
B4267
Fort Road
Ranny Bay
RA
R6
R4
R3
R5
R2
R1
0
100
200
300
400 m


Legend
Existing Receptors
N
Llandough
Llandough Hill
Lewis Road
Cogan Pill Road
Spencer Drive
Ysgool Gynradd Llandochau/Llandough County Primary School
Dochdwy Road
Ysbyty Athrofaol Llandochau/University Hospital Llandough
Penarth Road
Ffordd Watkiss / Watkiss Way
River Walk
River View
Corbett Road
Dylan Close
Old Barry Road
Cogan
Marconi Avenue
Terra Nova Way
Andrew Road
Pill Street
Dock Street
Cadwin Drive
Teasel Avenue
B4267
A4055
A4160
RY
RW
RX
RV
RU
RR
RT
RQ
RP
RS
0
100
200
300
400 m

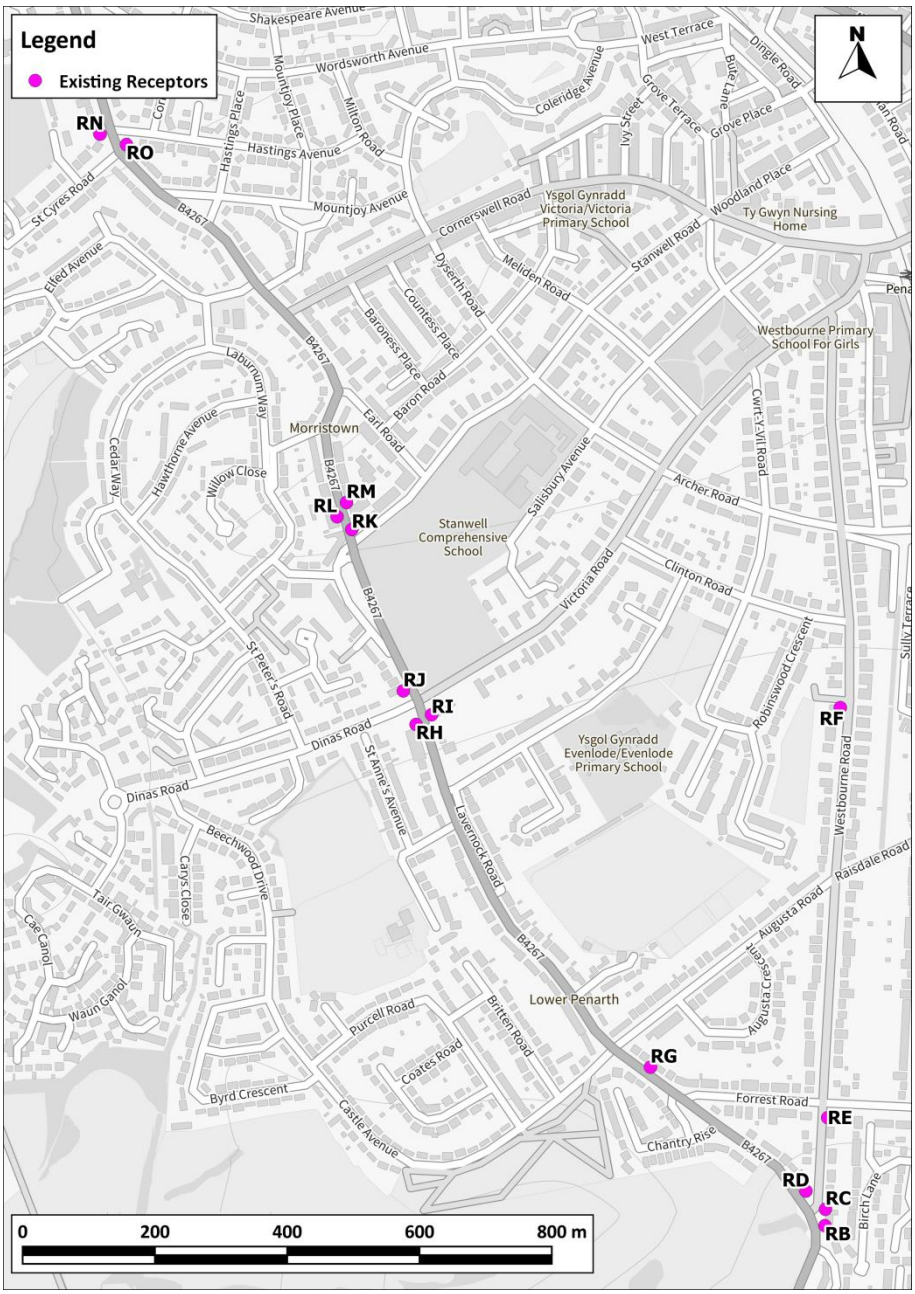


Figure 11.1: Receptor Locations Within and Adjacent to the Proposed Development Site (Top), Adjacent to the A4055, B4267 and A4160 (Middle) and Adjacent to the B4267 and Westbourne Road (Bottom)

Modelling Methodology

11.2.10 Concentrations have been predicted using the ADMS-Roads (v4) dispersion model, with vehicle emissions derived using Defra's Emission Factor Toolkit (EFT) (v9.0) (Defra, 2019b). Details of the model inputs, assumptions and the verification are provided in Appendix A11.6, together with the method used to derive base and future year background concentrations. Where assumptions have been made, a worst-case approach has been adopted.

Assessment Scenarios

11.2.11 Nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been predicted for a base year (2018) and the proposed year of opening (2022). For 2022, predictions have been made assuming both that the development does proceed (With Scheme), and does not proceed (Without Scheme). The With Scheme scenario includes all development related traffic for the anticipated year of completion (2029), thus the impacts in the opening year will be over-predicted.

11.2.12 In addition to the set of 'official' predictions (those from Defra's EFT), a sensitivity test has been carried out for nitrogen dioxide that involves assuming higher nitrogen oxides emissions from some diesel vehicles than have been predicted by Defra, using AQC's Calculator Using Realistic Emissions for Diesels (CURED v3A) tool (AQC, 2017).

Traffic Data

11.2.13 Traffic data for the assessment have been provided by Absri Transport Ltd, who have undertaken the Transport Assessment for the proposed development. Further details of the traffic data used in this assessment are provided in Appendix A11.6.

Uncertainty

11.2.14 There are many components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.

11.2.15 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A11.6). The level of confidence in the verification process is necessarily enhanced when data from an automatic analyser have been used, as has been the case for this assessment (see Appendix A11.6). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2018) concentrations.

11.2.16 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions.

11.2.17 European type approval ('Euro') standards for vehicle emissions apply to all new vehicles manufactured for sale in Europe. These standards have, over many years, become progressively more stringent and this is one of the factors that have driven reductions in both predicted and measured pollutant concentrations over time.

11.2.18 Historically, the emissions tests used for type approval were carried out within laboratories and were quite simplistic. They were thus insufficiently representative of emissions when driving in the real world. For a time, this resulted in a discrepancy, whereby nitrogen oxides emissions from new diesel vehicles reduced over time when measured within the laboratory, but did not fall in the real world. This, in turn, led to a discrepancy between models (which predicted improvements in nitrogen dioxide concentrations over time) and measurements (which very often showed no improvements year-on-year).

11.2.19 Recognition of these discrepancies has led to changes to the type approval process. Vehicles are now tested using a more complex laboratory drive cycle and also through 'Real Driving Emissions' (RDE) testing, which involves driving on real roads while measuring exhaust emissions. For Heavy Duty Vehicles (HDVs), the new testing regime has worked very well and NOx emissions from the latest vehicles (Euro VI1) are now very low when compared with those from older models (ICCT, 2017).

11.2.20 For Light Duty Vehicles (LDVs), while the latest (Euro 6) emission standard has been in place since 2015, the new type-approval testing regime only came into force in 2017. Despite this delay, earlier work by AQC (2016) showed that Euro 6 diesel cars manufactured prior to 2017 tend to emit significantly less NOx than previous (Euro 5 and earlier) models. Given the changes to the testing regime, it is reasonable to expect that diesel cars and vans registered for type approval since 2017 will, on average, generate even lower NOx emissions.

11.2.21 As well as reviewing information on the emissions from modern diesel vehicles in the real world (AQC, 2016), AQC has also reviewed the assumptions contained within Defra's EFT (v9.0) (AQC, 2019). One point of note is that the EFT makes a range of assumptions, which appear to be very conservative, regarding the continued use of diesel cars into the future and the relatively slow uptake of non-conventional (e.g. electric) vehicles (AQC, 2018a). Thus, despite previous versions of Defra's EFT being over-optimistic regarding future-year predictions, it is not unreasonable to consider that EFT v9.0 might under-state the scale of reductions over coming years (i.e. over-predict future-year traffic emissions).

11.2.22 Overall, it is considered that, for assessment years prior to 2021, the EFT provides a robust method of calculating emissions. While there is still some uncertainty regarding any predictions of what will occur in the future, there are no obvious reasons to expect predictions made using the EFT to under-predict concentrations in the future up to and including 2020.

11.2.23 For assessment years beyond 2020, EFT v9.0 makes additional assumptions regarding the expected performance of diesel cars and vans registered for type approval beyond this date, reflecting further planned changes to the type approval testing. While there is currently no reason to disbelieve these assumptions, it is sensible to consider the possibility that this future-year technology might be less effective than has been assumed. A sensitivity test has thus been carried out using AQC's CURED v3A model (AQC, 2017), which assumes that this, post-2020, technology does not deliver any benefits. Further details of CURED v3A are provided in a supporting report prepared by AQC (2018a).

11.2.24 It is also worth noting that the fleet projections incorporated within the EFT do not appear to reflect the Government's ambitions as set out in the Road to Zero Strategy (see Paragraphs

[1] Euro VI refers to HDVs while Euro 6 refers to LDVs.

11.3.3 and 11.3.4), predicting a relatively low proportion of zero tailpipe emission vehicles in years up to and including 2030. If the Government's ambitions relating to the uptake of zero tailpipe emission vehicles are realised then the EFT's emissions projections for NOx are likely to be overly-conservative for the latter part of the 2020s, if not the entire decade.

11.2.25 It must also be borne in mind that the predictions in 2022 are based on worst-case assumptions regarding the increase in traffic flows, such that all committed developments and the proposed development, are assumed to be fully operational. This will have overestimated the traffic emissions and hence the 2022 "With Scheme" concentrations and impacts.

LEGISLATIVE AND PLANNING POLICY CONTEXT

Air Quality Strategy

11.3.1 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations after Defra, provides the policy framework 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 Strategy 2019

11.3.2 The Clean Air Strategy (Defra, 2019e) sets out a wide range of actions by which the UK Government, in partnership with the Governments of Scotland, Wales and Northern Ireland, will seek to reduce pollutant emissions and improve air quality. Actions are targeted at four main sources of emissions: Transport, Domestic, Farming and Industry. At this stage, there is no straightforward way to take account of the expected future benefits to air quality within this assessment.

Reducing Emissions from Road Transport: Road to Zero Strategy

11.3.3 The Office for Low Emission Vehicles (OLEV) and Department for Transport (DfT) published a Policy Paper (DfT, 2018) in July 2018 outlining how the government will support the transition to zero tailpipe emission road transport and reduce tailpipe emissions from conventional vehicles during the transition. This paper affirms the Government's pledge to end the sale of new conventional petrol and diesel cars and vans by 2040. It states that the Government expects the majority of new cars and vans sold to be 100% zero tailpipe emission and all new cars and vans to have significant zero tailpipe emission capability by this year, and that by 2050 almost every car and van should have zero tailpipe emissions. It also states that the Government wants to see at least 50%, and as many as 70%, of new car sales, and up to 40% of new van sales, being ultra-low emission by 2030.

11.3.4 The paper sets out a number of measures by which Government will support this transition, but is clear that Government expects this transition to be industry and consumer led. The

Government has since announced *"plans to bring forward an end to the sale of new petrol and diesel cars and vans to 2035, or earlier if a faster transition is feasible, subject to consultation, as well as including hybrids for the first time"*. If these ambitions are realised then road traffic-related NOx emissions can be expected to reduce significantly over the coming decades, likely beyond the scale of reductions forecast in the tools utilised in carrying out this air quality assessment.

National Planning Policy

Planning Policy Wales (2018)

11.3.5 Land-use planning policy in Wales is established within the policy document Planning Policy Wales (PPW) (Welsh Government, 2018a), which provides the strategic policy framework for the effective preparation of local planning authority development plans. With regard to pollution and health effects, it states:

"*Planning authorities have a role to play in the prevention of physical and mental illnesses caused, or exacerbated, by pollution, disconnection of people from social activities (which contributes to loneliness) as well as the promotion of travel patterns which facilitate active lifestyles. The planning system must consider the impacts of new development on existing communities and maximise health protection and well-being and safeguard amenity. This will include considering the provision of, and access to, community and health assets, such as community halls, libraries, doctor's surgeries and hospitals. Health impacts should be minimised in all instances, and particularly where new development could have an adverse impact on health, amenity and well-being. In such circumstances, where health or amenity impacts cannot be overcome satisfactorily, development should be refused*".

"*Planning authorities should develop and maintain places that support healthy, active lifestyles across all age and socio-economic groups, recognising that investment in walking and cycling infrastructure can be an effective preventative measure which reduces financial pressures on public services in the longer term. The way a development is laid out and arranged can influence people's behaviours and decisions and can provide effective mitigation against air and noise pollution. Effective planning can provide calming, tranquil surroundings as well as stimulating and sensory environments, both of these make an important contribution to successful places*".

"*Green infrastructure can be an effective means of enhancing health and well-being, through linking dwellings, workplaces and community facilities and providing high quality, accessible green spaces. In all development and in public spaces especially, there should be sensitive management of light, and exposure to airborne pollution should be kept as low as reasonably practicable. The compatibility of land uses will be a key factor in addressing air quality and creating appropriate soundscapes which are conducive to, and reflective of, particular social and cultural activities and experiences, particularly in busy central areas of towns and cities. Equally, the provision of quiet, tranquil areas which provide peaceful sanctuaries in otherwise noisy environments can help to reduce general levels of pollution and promote both mental and physical well-being*".

11.3.6 PPW 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. Local development plans should enable consideration of the effects that the proposed development may have on air quality, as well

as the effect that air quality may have on the proposed development. To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location.

11.3.7 PPW also places considerable emphasis on the Well-being of Future Generations Act (Welsh Government, 2015) with the intention to improve the social, economic, environmental and cultural well-being of Wales, and outlines how this can be achieved through the concept of 'Placemaking'.

11.3.8 PPW is supported by a series of Technical Advice Notes (TANs) and National Assembly for Wales Circulars. Local planning authorities have to take PPW, TANs and Circulars into account when preparing Development Plans.

11.3.9 With respect to planning policy guidance, TAN 18 on transport (Welsh Government, 2007) makes reference to local air quality and the need for Air Quality Action Plans to be prepared for any Air Quality Management Areas declared.

11.3.10 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.

Local Planning Policy

Vale of Glamorgan Council Local Development Plan

11.3.11 The Vale of Glamorgan Local Development Plan (LDP) 2011-2026 provides the local planning policy framework for the Vale of Glamorgan and was adopted by the Council in June 2017. The Written Statement (Vale of Glamorgan Council, 2017) includes Policy MD7 on environmental protection, which states:

"*Development proposals will be required to demonstrate they will not result in an unacceptable impact on people, residential amenity, property and/or the natural environment from…pollution of land, surface water, ground water and the air…*"

and

"*Where impacts are identified the Council will require applicants to demonstrate that appropriate measures can be taken to minimise the impact identified to an acceptable level. Planning conditions may be imposed or legal obligation entered into, to secure any necessary mitigation and monitoring processes*".

Air Quality Action Plans

National Air Quality Plan

11.3.12 Defra has produced an Air Quality Plan to tackle roadside nitrogen dioxide concentrations in the UK (Defra, 2017); a supplement to the 2017 Plan (Defra, 2018a) was published in October 2018 and sets out the steps Government is taking in relation to a further 33 local authorities where shorter-term exceedances of the limit value were identified.

Welsh Government Supplemental Air Quality Plan

11.3.13 The Welsh Government has produced a supplemental plan to the 2017 UK plan for tackling roadside nitrogen dioxide concentrations (Welsh Government, 2018b). The document sets out the work done to date to identify how the Welsh Government will reduce concentrations of nitrogen dioxide around roads where levels are above legal limits. The plan expands on Section 7.6 (Additional Actions in Wales) of the 2017 UK plan for tackling roadside nitrogen dioxide concentrations, and sets out how the Welsh Government will comply within the shortest possible time with the limit values for nitrogen dioxide.

11.3.14 There is currently no practical way to take account of the effects of the Plan in the modelling undertaken for this assessment; however, consideration has been given to whether there is currently, or is likely to be in the future, a limit value exceedance in the vicinity of the proposed development. This assessment has principally been carried out in relation to the air quality objectives, rather than the EU limit values that are the focus of the Air Quality Plan.

11.3.15 The Welsh Government will publish a Clean Air Plan for Wales (the Welsh Plan) in 2019, which will supersede the National Air Quality Plan. This will include:

- "*a Clean Air Zone Framework to allow Local Authorities to establish Clean Air Zones in high pollution areas;*
- *improvements to Local Authority reporting on air quality issues; and*
- *the establishment of a National Air Quality Assessment and Monitoring Centre for Wales" (National Assembly for Wales Research Service, 2018)*.

Local Air Quality Action Plan

11.3.16 Vale of Glamorgan Council has declared an AQMA that incorporates properties numbered 100 to 172 evens and 15-163 odds of Windsor Road, Penarth, for exceedances of the annual mean nitrogen dioxide objective. The Council's 2018 Air Quality Annual Progress Report (APR) (Vale of Glamorgan Council, 2018) states that due to continual compliance with national air quality objectives, the Council will submit a formal request to the Welsh Government to revoke the Penarth AQMA. As such, the Vale of Glamorgan has not produced an Air Quality Action Plan.

Assessment Criteria

11.3.17 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 (Wales) Regulations (2000) and the Air Quality (Amendment) (Wales) Regulations (2002).

11.3.18 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 at roadside locations where the annual mean concentration is below 60 $\mu g/m^3$ (Defra, 2018b). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level.

Measurements have also shown that the 24-hour PM_{10} objective could be exceeded at roadside locations where the annual mean concentration is above 32 µg/m^3 (Defra, 2018b). The predicted annual mean PM_{10} concentrations are thus used as a proxy to determine the likelihood of an exceedance of the 24-hour mean PM_{10} objective. Where predicted annual mean concentrations are below 32 µg/m^3 it is unlikely that the 24-hour mean objective will be exceeded.

11.3.19 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2018b). The annual mean objectives for nitrogen dioxide and PM_{10} are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour mean objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets.

11.3.20 The European Union has also set limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$ (The European Parliament and the Council of the European Union, 2008). The limit values for nitrogen dioxide are the same numerical concentrations as the UK objectives, but achievement of these values is a national obligation rather than a local one. In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not normally recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded, unless such studies have been audited and approved by Defra and DfT's Joint Air Quality Unit (JAQU) or the Welsh Assembly Government.

11.3.21 The relevant air quality criteria for this assessment are provided in Table 11.2.

Table 11.2: Air Quality Criteria for Nitrogen 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
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 [a]
Fine Particles ($PM_{2.5}$) [b]	Annual Mean	25 µg/m^3

[a] A proxy value of 32 µg/m^3 as an annual mean is used in this assessment to assess the likelihood of the 24-hour mean PM_{10} objective being exceeded. Measurements have shown that, above this concentration, exceedances of the 24-hour mean PM_{10} objective are possible (Defra, 2018b).

[b] 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.

Construction Dust Criteria

11.3.22 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the Institute of Air Quality Management (IAQM)[2] (2016) has been used. Full details of this approach are provided in Appendix A11.3.

Screening Criteria for Road Traffic Assessments

11.3.23 Environmental Protection UK (EPUK) and the IAQM recommend a two-stage screening approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions from road traffic generated by a development have the potential for significant air quality impacts. The approach, as described in Appendix A11.4, first considers the size and parking provision of a development; if the development is residential and is for fewer than ten homes or covers less than 0.5 ha, or is non-residential and will provide less than 1,000 m^2 of floor space or cover a site area of less than 1 ha, and will provide ten or fewer parking spaces, then there is no need to progress to a detailed assessment. The second stage then compares the changes in vehicle flows on local roads that a development will lead to against specified screening criteria. Where these criteria are exceeded, a detailed assessment is required, although the guidance advises that *"the criteria provided are precautionary and should be treated as indicative"*, and *"it may be appropriate to amend them on the basis of professional judgement"*.

Descriptors for Air Quality Impacts and Assessment of Significance

Construction Dust Significance

11.3.24 Guidance from IAQM (2016) is that, with appropriate mitigation in place, the effects of construction dust will be 'not significant'. The assessment thus focuses on determining the appropriate level of mitigation so as to ensure that effects will normally be 'not significant'.

Operational Significance

11.3.25 There is no official guidance in the UK in relation to development control on how to describe air quality impacts, nor how to assess their significance. The approach developed jointly by EPUK and the IAQM (Moorcroft and Barrowcliffe et al, 2017) has therefore been used. This includes defining descriptors of the impacts at individual receptors, which take account of the percentage change in concentrations relative to the relevant air quality objective, rounded to the nearest whole number, and the absolute concentration relative to the objective. The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors. Full details of the EPUK/IAQM approach are provided in Appendix A11.4. The approach includes elements of professional judgement, and the experience of the consultants preparing the chapter is set out in Appendix A11.5.

11.3.26 It is important to differentiate between the terms impact and effect with respect to the assessment of air quality. The term impact is used to describe a change in pollutant concentration at a specific location. The term effect is used to describe an environmental response resulting from an impact, or series of impacts. Within this chapter, the air quality assessment has used published guidance and criteria described in the following sections to determine the likely air quality impacts at a number of sensitive locations. The potential significance of effects has then been determined by professional judgement, based on the

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

frequency, duration and magnitude of predicted impacts and their relationship to appropriate air quality objectives.

BASELINE CONDITIONS

11.4.1 The proposed development site is located on land off Upper Cosmeston Farm, Lavernock, south Penarth. The site is bounded by Lavernock Road to the west, Upper Cosmeston Farm and Cosmeston Drive to the north, coastline to the east and agricultural land to the south. It currently consists of a farm and livery. There are existing residential properties to the north of the site.

Industrial sources

11.4.2 A search of the UK Pollutant Release and Transfer Register (Defra, 2019a) has not identified any significant industrial or waste management sources that are likely to affect the proposed development, in terms of air quality.

Air Quality Management Areas

11.4.3 Vale of Glamorgan Council has investigated air quality within its area as part of its responsibilities under the LAQM regime. In 2013 an AQMA was declared incorporating properties numbered 100 to 172 evens and 15-163 odds of Windsor Road, Penarth, for exceedances of the annual mean nitrogen dioxide objective. As discussed in Paragraph 11.3.16, the Council is currently proposing to revoke the Penarth AQMA. The Penarth AQMA is located 3 km north of the proposed development site. The declared AQMA is shown in Figure 11.2.

11.4.4 In terms of PM_{10}, Vale of Glamorgan Council concluded that there are no exceedances of the objectives. It is, therefore, reasonable to assume that existing PM_{10} levels will not exceed the objectives within the study area (Vale of Glamorgan Council, 2018).

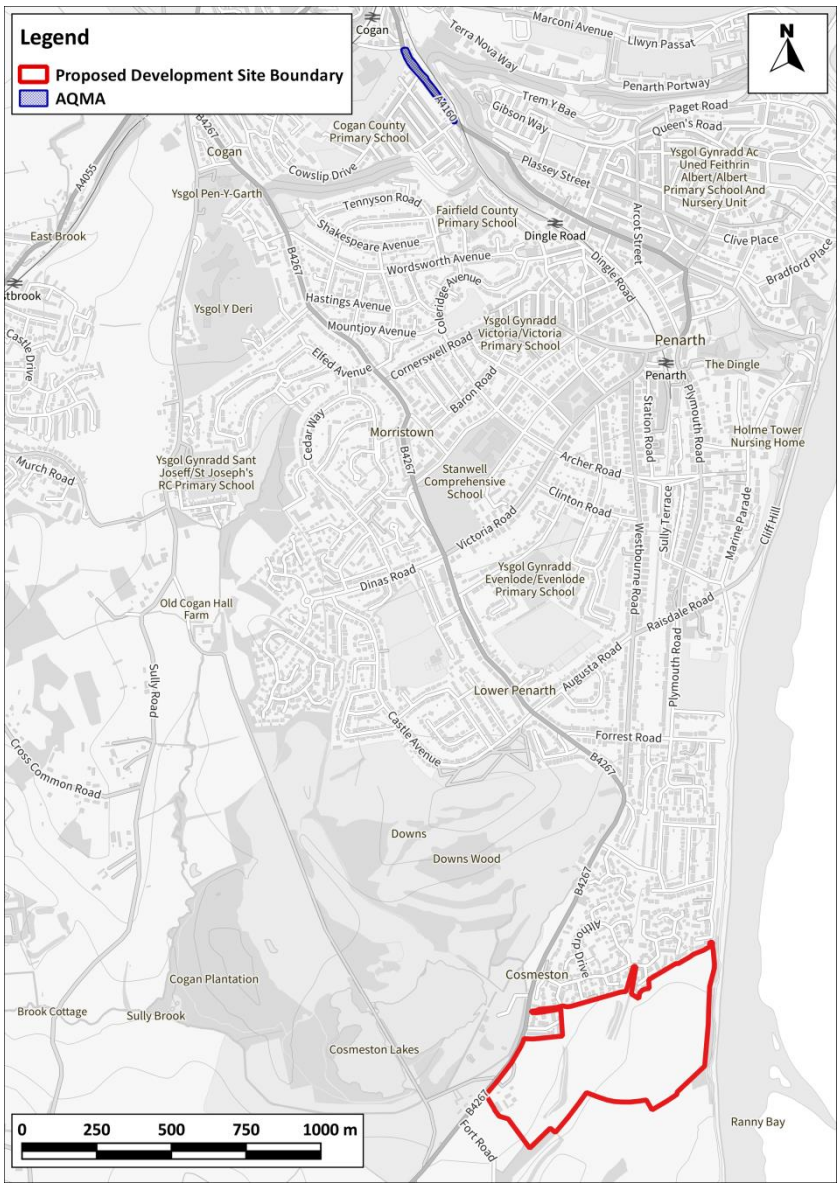


Figure 11.2: Declared AQMA

Local Air Quality Monitoring

11.4.5 Vale of Glamorgan Council operates one automatic monitoring station within its area. It is located on Windsor Road, Penarth, approximately 3.1 km north of the proposed development site. The Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by Environmental Scientifics Group Didcot (using the 50% TEA in water method). These include multiple tubes on Cardiff Road, approximately 3.2 to 3.6 km north of the proposed development site, and on Windsor Road, Penarth, approximately 2.8 to 3.4 km north of the site. In addition, there are two tubes on Plassey Street, adjacent to

Windsor Road, one on Stanwell Road, 2.1 km north of the site and one on Dispenser Road 2.6 km to the west of the proposed development site.

11.4.6 Results for the years 2013 to 2018 are summarised in Table 11.3 and the monitoring locations are shown in Figure 11.3.

Table 11.3: Summary of Nitrogen Dioxide (NO_2) Monitoring (2013-2018) [a, b]

Site No.	Site Type	Location	2013	2014	2015	2016	2017	2018
Automatic Monitor - Annual Mean (µg/m³)								
-	Roadside	Windsor Road, Penarth	-	27.7	26.5	28.3	26.5	24.3
Objective			**40**					
Automatic Monitor - No. of Hours > 200 µg/m³								
-	Roadside	Windsor Road, Penarth	-	0 (86)	0	0	0	0
Objective			**18 (200) [c]**					
Diffusion Tubes - Annual Mean (µg/m³) [d]								
22	Roadside	Stanwell Road, Penarth	26	24.4	23.7	23.6	21.8	20.3
41	Urban Background	Despenser Road, Barry	-	-	-	-	-	10.9
46	Roadside	46 Cardiff Road, Dinas Powys	22	19.7	18.6	18.7	17.1	17.9
53	Roadside	168 Windsor Road, Penarth	33	31.2	30.8	31.5	29.8	29.4 [d]
55	Roadside	134 Windsor Road, Penarth	33	27.1	27.7	28.9	26.3	27.6
56 [e]	Kerbside	134 Andrew Road, Penarth	38.5	33.9	**40.3**	17.5 [f]	23.2	20.5
61	Roadside	Railway Terrace, Dinas Powys	-	-	-	-	-	31.0
62	Roadside	154 Windsor Road, Penarth	36	33.9	31.7	33.2	31.2	28.1
67	Roadside	2 Matthew Terrace, Dinas Powys	30	26	24.2	24.8 [e]	21.4	23.6
68	Roadside	Glen View, 99 Penlan Road, Llandough	20.9	16.9	16.4	17.3	15.1	15.2
70	Roadside	Ty-Isaf, Penarth	19	21.9	23.2	24.6	20.3	22.3
72a	Roadside	Dinas Powys Infants School, Dinas Powys	24.1	27.8	23.8	21.9 [e]	19.9	19.8
74	Roadside	114 Windsor Road, Penarth	31	29.6	28	28.2	28.4	26.1 [d]
82	Roadside	98b Windsor Road, Penarth	21	19.6	17.4	18.0	16.9	17.1

Site No.	Site Type	Location	2013	2014	2015	2016	2017	2018
89	Roadside	160 Windsor Road, Penarth	34	31.2	30.8	31.8	28.3	29.9
90	Roadside	159 Windsor Road, Penarth	27	24.6	21.4	21.2	19.7	26.3
91	Roadside	16 Railway Terrace, Dinas Powys	-	-	-	-	-	21.3
92	Roadside	9 Wayside Cottages, Dinas Powys	-	-	-	-	-	27.9
100	Roadside	141 Plassey Street, Penarth	-	-	-	-	23.9	24.0
109	Roadside	85 Cardiff Road, Dinas Powys	-	-	-	-	-	19.4
111	Roadside	203 Cardiff Road, Dinas Powys	-	-	-	-	-	23.6
112	Roadside	Cogan Hill Flats, Penarth	-	-	-	-	-	19.4
Objective			**40**					

[a] Exceedances of the objectives are shown in bold.

[b] 2013-2017 Data taken from the Council's 2018 APR (Vale of Glamorgan Council, 2018). 2018 automatic monitoring data downloaded from the Air Quality in Wales website (Welsh Government, 2019). 2018 diffusion tube monitoring data have been provided by the Council. Data is shown at the level of precision as presented in the source material.

[c] Values in brackets are 99.8th percentiles, which are presented where data capture is <85%.

[d] Valid data capture is 67%.

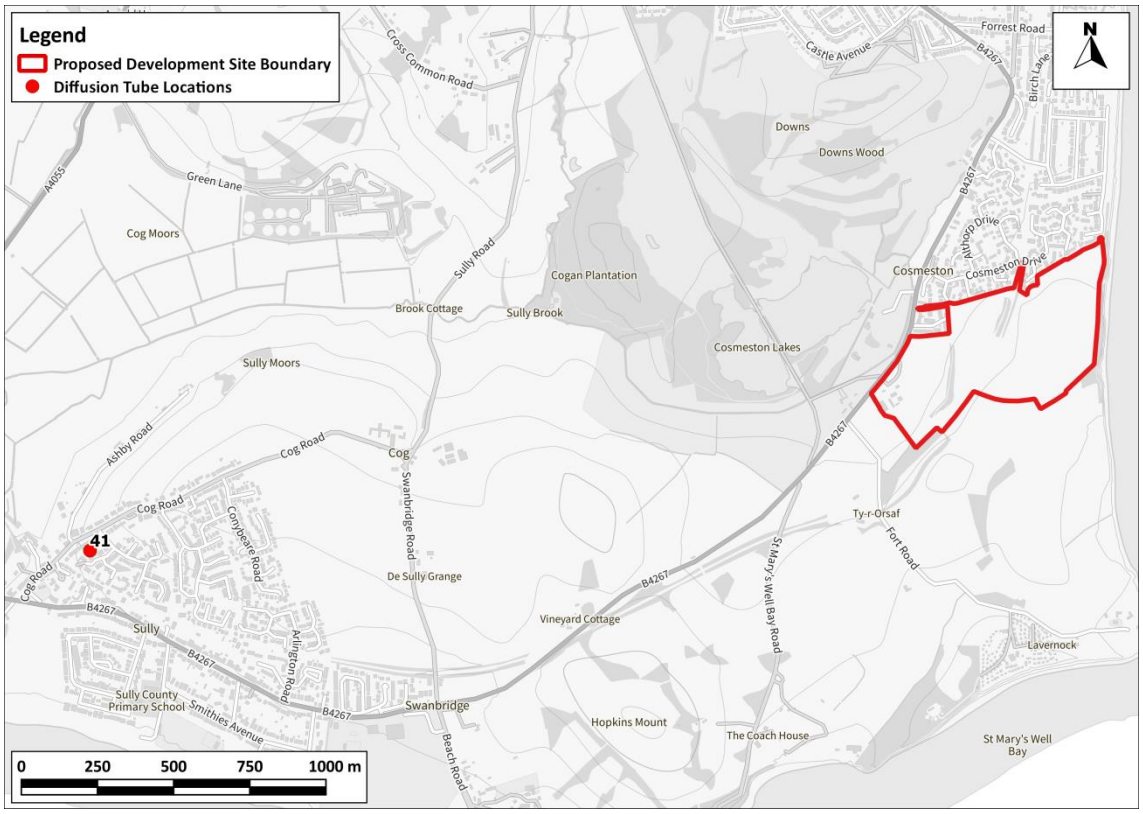
[e] As described by the Council in the 2018 ASR. The diffusion tube was moved in 2016 to the façade of a nearby property.

[f] Data have been annualised by the Council as valid data capture is <75%.

11.4.7 There was one measured exceedance of the annual mean nitrogen dioxide objective between 2013 and 2018 at the monitors shown in Table 11.3; this was measured at kerbside monitor 56 in 2015. This kerbside monitoring site did not represent relevant exposure, and the monitoring site was subsequently moved to the nearest property façade. Where data exist for the monitoring sites shown in Table 11.3, there has been a reduction in concentrations between 2013 and 2018 (except at site 70).

11.4.8 The majority of the monitors shown in Table 11.3 are located at roadside or kerbside locations on busy A-roads, and many lie within street canyons formed by houses and/or vegetation, or on complex junctions. The proposed development site is located in a more open, rural area, bounded by the coast to the east and agricultural fields to the south. It is thus considered that the majority of the monitoring sites for which data are presented will experience higher concentrations than the proposed development site; the new homes within the proposed development site will be set back from the B4267 by at least 12.5 m, and can be expected to experience nitrogen dioxide concentrations close to background levels. Thus, urban

background monitor 41 is considered to be the most representative of conditions within the majority of the site.



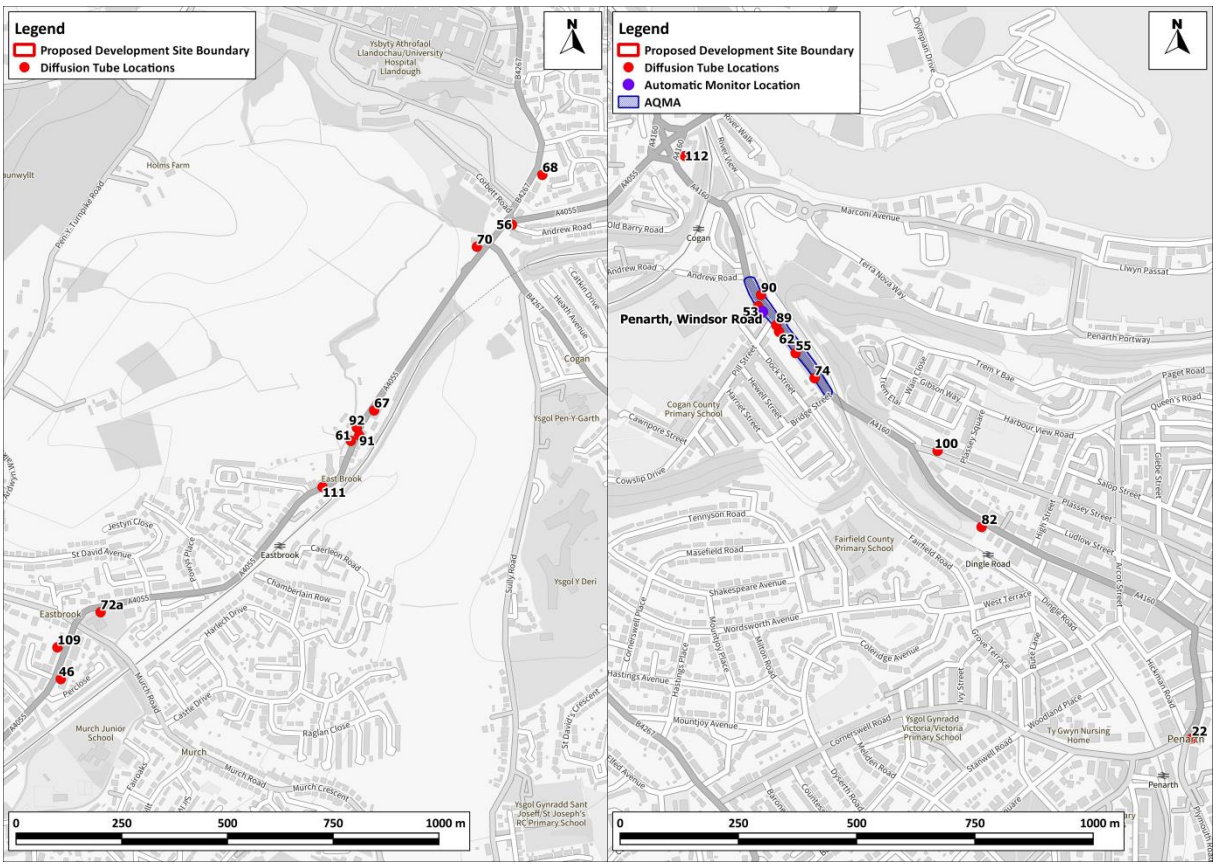


Figure 11.3: Monitoring Locations

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11.4.9 The Penarth, Windsor Road roadside automatic monitoring station also measures PM_{10} concentrations. Results for the years 2014 to 2018 are presented in Table 11.4. There were no measured exceedances of the PM_{10} objectives between 2014 and 2018, and there are no discernible trends in the measured concentrations over those years.

Table 11.4: Summary of PM_{10} Automatic Monitoring (2014-2018) [a]

Site No.	Site Type	Location	2014	2015	2016	2017	2018
PM_{10} Annual Mean (µg/m^3)							
-	Roadside	Windsor Road, Penarth	17.5 [b]	20.8	21.4	15.6	21.7
Objective			**40**				
PM_{10} No. Days >50 µg/m^3							
-	Roadside	Windsor Road, Penarth	0 (20.7)	4 (31.2)	1 (31.9)	2	0
Objective			**35 (50) [c]**				

[a] 2014-2017 Data taken from the Council's 2018 APR (Vale of Glamorgan Council, 2018). 2018 Data downloaded from the Air Quality in Wales website (Welsh Government, 2019).

[b] Data have been annualised where valid data capture is <75%.

[c] The 90.4th percentile of daily means is provided in parentheses where data capture is <85%.

Exceedances of EU Limit Value

11.4.10 There are no AURN monitoring sites within the study area with which to identify exceedances of the annual mean nitrogen dioxide limit value. Defra's roadside annual mean nitrogen dioxide concentrations (Defra, 2019c), which are used to report exceedances of the limit value to the EU, do not identify any exceedances within the study area in 2017. As such, there is considered to be no risk of a limit value exceedance in the vicinity of the proposed development by the time that it is operational.

Background Concentrations

11.4.11 Estimated background concentrations in the study area have been determined for 2018 and the opening year 2022 using Defra's 2017-based background maps (Defra, 2019b). The background concentrations are set out in Table 11.5 and have been derived as described in Appendix A11.6. The background concentrations are all well below the objectives.

Table 11.5: Estimated Annual Mean Background Pollutant Concentrations in 2018 and 2022 (µg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2018	8.2 - 18.7	9.9 - 12.3	6.6 - 7.8
2022 [a]	6.9 - 15.6	9.5 - 11.8	6.2 - 7.4
2022 Sensitivity Test [b]	*7.7 - 17.7*	*N/A*	*N/A*
Objectives	**40**	**40**	**25 [c]**

N/A = not applicable. The range of values is for the different 1x1 km grid squares covering the study area.

[a] In line with Defra's forecasts.

[b] Assuming higher emissions from future diesel cars and vans as described in Paragraph A11.6.7 in Appendix A11.6.

[c] 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.

Baseline Dispersion Model Results

11.4.12 Baseline concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been modelled at each of the existing receptor locations (see Figure 11.1 and Table 11.1 for receptor locations). The results, which cover both the existing (2018) and future year (2022) baseline (Without Scheme), are set out in Table 11.6 and Table 11.7. The predictions for nitrogen dioxide include a sensitivity test which accounts for the potential under-performance of emissions control technology on future diesel cars and vans. In addition, the modelled road components of nitrogen oxides, PM_{10} and $PM_{2.5}$ have been increased from those predicted by the model based on a comparison with local measurements (see Appendix A11.6 for the verification methodology).

Table 11.6: Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide (µg/m^3) at Existing Receptors

Receptor	2018	2022 Without Scheme	
		'Official' Prediction [a]	*Sensitivity Test* [b]
RA	12.6	10.6	*11.5*
RB	12.7	10.7	*11.5*
RC	14.4	12.1	*13.4*
RD	14.4	12.1	*13.3*
RE	13.5	11.4	*12.6*
RF	12.7	10.8	*12.0*
RG	13.3	11.1	*12.4*
RH	13.6	11.4	*12.7*
RI	14.3	12.0	*13.2*
RJ	13.5	11.3	*12.6*
RK	18.4	15.3	*16.8*
RL	17.1	14.2	*15.7*
RM	17.3	14.3	*15.9*
RN	14.9	12.5	*14.1*
RO	15.9	13.3	*14.8*
RP	19.3	16.1	*17.8*
RQ	20.1	16.8	*18.5*
RR	24.9	20.8	*22.4*

Receptor	2018	2022 Without Scheme	
		'Official' Prediction [a]	*Sensitivity Test* [b]
RS	20.1	16.8	*18.4*
RT	21.4	17.8	*19.4*
RU [c]	27.6	23.0	*24.6*
RV	20.1	16.6	*18.2*
RW	23.8	19.5	*21.1*
RX	19.1	15.7	*17.4*
RY	20.6	17.2	*19.2*
Objective	**40**		

[a] In line with Defra's forecasts.

[b] Assuming higher emissions from future diesel cars and vans as described in Paragraph A11.6.7 in Appendix A11.6.

[c] The result for the worst-case height modelled (1.5 m) is shown.

Table 11.7: Modelled Annual Mean Baseline Concentrations of PM_{10} and $PM_{2.5}$ at Existing Receptors (µg/m^3)

Receptor	PM_{10}		$PM_{2.5}$	
	2018	2022 Without Scheme	2018	2022 Without Scheme
RA	14.4	14.0	9.2	8.8
RB	13.8	13.4	9.0	8.6
RC	13.8	13.4	9.1	8.7
RD	14.0	13.5	9.2	8.8
RE	13.3	13.0	8.8	8.4
RF	12.1	11.7	8.1	7.8
RG	13.0	12.6	8.7	8.2
RH	13.1	12.6	8.7	8.3
RI	13.6	13.1	9.1	8.6
RJ	13.0	12.5	8.7	8.2
RK	15.6	15.0	10.4	9.8
RL	14.5	14.0	9.7	9.2
RM	14.8	14.3	9.9	9.4
RN	13.0	12.5	8.8	8.3
RO	13.8	13.3	9.2	8.8
RP	15.3	15.0	10.0	9.6

Receptor	PM_{10}		$PM_{2.5}$	
	2018	2022 Without Scheme	2018	2022 Without Scheme
RQ	16.0	15.7	10.5	10.0
RR	20.0	19.8	12.9	12.4
RS	16.2	15.8	10.6	10.1
RT	17.3	17.0	11.2	10.7
RU [b]	22.4	22.2	14.4	13.8
RV	15.6	15.2	10.3	9.8
RW	18.7	18.2	12.1	11.5
RX	14.6	14.1	9.7	9.2
RY	14.3	13.9	9.0	8.6
Objective / Criterion	**32** [a]		**25** [c]	

[a] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[b] The result for the worst-case height modelled (1.5 m) is shown.

[c] 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.

2018 Baseline

11.4.13 The predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ are well below the objectives in 2018 at all receptors. The annual mean PM_{10} concentrations are below 32 µg/m^3 and it is, therefore, unlikely that the 24-hour mean PM_{10} objective will be exceeded.

11.4.14 These results are consistent with the conclusions of Vale of Glamorgan in the outcome of its air quality review and assessment work.

2022 Baseline

11.4.15 The predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ are well below the objectives in 2022 at all receptor locations. The annual mean PM_{10} concentrations are below 32 µg/m^3 and it is, therefore, unlikely that the 24-hour mean PM_{10} objective will be exceeded.

Sensitivity Test for Nitrogen Dioxide

11.4.16 The results from the upper-bound sensitivity test are between 0.8 and 2.1 µg/m^3 higher than the concentrations derived using the 'official' predictions, and are all well below the annual mean nitrogen dioxide objective.

ASSESSMENT OF POTENTIAL IMPACTS

Construction Phase Impact Assessment

11.5.1 The construction works for the proposed development will be phased; by the end of 2022 it is it expected that 50 residential units will be completed, with 260 residential units and the school completed by the end of 2025, and the full 576 residential units completed by the end of 2029. Thus, the build-out rate is approximately 70 residential units per year. At this rate it is unlikely that the number of HGV movements generated by the construction will be greater than 100 AADT (the screening threshold set out in the EPUK/IAQM guidance for considering the impact of traffic emissions outside of an AQMA (Moorcroft and Barrowcliffe et al, 2017)). It is therefore not considered necessary to assess the impacts of traffic emissions during the construction phase.

11.5.2 The construction works will give rise to a risk of dust impacts during demolition, earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway. Step 1 of the assessment procedure is to screen the need for a detailed assessment. There are receptors within the distances set out in the guidance (see Appendix A11.3), thus a detailed assessment is required. The following section sets out Step 2 of the assessment procedure.

Potential Dust Emission Magnitude

11.5.3 At the time of writing this chapter, very little information is known about the construction phase, thus reasonable worst-case assumptions have been made in this assessment.

Demolition

11.5.4 There will be a requirement to demolish the livery and farm onsite, comprising approximately six farm buildings, including barns constructed from corrugated metal and two brick buildings. The approximate total volume is estimated as 13,000 m^3. The method of demolition has not yet been decided. Based on the example definitions set out in Table A11.3.1 in Appendix A11.3, the dust emission class for demolition is considered to be *small*.

Earthworks

11.5.5 The characteristics of the soil at the development site have been defined using the British Geological Survey's UK Soil Observatory website (British Geological Survey, 2019), as set out in Table 11.8. Overall, it is considered that, when dry, this soil has the potential to be moderately dusty.

Table 11.8: Summary of Soil Characteristics

Category	Record
Soil Layer Thickness	Deep
Soil Parent Material Grain Size	Mixed (Argillaceous [a] – Arenaceous [b])
Subsoil Description	Calcareous Rocks and Mudstone
Soil Group	Medium to Light (Silty) to Heavy
Soil Texture	Clayey Loam [c] to Silty Loam

[a] grain size < 0.06 mm.

[b] grain size 0.06 – 2.0 mm.

[c] a loam is composed mostly of sand and silt.

11.5.6 The site covers approximately 235,000 m^2 and most of this will be subject to earthworks. Dust will arise mainly from vehicles travelling over unpaved ground and from the handling of dusty materials (such as dry soil). Based on the example definitions set out in Table A11.3.1 in Appendix A11.3, the dust emission class for earthworks is considered to be *large*.

Construction

11.5.7 Construction will involve approximately 576 brick built residential properties, a school and a community building. The total building volume is currently unknown, but it is estimated to be approximately 350,000 m^3. Dust will arise from vehicles travelling over unpaved ground, the handling and storage of dusty materials, and from the cutting of concrete. The construction will take place over an eight-year period. Based on the example definitions set out in Table A11.3.1 in Appendix A11.3, the dust emission class for construction is considered to be *large*.

Trackout

11.5.8 The number of heavy vehicles accessing the site, which may track out dust and dirt, is currently unknown, but given the phasing of the construction, it is likely that there will be a maximum of between 10-50 outward heavy vehicle movements per day. Based on the example definitions set out in Table A11.3.1 in Appendix A11.3, the dust emission class for trackout is considered to be *medium*.

11.5.9 Table 11.9 summarises the dust emission magnitude for the proposed development.

Table 11.9: Summary of Dust Emission Magnitude

Source	Dust Emission Magnitude
Demolition	Small
Earthworks	Large
Construction	Large
Trackout	Medium

Sensitivity of the Area

11.5.10 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 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

11.5.11 The IAQM guidance explains that residential properties are 'high' sensitivity receptors to dust soiling, while the Cosmeston Lakes Country Park (and car park) and Cosmeston Medieval Village are 'low' sensitivity receptors (Table A11.3.2 in Appendix A11.3). There are approximately 71 residential properties within 20 m of the site, while the Cosmeston Lakes Country Park is approximately 30 m from the site and the Cosmeston Medieval Village is approximately 25 m from the site, but these are shielded from the site by vegetation (see Figure 11.4). Using the matrix set out in Table A11.3.3 in Appendix A11.3, the area surrounding the onsite works is of 'high' sensitivity to dust soiling.

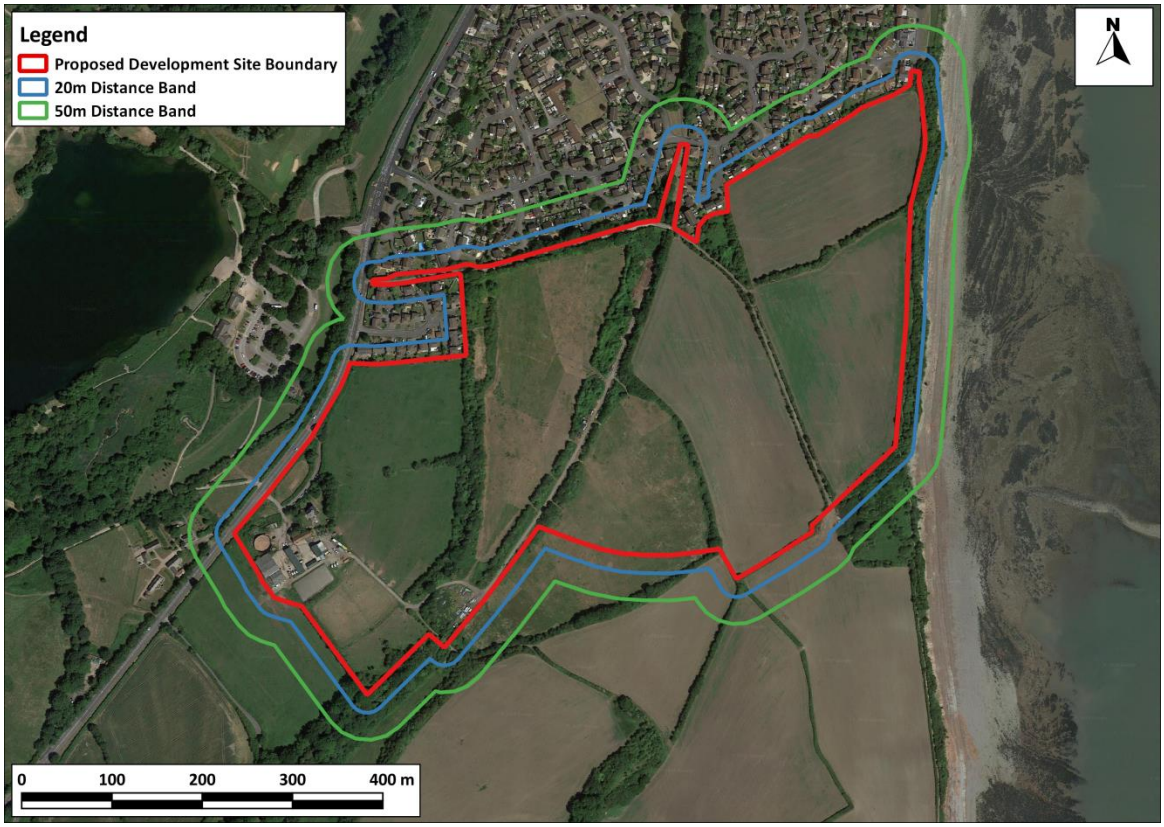

Figure 11.4: 20 m and 50 m Distance Bands around Site Boundary

11.5.12 Table 11.9 shows that the dust emission magnitude for trackout is *medium* and Table A11.3.3 in Appendix A11.3 thus explains that there is a risk of material being tracked 200 m from the site exit. Since it is not known which roads construction vehicles will use, it has been assumed that construction traffic will travel in both directions along the B4267. There are

approximately 5 residential properties within 20 m of the roads along which material could be tracked (see Figure 11.5), and Table A11.3.3 in Appendix A11.3 thus indicates that the area is of 'medium' sensitivity to dust soiling due to trackout.

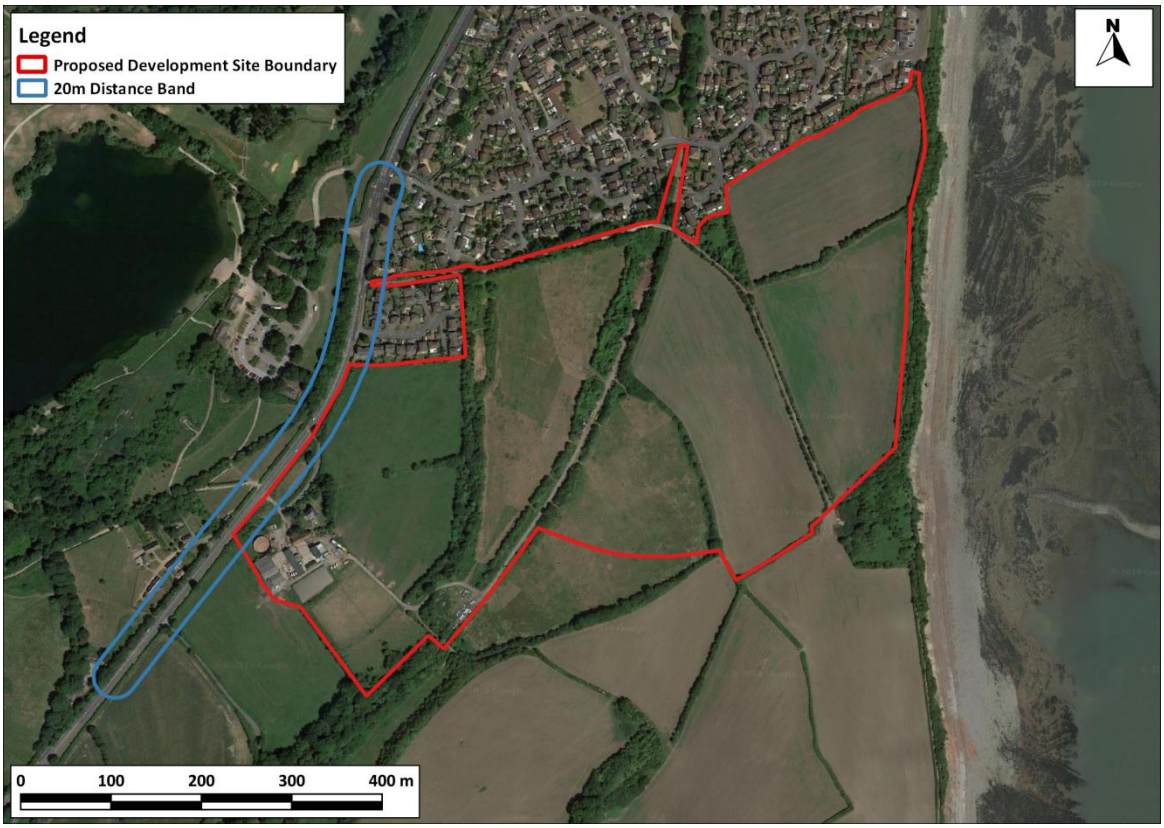

Figure 11.5: 20 m Distance Bands around Roads Used by Construction Traffic Within 200 m of the Site

Sensitivity of the Area to any Human Health Effects

11.5.13 Residential properties are also classified as being of 'high' sensitivity to human health effects, while places of work are classified as being of 'medium' sensitivity. The matrix in Table A11.3.4 in Appendix A11.3 requires information on the baseline annual mean PM_{10} concentration in the area. Receptor RA in Figure 11.1 is within 20 m of the site. The maximum predicted baseline PM_{10} concentration at this receptor is 14.4 µg/m^3 (Table 11.7), and this value has been used. Using the matrix in Table A11.3.4 in Appendix A11.3, the area surrounding the onsite works is of 'low' sensitivity to human health effects, while the area surrounding roads along which material may be tracked from the site is of 'low' sensitivity.

Sensitivity of the Area to any Ecological Effects

11.5.14 The Environmental Dimension Partnership Ltd, who has undertaken the ecological assessment for the proposed development, has advised on the sensitivity of nearby ecological sites to dust pollution.

11.5.15 The IAQM guidance considers Sites of Special Scientific Interest (SSSIs) with dust-sensitive features to be of 'medium' sensitivity. Penarth Coast SSSI lies 12 m from the site boundary and includes calcareous grassland habitats. Since the Penarth Coast SSSI is within 20 m from site boundary, Table A11.4.6 in Appendix A11.4 shows that the area is of 'medium' sensitivity to ecological effects from on-site works.

11.5.16 The Severn Estuary Ramsar / Special Protection Area (SPA) / Special Area of Conservation (SAC) is located 31 m from the site boundary. The Severn Estuary is considered to be a 'high' sensitive receptor, within which aquatic environments and terrestrial habitats such as saltmarsh may be impacted by physical or chemical means. Since the Severn Estuary is within 50 m but more than 20 m from the site boundary, Table A11.3.5 in Appendix A11.3 shows that the area is of 'medium' sensitivity to ecological effects from on-site works.

11.5.17 Impacts on the above internationally designated sites are only likely when works take place within 50 m of these sites. Rigorous dust suppression is thus required in these areas.

11.5.18 Cosmeston Lakes SSSI lies 125 m from the site boundary and 100 m from roads along which material may be tracked from the site, as such, it does not need to be considered further. Cosmeston Lakes Local Nature Reserve (LNR) lies 13 m from the site boundary, adjacent to roads along which material may be tracked from the site. Habitats associated with the LNR which would be sensitive to dust pollution include woodland sand scrub habitats; the LNR is considered to be a 'low' sensitivity receptor. Table A11.4.6 in Appendix A11.4 thus shows that the area is of 'low' sensitivity to ecological effects from trackout and on-site works.

Summary of the Area Sensitivity

11.5.19 Table 11.10 summarises the sensitivity of the area around the proposed construction works.

Table 11.10: Summary of the Area Sensitivity

Effects Associated With:	Sensitivity of the Surrounding Area	
	On-site Works	Trackout
Dust Soiling	High Sensitivity	Medium Sensitivity
Human Health	Low Sensitivity	Low Sensitivity
Ecological	Medium Sensitivity	Low Sensitivity

Risk and Significance

11.5.20 The dust emission magnitudes in Table 11.9 have been combined with the sensitivities of the area in Table 11.10 using the matrix in Table A11.3.6 in Appendix A11.3, in order to assign a risk category to each activity. The resulting risk categories for the four construction activities, without mitigation, are set out in Table 11.11. These risk categories have been used to determine the appropriate level of mitigation as set out in Section 11.6 (step 3 of the assessment procedure).

Table 11.11: Summary of Risk of Impacts Without Mitigation

Source	Dust Soiling	Human Health	Ecology
Demolition	Medium Risk	Negligible	Low Risk
Earthworks	High Risk	Low Risk	Medium Risk
Construction	High Risk	Low Risk	Medium Risk
Trackout	Low Risk	Low Risk	Low Risk

11.5.21 The IAQM guidance 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' (IAQM, 2016).

Operational Phase Impact Assessment

Impacts at Existing Receptors

Initial Screening Assessment of Development-Generated Road Traffic Emissions

11.5.22 The trip generation of the proposed development on local roads (as provided by Asbri Transport Ltd) has initially been compared to the screening criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017) (see Paragraphs A11.4.7 to A11.4.10 in Appendix A11.4). The proposed development will increase Annual Average Daily Traffic (AADT) flows by 2,558 vehicles along Lavernock Road north of the proposed development site, thus a detailed assessment is required.

Detailed Assessment of Development-Generated Road Traffic Emissions

11.5.23 Predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ in 2022 for existing receptors are set out in Table 11.12 and Table 11.13 for both the "Without Scheme" and "With Scheme" scenarios. These tables also describe the impacts at each receptor using the impact descriptors given in Appendix A11.4. For nitrogen dioxide, results are presented for two scenarios so as to include a sensitivity test.

Table 11.12: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2022 (µg/m^3)

Receptor	Without Scheme [a]	With Scheme [a]	% Change [a,b]	Impact Descriptor [b]	*Sensitivity Test [c]*			
					Without Scheme	*With Scheme*	*% Change [b]*	*Impact Descriptor*
RA	10.6	11.5	2	Negligible	*11.5*	*12.4*	*2*	*Negligible*
RB	10.7	11.2	1	Negligible	*11.5*	*12.0*	*1*	*Negligible*
RC	12.1	12.6	1	Negligible	*13.4*	*13.8*	*1*	*Negligible*

Receptor	Without Scheme [a]	With Scheme [a]	% Change [a,b]	Impact Descriptor [b]	*Sensitivity Test [c]*			
					Without Scheme	*With Scheme*	*% Change [b]*	*Impact Descriptor*
RD	12.1	12.8	2	Negligible	*13.3*	*14.0*	*2*	*Negligible*
RE	11.4	11.7	1	Negligible	*12.6*	*12.9*	*1*	*Negligible*
RF	10.8	10.9	0	Negligible	*12.0*	*12.2*	*0*	*Negligible*
RG	11.1	11.8	2	Negligible	*12.4*	*13.0*	*2*	*Negligible*
RH	11.4	11.8	1	Negligible	*12.7*	*13.1*	*1*	*Negligible*
RI	12.0	12.5	1	Negligible	*13.2*	*13.7*	*1*	*Negligible*
RJ	11.3	11.6	1	Negligible	*12.6*	*12.9*	*1*	*Negligible*
RK	15.3	16.0	2	Negligible	*16.8*	*17.5*	*2*	*Negligible*
RL	14.2	14.7	1	Negligible	*15.7*	*16.2*	*1*	*Negligible*
RM	14.3	14.9	1	Negligible	*15.9*	*16.4*	*1*	*Negligible*
RN	12.5	12.8	1	Negligible	*14.1*	*14.3*	*1*	*Negligible*
RO	13.3	13.7	1	Negligible	*14.8*	*15.2*	*1*	*Negligible*
RP	16.1	16.2	0	Negligible	*17.8*	*17.9*	*0*	*Negligible*
RQ	16.8	17.0	0	Negligible	*18.5*	*18.7*	*0*	*Negligible*
RR	20.8	21.3	1	Negligible	*22.4*	*22.9*	*1*	*Negligible*
RS	16.8	17.1	1	Negligible	*18.4*	*18.8*	*1*	*Negligible*
RT	17.8	18.2	1	Negligible	*19.4*	*19.8*	*1*	*Negligible*
RU [d]	23.0	23.6	1	Negligible	*24.6*	*25.1*	*1*	*Negligible*
RV	16.6	16.7	0	Negligible	*18.2*	*18.4*	*0*	*Negligible*
RW	19.5	19.7	0	Negligible	*21.1*	*21.3*	*0*	*Negligible*
RX	15.7	15.8	0	Negligible	*17.4*	*17.5*	*0*	*Negligible*
RY	17.2	17.2	0	Negligible	*19.2*	*19.3*	*0*	*Negligible*
Objective	**40**		**-**	**-**	***40***		**-**	**-**

[a] In line with Defra's forecasts.

[b] % changes are relative to the objective and have been rounded to the nearest whole number.

[c] Assuming higher emissions from future diesel cars and vans as described in Paragraph A11.6.7 in Appendix A11.6.

[d] The result for the worst-case height modelled (1.5 m) is shown.

Table 11.13: Predicted Impacts on Annual Mean PM_{10} and $PM_{2.5}$ Concentrations in 2022 ($\mu g/m^3$)

Receptor	Annual Mean PM_{10} ($\mu g/m^3$)				Annual Mean $PM_{2.5}$ ($\mu g/m^3$)			
	Without Scheme	With Scheme	% Change [a]	Impact Descriptor	Without Scheme	With Scheme	% Change [a]	Impact Descriptor
RA	14.0	15.1	3	Negligible	8.8	9.4	2	Negligible
RB	13.4	14.1	2	Negligible	8.6	9.0	2	Negligible
RC	13.4	13.9	2	Negligible	8.7	9.0	1	Negligible
RD	13.5	14.4	3	Negligible	8.8	9.2	2	Negligible
RE	13.0	13.3	1	Negligible	8.4	8.6	1	Negligible
RF	11.7	11.9	0	Negligible	7.8	7.8	0	Negligible
RG	12.6	13.4	2	Negligible	8.2	8.7	2	Negligible
RH	12.6	13.0	1	Negligible	8.3	8.5	1	Negligible
RI	13.1	13.6	2	Negligible	8.6	8.8	1	Negligible
RJ	12.5	12.8	1	Negligible	8.2	8.4	1	Negligible
RK	15.0	15.8	2	Negligible	9.8	10.2	2	Negligible
RL	14.0	14.6	2	Negligible	9.2	9.5	1	Negligible
RM	14.3	14.9	2	Negligible	9.4	9.7	1	Negligible
RN	12.5	12.8	1	Negligible	8.3	8.5	1	Negligible
RO	13.3	13.6	1	Negligible	8.8	9.0	1	Negligible
RP	15.0	15.1	0	Negligible	9.6	9.7	0	Negligible
RQ	15.7	15.9	1	Negligible	10.0	10.1	0	Negligible
RR	19.8	20.3	2	Negligible	12.4	12.7	1	Negligible
RS	15.8	16.2	1	Negligible	10.1	10.3	1	Negligible
RT	17.0	17.3	1	Negligible	10.7	10.9	1	Negligible
RU [b]	22.2	22.9	2	Negligible	13.8	14.1	1	Negligible
RV	15.2	15.4	1	Negligible	9.8	9.9	0	Negligible
RW	18.2	18.4	1	Negligible	11.5	11.6	0	Negligible
RX	14.1	14.2	0	Negligible	9.2	9.2	0	Negligible
RY	13.9	14.0	0	Negligible	8.6	8.7	0	Negligible
Criterion	**32 [c]**		-	-	**25 [d]**		-	-

[a] % changes are relative to the criterion and have been rounded to the nearest whole number.

[b] The result for the worst-case height modelled (1.5 m) is shown.

[c] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[d] 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.

Nitrogen Dioxide

11.5.24 The annual mean nitrogen dioxide concentrations are well below the objective at all receptors. The percentage changes in concentrations, relative to the air quality objective (when rounded), are predicted to be zero at seven of the receptors, 1% at 14 of the receptors and 2% at four of the receptors. Using the matrix in Table A11.4.1 (Appendix A11.4), these impacts are described as *negligible*.

11.5.25 The annual mean nitrogen dioxide concentrations are below 60 µg/m^3 at every receptor; it is, therefore, unlikely that the 1-hour mean nitrogen dioxide objective will be exceeded (see Paragraph 11.3.17).

Sensitivity Test

11.5.26 The results from the sensitivity test are not materially different from those derived using the 'official' predictions.

PM_{10} and $PM_{2.5}$

11.5.27 The annual mean PM_{10} and $PM_{2.5}$ concentrations are well below the relevant criteria at all receptors, with or without the proposed development. Furthermore, as the annual mean PM_{10} concentrations are below 32 µg/m^3, it is unlikely that the 24-hour mean PM_{10} objective will be exceeded at any of the receptors. The percentage changes in PM_{10} concentrations, relative to the applied annual mean criteria (when rounded), are predicted to be zero at four of the receptors, 1% at ten of the receptors, 2% at nine of the receptors and 3% at two of the receptors. Using the matrix in Table A11.4.1 (Appendix A11.4), these impacts are described as *negligible.* The percentage changes in $PM_{2.5}$ concentrations, relative to the applied annual mean criteria (when rounded), are predicted to be zero at seven of the receptors, 1% at thirteen of the receptors and 2% at five of the receptors. Using the matrix in Table A11.4.1 (Appendix A11.4), these impacts are described as *negligible.*

<u>Impacts of Existing Sources on Future Residents of the Development</u>

Detailed Assessment of Air Quality at Receptors Within the Development

11.5.28 Predicted air quality conditions for future residents of the proposed development, taking account of emissions from the adjacent road network, are set out in Table 11.14 for Receptors R1 to R6 (see Table 11.1 and Figure 11.1 for receptor locations). All of the values are well below the objectives. Air quality for future residents within the development will thus be acceptable.

Table 11.14: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2022 for New Receptors in the Development Site

Receptor	Annual Mean NO_2 (µg/m^3)		Annual Mean PM_{10} (µg/m^3)	Annual Mean $PM_{2.5}$ (µg/m^3)
	'Official' Prediction [a]	*Sensitivity Test* [b]		
R1	11.0	*11.7*	14.9	9.2
R2	10.9	*11.6*	14.7	9.1
R3	12.3	*13.2*	15.9	9.8
R4	12.7	*13.6*	16.2	10.0
R5	9.5	*10.5*	12.6	8.0
R6	10.5	*11.4*	13.7	8.6
Objective / Criterion	**40**		**32** [c]	**25** [d]

[a] In line with Defra's forecasts.

[b] Assuming higher emissions from future diesel cars and vans as described in Paragraph A11.6.7 in Appendix A11.6.

[c] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[d] 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.

Significance of Operational Air Quality Effects

11.5.29 The operational air quality effects without mitigation are judged to be 'not significant'. This professional judgement is made in accordance with the methodology set out in Appendix A11.4, and also takes into account the results of the sensitivity test for nitrogen dioxide. More specifically, this judgement that the air quality effects will be 'not significant' without mitigation takes account of the assessment that:

- pollutant concentrations at worst-case locations within the proposed development will all be well below the objectives, thus future residents will experience acceptable air quality;
- pollutant concentrations at all of the selected worst-case existing receptors along the local road network will be well below the air quality objectives, and all of the impacts are predicted to be *negligible*; and
- the assessment assumes that the entire development is operational in 2022, when in reality the anticipated completion year is 2029. Thus the assessment has over-predicted the traffic-related impacts.

MITIGATION

Mitigation Included by Design

11.6.1 The EPUK/IAQM or Environmental Protection Scotland guidance advises that good design and best practice measures should be considered, whether or not more specific mitigation is required. The proposed development incorporates the following good design and best practice measures:

- adoption of a Dust Management Plan (DMP) or Construction Environmental Management Plan (CEMP) to minimise the environmental impacts of the construction works;
- an expected 5% of car parking spaces will be provided with electric vehicle charging infrastructure;
- provision of cycle parking within the development, and an on-site Bicycle Users Group which will be organised by the Travel Plan Co-ordinator(s);
- provision of a detailed travel plan setting out measures to encourage sustainable means of transport (public, cycling and walking), including a Welcome Pack for new residents;
- access to the local and wider city area will be provided via a dedicated cycling/pedestrian route that traverses the site north to south and which will form an extension of National Cycle Network Route 88; and
- a new Toucan crossing on Lavernock Road allowing pedestrians and cyclists to access Cosmeston Lakes and passengers to access the northbound bus stop.

Recommended Mitigation

Construction Impacts

11.6.2 Measures to mitigate dust emissions will be required during the construction phase of the development in order to minimise effects upon nearby sensitive receptors.

11.6.3 The site has been identified as a *Medium* Risk site during demolition, *High* Risk during earthworks and construction, and *Low* Risk for trackout, as set out in Table 11.11. Comprehensive guidance has been published by IAQM (2016) that describes measures that should be employed, as appropriate, to reduce the impacts, along with guidance on monitoring during demolition and construction (IAQM, 2018). This reflects best practice experience and has been used, together with the professional experience of the consultant who has undertaken the dust impact assessment and the findings of the assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in Appendix A11.7.

11.6.4 The mitigation measures should be written into a dust management plan (DMP). The DMP may be integrated into a Code of Construction Practice or the Construction Environmental Management Plan, and may require monitoring.

11.6.5 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. Rigorous dust suppression is required in areas adjacent to designated ecological sites.

Road Traffic Impacts

11.6.6 The assessment has demonstrated that the proposed development will not cause any exceedances of the air quality objectives, even when it is assumed that the entire development will be operational in 2022, and that the overall effect of the proposed development will be 'not significant'. It is, therefore, not considered appropriate to propose further mitigation measures for this development.

11.6.7 Measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation (which is written into UK law).

RESIDUAL IMPACTS

Residual Effects

Construction

11.7.1 The IAQM guidance is clear that, with appropriate mitigation in place, the residual effects will normally be 'not significant'. The mitigation measures set out in Section 11.6 and Appendix A11.7 are based on the IAQM guidance. With these measures in place and effectively implemented the residual effects are judged to be 'not significant'.

11.7.2 The IAQM guidance does, however, recognise 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 of the time, for instance under adverse weather conditions. During these events, short-term dust annoyance may occur, however, the scale of this would not normally be considered sufficient to change the conclusion that overall the effects will be 'not significant'.

Road Traffic Impacts

11.7.3 The residual impacts will be the same as those identified in Section 11.7. The overall effects of the proposed development will be 'not significant'.

CONCLUSION

11.8.1 The construction works have the potential to create dust. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emissions. With these measures in place, it is expected that any residual effects will be 'not significant'.

11.8.2 The operational impacts of increased traffic emissions arising from the additional traffic on local roads, due to the development, have been assessed. Concentrations have been modelled for twenty-five worst-case receptors, representing existing properties where impacts are expected to be greatest. In addition, the impacts of traffic emissions from local roads on the air quality for future residents have been assessed at six worst-case locations within the new development itself. In the case of nitrogen dioxide, a sensitivity test has also been carried out which considers the potential under-performance of emissions control technology on future diesel cars and vans.

11.8.3 It is concluded that concentrations of PM_{10} and $PM_{2.5}$ will remain below the objectives at all existing receptors in 2022, with or without the proposed development. This conclusion is consistent with the outcomes of the reviews and assessments prepared by Vale of Glamorgan Council, which show that exceedances of the PM_{10} objective are unlikely at any location.

11.8.4 In the case of annual mean nitrogen dioxide, concentrations remain below the objective at all existing receptors in 2022, with or without the proposed development, and taking account of the sensitivity test.

11.8.5 The additional traffic generated by the proposed development will affect air quality at existing properties along the local road network. The assessment has demonstrated that the increases in annual mean concentrations of PM_{10} at relevant locations, relative to the objectives, are predicted to range from 0% to 3%, (when rounded) and the impacts will all be *negligible*. In the case of annual mean nitrogen dioxide and $PM_{2.5}$, the percentage increases are predicted to range from 0% to 2%, and the impacts will all be *negligible*.

11.8.6 The effects of local traffic on the air quality for residents living in the proposed development have been shown to be acceptable at the worst-case locations assessed, with concentrations being well below the air quality objectives.

11.8.7 The overall operational air quality effects of the development are judged to be 'not significant'. This conclusion, which takes account of the uncertainties in future projections for nitrogen dioxide, is based on the concentrations at existing receptors being well below the objectives and impacts all being *negligible*, while concentrations for future residents of the development will be below the objectives.

11.8.8 The proposed development is consistent with the PPW, which requires that new development is appropriate for its location in order to prevent unacceptable risks from air pollution. Furthermore, the proposed development does not conflict with the requirements of Policy MD7 of the Vale of Glamorgan Local Development Plan.