8 Air quality

8.1 Introduction

8.1.1 This section describes the likely significant effects of the proposed development on air quality. It outlines the methodology, the baseline conditions and the likely significant air quality effects associated with the construction and operation of the proposed development. Mitigation measures which would be implemented to minimise the effect of the proposed development on air quality are also described, where relevant.

8.2 Review of proposed development

8.2.1 The development proposals for Cardiff Hendre Lakes are described in Chapter 3 of this report.

8.2.2 The proposed development is likely to generate changes to the amount of traffic and has the potential for causing an adverse air quality impact as a result of the emissions from the additional construction and operational traffic.

8.2.3 The space and water heating for the office buildings may be provided by gas-fired boilers. Details of the heating systems will be included in the submission of reserved matters applications. Should gas fired boilers be deployed then emissions from their operation has the potential to impact on the proposed development. However, it has been assumed that their installation will be in accordance with other relevant regulations and will not adversely impact on the local air quality.

8.2.4 The proposed development includes ground-level car parking spaces for the office units, as well as a park and ride facility next to the proposed Cardiff Parkway train station. The exact locations and number of spaces in each parking plot have not yet been confirmed due to the outline nature of the application.

8.2.5 The proposed Cardiff Parkway train station, which will serve as an additional stop on the existing Paddington to Swansea rail line, is part of the proposed development. This rail line is identified in Defra’s Local Air Quality Management

(LAQM) Technical Guidance TG(16)[1] as having heavy traffic of diesel passenger trains.

8.2.6 Junction modification work is proposed at the A48/B4487/Cypress Drive roundabout where there will be realignment of roads more than 5m.

8.2.7 The proposed development includes ancillary uses and these may include a small number of restaurants/commercial kitchens.

8.3 Legislation, policy context and guidance

8.3.1 The key national, regional and local legislation and policy, as well as relevant technical guidance have been considered in relation to this assessment. A summary of the review can be found in Appendix F1.

8.3.2 The key documents reviewed include:

Legislation

- Air Quality Framework Directive on ambient air quality assessment and management (96/62/EC);
- Air Quality Strategy for England, Scotland, Wales and Northern Ireland[2];

Policy

- Well-being of Future Generations (Wales) Act 2015;
- The 10th edition of Planning Policy Wales[3];
- Cardiff Council (CC) Local Development Plan (LDP)[4];
- Planning for Health and Well-being: Supplementary Planning Guidance (SPG)[5];
- Managing Transportation Impacts: Supplementary Planning Guidance[6];
- Newport County Council (NCC) Local Development Plan (LDP)[7];

Guidance

- Defra Local Air Quality Management (LAQM) Planning Policy Guidance (PG(16))[8] and Technical Guidance (TG(16))[9];
- Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction[10];

[1] Defra (2016) Local Air Quality Management Technical Guidance.TG(16)
[2] Defra et al 2007, Air Quality Strategy for England, Scotland, Wales and Northern Ireland
[3] Welsh Government (2018) Planning Policy Wales Edition 10 (PPW10)
[4] Cardiff Council (2016) Local Development Plan 2006-2026
[5] Cardiff Council (2017) Planning for Health and Well-being -Supplementary Planning Guidance
[6] Cardiff Council (2017) Managing Transportation Impacts – Supplementary Planning Guidance
[7] Newport County Council 2015, Local Development Plan (2011-2026)
[8] Defra (2016) Local Air Quality Management Policy Guidance. PG(16)
[9] Defra (2016) Local Air Quality Management Technical Guidance.TG(16)
[10] IAQM (2016) Guidance on the Assessment of Dust from Demolition and Construction (Version 1.1)

- Environmental Protection UK (EPUK) and IAQM 2017 Land-Use Planning & Development Control guidance document[11]; and
- Institute of Air Quality Management (IAQM) A guide to the assessment of air quality impacts on designated nature conservation site[12].

8.4 Scoping and consultation

Scoping

8.4.1 A Scoping Report[14] (dated 5th July 2018, see Appendix A1) was submitted to Cardiff Council (CC) and Natural Resource Wales (NRW) which set out the intended assessment technical scope and methodology for the Air Quality assessment.

8.4.2 A formal Scoping Opinion[15] (see Appendix A1) was issued by Cardiff Council on 25th September 2018. The key comments received are detailed in Table 8.1 below, along with Arup's correlating response.

Table 8.1: Response to Scoping Opinion

Scoping Opinion clause	Response
From: Cardiff Council – James Clemence (Head of Planning) Cardiff Council has advised that the air quality modelling may need to be revisited once the detail surrounding the provision of boilers is confirmed. Cardiff Council would also like to seek clarification on how verification of the modelling will be undertaken.	The buildings within the proposed development will provide combustion plant, most likely gas-fired boilers, for heating purposes. However, there is insufficient detail at the outline planning stage to allow for any detailed dispersion modelling for the combustion plant. In view of the lack of LAQM monitoring in the vicinity, A scheme-specific diffusion tube monitoring programme for six months between April and October 2019 has been carried out. The purpose of this monitoring programme is to provide additional data in at and near the proposed development site to facilitate model verification. Further details for the monitoring programme have been included in paragraph 8.7.9 of this ES chapter. These have been discussed further with Cardiff Council. See Table 8.2.
From: Natural Resources Wales (NRW) - Helen Griffiths NRW does not consider the information provided in the Scoping Report to be sufficient to screen out significant construction phase traffic emission effects on the Gwent Levels: Rumney and Peterstone SSSI. Process contributions should be considered in relation to Critical Levels and Critical Loads.	A detailed assessment for the impact from construction traffic on the Rumney and Peterstone SSSI has been carried out. Further consultation with NRW has also been carried out to agree the pollutants to assess and the relevant Critical Levels and Critical Loads to be used for the assessment. See Table 8.2 for details on this further consultation.

[11] EPUK/IAQM, (2017) Land-Use Planning & Development Control: Planning for Air Quality
[12] IAQM (2019) A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.0
[14] Cardiff Parkway, Environmental Impact Assessment, Scoping Report. Arup. 5th July 2018.
[15] Scoping Opinion for New Mainline Station, Parl and Ride Facility and Ancillary Development. Cardiff Council. 25th September 2018. JC/TW/SC/18/00002/MJR

Scoping Opinion clause	Response
In addition to these, an appropriate conversion of NOx to nitrogen deposition should be made and assessed against the nitrogen critical load of 10-20kgN/ha/yr for the SSSI.	
From: Shared Regulatory Services (Cardiff, Bridgend, VoG) - Craig Lewis A full AQA is required by Cardiff Council and consultation with consultation with Shared Regulatory Service prior to assessment being undertaken is recommended. The key elements of concern are summarised below: • Potential impact from the operation of the proposed development due to the increase in emissions from road traffic on nearby existing sensitive receptors; • Potential impact at the commercial buildings within the proposed development (against short-term objectives for NO_2 and PM_{10}); • Consideration of emissions from diesel locomotives; • Potential impact from combustion plant; and Consideration of mitigation measures.	Full details of the assessment are presented in this chapter. Further consultation with CC Shared Regulatory Services has also been carried out, which the details can be found in Table 8.2 below.

Consultation and agreed scope of assessment

8.4.3 Following the adoption of the formal Scoping Opinion, further consultation has been held with the key stakeholders at CC and NRW to discuss and close out all comments from the Scoping Opinion. Through this further consultation the exact scope of work has been agreed. The comments on the various elements for the air quality assessment, and the corresponding responses, are summarised in Table 8.2.

Table 8.2: Summary of further consultation

Stakeholder	Comment	Response
CC	A construction dust risk assessment should be carried out	A construction dust risk assessment has been carried out with any assumptions made stated clearly in the ES (see section 8.5 for methodology and section 8.5.21 for results).
CC	Details of scoping for emissions from diesel locomotives should be provided	Arup has provided further evidence that the risk of impact from moving trains can be scoped out as the background annual mean NO_2 concentration is below 25µg/m^3. This is based on the guidance provided in paragraph 7.18 in the Defra LAQM TG16. With regards to idling/stationary trains, The LAQM TG(16) guidance also suggests that there is a risk of exceedance of the SO_2 15-minute mean objective, should there be: • diesel or steam locomotives regularly (at least 3 times a day) stationary for periods of 15 minutes or more; and • relevant exposure within 15m of the locomotives. Under standard scheduled occurrences, there will be no idling for diesel trains for longer than 15 minutes at or around the new station within the proposed development.

		There may be short-term unplanned events that would result in trains idling in a location for any unspecified amount of time. Based on historical data between December 2017 and May 2018 as provided by the project team, there could be approximately seven idling trains at or near the proposed development as a worst case. However, the locations where trains would idle are subject to great uncertainty and variability, and whether or not there would be relevant exposure within 15m of such location repeatedly. On balance, it is not considered that there is a risk of exceedance of the SO_2 15-minute mean objective for stationary locomotives and no further assessment is required. This has been agreed with CC.
CC	An assessment for combustion plant should be carried out	Gas supply will be present at the proposed development site and the commercial buildings are likely to be equipped with gas fired boilers. However since this is an outline planning application, no information is available with regards to the number of buildings, their exact locations and information about the combustion plant (including make and model, and arrangement for flue stacks). Arup proposed to acknowledge the presence of combustion plant within the site in the ES and to carry out a detailed assessment at a later stage when further information becomes available. This has been accepted by CC, likely to be instated as a condition which would outline a need to review the modelling
CC	Any potential odour impact?	The proposed development includes ancillary uses and these may include a small number of restaurants/commercial kitchens. However no information is available at this stage for these uses. An assessment can be carried out at the later stage (e.g. reserved matter stage) to ensure that any odour impact is taken into account, and any mitigation measures required will be identified appropriately.
CC	Details for construction and operational traffic impact assessment should be provided.	Based on the traffic data provided, it has been confirmed that the increase in both the construction and operational traffic due to the proposed development will be above the screening threshold as per IAQM/EPUK guidance. As a result detailed assessment for construction and operational traffic using ADMS Roads dispersion modelling has been carried out. Details of the dispersion modelling are provided in section 8.5 of this ES chapter.
CC	How will model verification be carried out	Model verification against scheme-specific and local authority monitoring data has been carried out. Detailed can be found in section 8.10 as well as in Appendix F3.
CC	Locations for receptors should be agreed with CC prior to assessment	A figure showing all the receptors to be assessed has been issued to CC for review and comments prior to the submission of the ES, and CC has confirmed that they are satisfactory. A copy of the email correspondence has been provided in Appendix A1.
CC	Sensitivity test should be carried out to determine impact of car parks on the proposed buildings	Since the scheme is at an outline planning stage, details on the surface car parking (i.e. how many car parks, their locations, spaces within each plots and the corresponding number of vehicle movements) are not available. As a result it has not been possible to carry out any dispersion modelling at this stage. It is proposed to carry out a detailed assessment at a later stage when further information becomes available. CC has confirmed that quantifying the emissions generated by the car park at a later stage is acceptable. A copy of the email correspondence has been provided in Appendix A1.
NRW	NRW asked to confirm the approach to assess the ecological receptors, in	An assessment on ecological receptors, including the Gwent Levels: Rumney and Peterstone SSSI and other selected sites within 200m of the roads affected by the proposed development,

	particular the Gwent Levels: Rumney and Peterstone SSSI adjacent to the proposed development	has been carried out. Details for the assessment, including the relevant assessment criteria, are provided in section 8.5. Ecological impact assessment has been carried out and are presented in Chapter 7 of the ES.

8.5 Methodology

Overview

8.5.1 This section outlines the approach for assessing the baseline air quality and likely significant effects on air quality from construction and operation of the proposed development.

8.5.2 The overall approach to the air quality assessment comprises:

- a review of the existing air quality conditions at the site and within 200m of the assessment road network (the study area);
- an assessment of the potential changes in air quality arising from the construction and operation of the proposed development; and
- formulation of mitigation measures, where necessary, to ensure any adverse effects on air quality are minimised.

Establishing baseline conditions

8.5.3 Existing or baseline air quality refers to the concentration of pollutants of interest for this assessment (nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$)) that are already present in the environment. These are present from various sources, such as industrial processes, commercial and domestic activities, traffic and natural sources.

8.5.4 A desk-based review of the following data sources has been undertaken to determine baseline conditions of air quality at and in the vicinity of the proposed development and the study area in this assessment.

- CC Air Quality Progress Report[18];
- NCC Air Quality Progress Report[19];
- Defra Local Air Quality Management website[20];
- UK Air Information Resource website[21]; and
- Environmental Agency (EA) register on industrial installations[22].

[18] Cardiff Council (2019) Air Quality Progress Report 2019 [Accessed: January 2020]
[19] Newport County Council (2019) Air Quality Progress Report 2019 [Accessed: January 2020]
[20] Defra; *Local Air Quality Management (LAQM) Support;* Available at http://laqm.defra.gov.uk [Accessed: January 2020]
[21] Defra; *UK Air Information Resource; Interactive monitoring networks map* Available at https://uk-air.defra.gov.uk/interactive-map [Accessed: January 2020]
[22] Environment Agency; *DEFRA data services platform;* Available at https://environment.data.gov.uk/public-register/view/search-industrial-installations [Accessed: January 2020]

8.5.5 The review included the local authority air quality monitoring data for recent years (2015-2019) and local background pollutant concentrations. A scheme-specific monitoring programme has also been carried out which informed the baseline air quality at and around the proposed development site. The scheme-specific diffusion tube monitoring was set up as there were no local authority tubes at locations close enough to establish the baseline air quality of the proposed development.

Screening of assessment

Screening of road traffic

8.5.6 The extent of the study area for the construction and operational traffic assessments was determined using the screening criteria as detailed in the EPUK/IAQM land-use guidance screening criteria.

8.5.7 CC and NCC have declared multiple areas as Air Quality Management Areas (AQMAs) as shown in Figure 8.1. The proposed development is not in any of these AQMAs. However, the road network affected by the traffic generated during the construction and operation of the proposed development extends into these designated AQMAs. Therefore, more stringent screening for road traffic within AQMAs has been taken into account in this assessment.

8.5.8 The EPUK/IAQM screening criteria[11] for areas in or outside an AQMA were used as appropriate across the road network. Meeting any of the respective criteria indicates that detailed dispersion modelling of road traffic emissions is likely to be required.

8.5.9 The screening criteria in relation to change in traffic flows and road realignment are as follows:

- For an area within or adjacent to an AQMA:
  - A change of Light Duty Vehicle (LDV) flows of more than 100 Annual Average Daily Traffic (AADT) movements;
  - A change of Heavy-Duty Vehicle (HDV) flows of more than 25 AADT movements; and
  - Realign roads, i.e. changing the proximity of receptors to traffic lanes 5m where change is 5m or more and the road is within an AQMA.
- For areas elsewhere:
  - A change of LDV flows of more than 500 AADT movements; and
  - A change of HDV flows of more than 100 AADT movements.

8.5.10 Traffic data for the assessment was screened using the above criteria. Based on the traffic data provided by the Arup transport consultants detailed assessments are

required for both construction and operational traffic, as the increase in traffic in both scenarios will be above the relevant screening criteria.

8.5.11 There is also junction modification work at the A48/B4487/Cypress Drive roundabout where there will be realignment of roads more than 5m. This modification is reflected in the dispersion modelling.

8.5.12 The extent of the modelled road network (i.e. the study area) is shown in Figure 8.2. Details of the modelled road networks for construction and operational assessments including the junction modification are provided in Appendix F3.

Sensitive human receptors

8.5.13 A desk-top study was undertaken to identify the sensitive receptors at and around the proposed development. Sensitive receptors include those residential properties/schools/hospitals that are likely to experience a change in pollutant concentrations due to the operation of the proposed development. Receptors were chosen at locations where they are likely to experience the greatest potential effect from construction and operation of the proposed development, as well as at locations in existing AQMAs.

8.5.14 There are three AQMAs located on the road network where the traffic data exceeded the EPUK/IAQM screening threshold set out in 8.5.9. Residential receptors at each of the AQMAs (Glasllwch AQMA, Newport - HighCross AQMA 2018 and Shaftesbury/Crindau AQMA) were assessed. All three AQMAs were designated due to exceedances of the annual mean NO_2 objective[24].

8.5.15 At the request of CC, receptors at the possible future location of the new office buildings in the proposed development have also been included and will be assessed against the relevant short-term air quality objectives as future sensitive receptors in the operational assessment.

8.5.16 The choice of the receptors has been agreed with CC (see Appendix A1).

Ecological receptors

8.5.17 The proposed development is located on the Gwent Levels (Rumney and Peterstone) SSSI, which has been included the assessment.

8.5.18 There are three other SSSIs (Fforestganol A Chwm Nofydd, Glamorgan Canal/Long Wood and Ely Valley) that are within 200m of the road network affected by the proposed development, where the change in traffic will be above the EPUK/IAQM screening threshold. These three SSSIs have also been included in the assessment.

8.5.19 A selection of other local nature reserves (LNRs) and ancient woodlands (AWs) within 200m of the road network affected by the proposed development have been

[24] Defra, UK AIR Air Information Resource, Air Quality Management Areas, Available at: https://uk-air.defra.gov.uk/aqma/

included in the assessment. These are considered as worst-case receptors based on their proximity to the proposed development, where changes in traffic will be the biggest.

8.5.20 Figure 8.3 and Figure 8.4 show the locations of the human and ecological receptors respectively included in the assessment and details including description and OS grid reference coordinates for all the receptors chosen are provided in Appendix F2.

Construction effects

Construction dust

8.5.21 Construction dust effects have been assessed using the qualitative approach described in IAQM guidance[10], which considers the potential for dust emissions from the following activities:

- Demolition;
- Earthworks (i.e. soil stripping, ground levelling, excavation and land);
- Construction; and
- Trackout (i.e. incidental movement of dust and dirt from the construction or demolition site onto the public road network).

8.5.22 For each of the above activities, the guidance considers three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and
- The risk of health effects due to a significant increase in PM_{10} exposure.

8.5.23 The methodology accounts for the scale at which the above effects are likely to be generated (classed as small, medium or large). The distance of the closest human and ecological receptors and background PM_{10} concentrations are taken into account in order to determine the sensitivity of the surrounding area. An overall risk factor is derived based on the sensitivity of the area, background concentrations and the likely magnitude of construction dust effects. Appropriate mitigation measures will be identified and proposed to reduce the risk to air quality during construction. These mitigation measures are outlined in Appendix F4. Further detail on the construction dust assessment methodology and assessment tables are included in Appendix F2. The assessment tables are also presented below for information.

Table 8.3: Dust emission magnitude

Dust emission magnitude		
Small	**Medium**	**Large**
Demolition		
• total building volume <20,000m^3; • construction material with low potential for dust release (e.g. metal cladding or timber);	• total building volume 20,000 – 50,000m^3; • potentially dusty construction material; and	• total building volume >50,000m^3; • potentially dusty construction material (e.g. concrete); • on-site crushing and screening; and

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

Table 8.4: Sensitivity of the area to dust soiling effects

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
	< 10	Medium	Low	Low	Low
Medium	> 1	Medium	Low	Low	Low
Low	> 1	Low	Low	Low	Low

Table 8.5: Sensitivity of the area to human health impacts

Background PM_{10} concentrations (annual mean)	**Number of receptors**	**Distance from the source (m)**				
		< 20	**< 50**	**< 100**	**< 200**	**< 350**
High receptor sensitivity						
> 32µg/m^3	> 100	High	High	High	Medium	Low
	10 – 100			Medium	Low	
	< 10		Medium	Low		
28 – 32µg/m^3	> 100	High	High	Medium	Low	Low
	10 – 100		Medium	Low		
	< 10					
24 – 28µg/m^3	> 100	High	Medium	Low	Low	Low
	10 – 100					
	< 10	Medium	Low			

Background PM_{10} concentrations (annual mean)	Number of receptors	Distance from the source (m)				
		< 20	< 50	< 100	< 200	< 350
High receptor sensitivity						
< 24µg/m^3	> 100	Medium	Low	Low	Low	Low
	10 – 100	Low				
	< 10					
Medium receptor sensitivity						
> 32µg/m^3	> 10	High	Medium	Low	Low	Low
	< 10	Medium	Low			
28 – 32µg/m^3	> 10	Medium	Low	Low	Low	Low
	< 10	Low				
24 – 28µg/m^3	> 10	Low	Low	Low	Low	Low
	< 10					
< 24µg/m^3	> 10	Low	Low	Low	Low	Low
	< 10					
Low receptor sensitivity						
–	> 1	Low	Low	Low	Low	Low

Table 8.6: Sensitivity of the area to ecological impacts

Receptor sensitivity	Distance from the source (m)	
	< 20	< 50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table 8.7: Risk of dust impacts

Sensitivity of area	Dust emission magnitude		
	Large	Medium	Small
Demolition			
High	High risk site	Medium risk site	Medium risk site
Medium	High risk site	Medium risk site	Low risk site
Low	Medium risk site	Low risk site	Negligible
Earthworks			
High	High risk site	Medium risk site	Low risk site
Medium	Medium risk site	Medium risk site	Low risk site
Low	Low risk site	Low risk site	Negligible
Construction			
High	High risk site	Medium risk site	Low risk site
Medium	Medium risk site	Medium risk site	Low risk site
Low	Low risk site	Low risk site	Negligible
Trackout			
High	High risk site	Medium risk site	Low risk site
Medium	Medium risk site	Low risk site	Negligible
Low	Low risk site	Low risk site	Negligible

Baseline traffic

8.5.24 The baseline scenario (2019 traffic data using 2019 emission factors and backgrounds) was used for dispersion model verification. The methodology of the model verification is detailed in Appendix F3 with baseline traffic data presented in Appendix F2.

Construction traffic

8.5.25 Construction traffic impacts could arise because of traffic changes on the local road network. A detailed construction traffic assessment was carried out using dispersion modelling. Further details on the construction traffic changes can be found in Chapter 4.

8.5.26 There are a number of existing and proposed accesses onto the proposed development site north of the railway line which could be utilised for site construction activities including surveys, clearance, import of materials, workforce travel and export of materials. A combination of locations are likely to be used during the construction programme, with these reflecting different access requirements, constraints, and phasing of activities. To provide flexibility two scenarios have been assessed for planning:

- Option 1: All construction traffic movements north of the railway line utilise the existing access north of the gas reduction station access via Heol Las on the eastern boundary of the site. As set out in Section 5.2 of the Transport Assessment (TA) prepared by Arup (HDL-ARP-EZ-XX-REP-EEN-000003), this would require land in the NCC administrative area and therefore delivery is subject to agreement with NCC and acquisition of relevant land interests; and
- Option 2: All construction traffic movements north of the railway line utilise the proposed secondary access at the Cypress Drive/Sandbrook Road roundabout on the western boundary of the site.

8.5.27 For both options there continues to be construction traffic movements associated with railway and station building works south of the railway line.

8.5.28 The assessment scenarios for each route option are as follows:

- Future Do-Minimum (DM) (2022 future baseline traffic data, using 2022 emission factors and backgrounds); and
- Future Do-Something (DS) (2022 future baseline traffic data plus construction traffic, using 2022 emission factors and backgrounds).

8.5.29 The assessment includes emissions from the traffic generated by other committed developments in the area in the future DM and DS scenarios. The list of

developments taken into account in this assessment are stated in the Cumulative Effects Chapter 16.

8.5.30 Dispersion modelling using CERC's ADMS Roads software has been carried out to determine the impact of the construction traffic on both human and ecological receptors. Detailed methodology and information about the setup for the dispersion model, including traffic data, road geometry, meteorological data and other parameters are given in Appendix F2.

Operational effects

8.5.31 Operational traffic impacts could arise because of traffic changes on the local road network. A detailed operational traffic assessment was carried out using dispersion modelling. Further details on the operational traffic changes can be found in Chapter 4.

8.5.32 The assessment scenarios are as follows:

- Future DM (2028 future baseline traffic data, using 2028 emission factors and backgrounds); and
- Future DS (2028 future baseline traffic data plus operational traffic, using 2028 emission factors and backgrounds).

8.5.33 The assessment includes emissions from the traffic generated by other committed developments in the area in the future DM and DS scenarios.

8.5.34 Traffic data was received on 28th April 2020, with a minor update on 10th June 2020. The update included changes to traffic flows on two modelled road links, Links 75 and 76. These link IDs represent the A4051 north and south of Junction 26 on the M4. The latest traffic data flows show a slight reduction in operational traffic in the 2028 DS scenario compared to the traffic data received on 28th April 2020.

8.5.35 The updated traffic data was used to rescreen the modelled roads with the criteria stated in 8.5.9. Based on the latest traffic data Link 75 is now screened out as the change in traffic on this link is now below the screening criteria.

8.5.36 Since there is a reduction in traffic on Links 75 and 76, the dispersion modelling based on the traffic data received on 28th April 2020 is more conservative. Therefore dispersion modelling has not been revised based on the updated traffic data.

8.5.37 The changes between the two sets of traffic data are summarised in Appendix F2 Table 7.

8.5.38 Dispersion modelling using CERC's ADMS Roads software has been carried out to determine the impact of the operational traffic on both human and ecological

receptors. Detailed methodology and information about the setup for the dispersion model are given in Appendix F2.

Cumulative effects

8.5.39 Cumulative effects have been considered throughout the air quality assessment. The traffic data provided includes the increase in traffic from committed developments in the local area. List of committed developments can be found in chapter 16 of this ES.

Sensitivity Tests

8.5.40 CC has requested sensitivity tests to be carried out by using the baseline year (2019) emission factors and background concentrations for the future predictions. This is a very conservative approach as there are expected to be improvements in both vehicle emissions and background pollutant concentrations as a result of local and national initiatives.

8.5.41 Results from the sensitivity tests are provided in Appendix F3. The results are provided for comparison purpose and not considered to be representative.

Assessment of significance

8.5.42 For the assessment of impacts and significance at sensitive human receptors, the approach described in the EPUK/IAQM guidance[11] has been used (Table 8.8). This is considered to be best practice for undertaking air quality assessments.

8.5.43 Impact descriptors are determined based on the magnitude of incremental change as a proportion of the relevant assessment level, in this instance the air quality standards. The change is then examined in relation to the predicted total pollutant concentrations in the assessment year and its relationship with the relevant air quality standard (Table 8.8).

Table 8.8: Impact descriptors from EPUK/IAQM guidance

Predicted concentration relative to air quality standard	% Change in concentrations relative to air quality standard			
	1%	2-5%	6-10%	> 10%
< 75%	Negligible	Negligible	Minor	Moderate
76-94%	Negligible	Minor	Moderate	Moderate
95-102%	Minor	Moderate	Moderate	Major
103-109%	Moderate	Moderate	Major	Major
> 110%	Moderate	Major	Major	Major
Changes of less than 0.5% are described as negligible. **Slight and substantial impacts from the EPUK/IAQM guidance have been called 'minor' and 'major' respectively for this assessment.**				

8.5.44 The impact descriptors at each of the assessed receptors have been used as a starting point to make a judgement on the overall significance of effect of the proposed development, however other influences have also been accounted for, such as:

- The existing future air quality in the absence of the proposed development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

8.5.45 In circumstances where the proposed development can be judged in isolation, the guidance suggests that a 'moderate' or 'major' impact is likely to give rise to a significant effect and a 'negligible' or 'minor' is not likely to result in a significant effect.

8.5.46 With regards to impact on ecological receptors, the IAQM guidance[12] recommends that concentrations of oxides of nitrogen (NOx) are used as the main basis for evaluating the potential for significant effects. An increase in annual mean NOx concentration of more than 0.4µg/m³ cannot be dismissed as imperceptible. If the increase is not imperceptible at an ecological site, and the NOx critical level (30µg/m³) is exceeded, then changes in nutrient nitrogen deposition should be calculated to assist the evaluation of significance.

8.6 Limitations and assumptions

8.6.1 The key limitations and assumptions were made in the air quality assessment, they are detailed below.

Limitations

8.6.2 Air quality dispersion modelling has inherent limitations and areas of uncertainty, as below:

- Traffic data used in the model;
- Traffic emissions data;
- Simplifications in model algorithms and empirical relationships that are used to simulate complex physical and chemical processes in the atmosphere;

- Background concentrations; and
- Meteorological data.

8.6.3 To reduce uncertainty, model verification has been carried out to determine the model accuracy compared with real world monitoring results. The methodology proposed for this assessment is designed to provide a robust assessment, reducing uncertainty caused by the above limitations.

8.6.4 Emissions from car parks and boilers have not been included in the assessment as there is currently insufficient detail available. This will be assessed when detailed design becomes available. This has been agreed with CC.

Assumptions

8.6.5 The following have been assumed in this assessment:

- Defra's LAQM TG(16)[9] states that the short-term hourly mean objective for NO_2 (which is 200µg/m^3 not to be exceeded more than 18 times a year) is only likely to be exceeded if the annual mean concentrations are greater than 60µg/m^3;
- The impacts of Part A and Part B industrial processes are assumed to be represented in the Defra background concentrations that were used in the assessment. Further details are provided in sections 8.7.2 to 8.7.5; and
- The speeds for the modelled road network were based on the designated speed limits; modelled road speeds were reduced to 20kph for all junctions and roundabouts (to represent congested conditions following the LAQM TG(16)[9] guidance).

8.7 Baseline environment

8.7.1 Baseline ambient air quality refers to the concentrations of pollutants of interest for this assessment (nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$)) that are already present in the atmosphere which are present from various sources such as industrial processes, commercial and domestic activities, agriculture, traffic and natural sources.

Industrial processes

8.7.2 Industrial air pollution sources are regulated through a system of operating permits or authorisations, requiring stringent emission limits to be met and ensuring that any releases to the environment are minimised or rendered harmless. Regulated (or prescribed) industrial processes are classified as Part A or Part B processes, regulated through the Pollution Prevention and Control (PPC) system[25,26]. The larger, more polluting processes are regulated by NRW and the smaller, less

[25] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
[26] The Environmental Permitting (England and Wales) (Amendment) Regulations 2013, SI 2013/390

polluting ones by the local authorities. Local authorities tend to regulate only for emissions to air, whereas NRW regulates emissions to air, water and land.

8.7.3 A review of the Annual Progress Reports for CC and NCC does not identify any planning applications for new installations within 2km of the proposed development.

8.7.4 A review of the industrial sites database under Environmental Permitting Regulation does not identify existing installations within 2km[27].

8.7.5 The impact of Part A and Part B processes is assumed to be included in the background monitoring and Defra background concentrations.

Road traffic

8.7.6 In recent decades, transport atmospheric emissions on a national basis have grown to match or exceed other sources in respect to many pollutants, particularly in urban areas. Vehicle emissions are likely to be the dominant source of air pollution in the study area. The main pollutants associated with road traffic are NO_2, PM_{10} and $PM_{2.5}$.

Local Authority air quality monitoring

8.7.7 CC and NCC undertake air quality monitoring using automatic monitors and passive diffusion tubes in their respective administrative regions. No automatic or diffusion tube monitoring sites are within 2km of the proposed development. The nearest CC air quality monitoring site is 4km west of the proposed development (St Teilos School) located along Circle Way East in Llanedeyrn and the nearest NCC air quality monitoring site is located on Forge Road A467 approximately 5.5km from the proposed development. The monitoring undertaken are not considered to be representative of air quality at the proposed development site due to the distance from the proposed development.

8.7.8 There are monitoring sites operated by CC and NCC along the road network affected by the proposed development. Monitoring data from these sites have been used in the model verification. The details for these diffusion tubes are shown in Appendix F2 and their locations are shown in Figure 8.5.

Scheme-specific diffusion tube monitoring

8.7.9 A scheme-specific monitoring programme was installed in order to fully understand the baseline air quality around the proposed development. CC has acknowledged that the data from the monitoring can be used for model verification.

8.7.10 NO_2 diffusion tubes (20% Triethanolamine (TEA) in water from the accredited laboratory Gradko) were used in this six-month monitoring programme, in accordance to best practice guidance provided in Defra's LAQM TG(16)[9]. The

[27] Natural Resources Wales. Environmental Permitting Regulations – Industrial Sites. Available at: http://lle.gov.wales/catalogue/item/EnvironmentalPermittingRegulationsIndustrialSites/?lang=en

diffusion tubes were deployed at eight locations in the study area and the programme was carried out between April and October 2019. Duplicate diffusion tubes were deployed at each monitoring location.

8.7.11 The diffusion tubes were at kerbside, roadside and urban background locations. The details of the diffusion tubes are shown in Table 8.9 and their locations are shown in Figure 8.6.

Table 8.9: Scheme-specific NO_2 diffusion tube monitoring sites

Site ID	Description	X	Y	Height (m)	Type
1	Heol Las	325172	181431	2.1	Roadside
2	Harrison Drive	324352	180507	2.1	Urban background
3	Cypress Drive (South)	324652	180888	2.2	Roadside
4	Cypress Drive (North)	324275	181766	2.2	Kerbside
5	Channel View	324880	183115	2.2	Kerbside
6	Newport Road/Park Store Ave	323353	181608	2.5	Roadside
7	Newport Road Schools	322526	180511	2.2	Roadside
8	Newport Road/The Walk	321418	179367	2.2	Roadside

8.7.12 The monitoring data at all locations was annualised following the standard method as recommended in LAQM TG(16)[9]. A national bias adjustment factor of 0.93, which was based on 20% TEA in water diffusion tubes from Gradko for 2019 using the latest Defra tool[28], has also been applied.

8.7.13 Table 8.10 presents the average monthly values (period mean) at each monitoring location, and the corresponding bias-adjusted and annualised NO_2 concentration. The measured NO_2 concentrations were below the annual mean NO_2 objective at all locations.

Table 8.10: Scheme-specific NO_2 diffusion tube monitoring results

Site ID	April 2019	May 2019	June 2019	July 2019	August 2019	September 2019	Bias-adjusted and annualised 2019 concentrations (µg/m^3)
1	14.0	8.6	11.2	11.0	9.6	12.0	14.6
2	12.4	11.5	10.5	10.1	11.5	12.8	15.1
3	13.6	10.4	12.3	11.4	12.0	13.2	16.0
4	23.6	18.1	21.3	20.8	19.6	21.5	27.5
5	32.9	26.4	29.3	28.3	30.3	29.4	38.9
6	27.4	23.4	24.7	25.3	24.5	26.0	33.3
7	0.0	16.7	16.0	16.5	14.3	17.8	21.5
8	29.1	20.2	23.4	20.2	17.3	23.4	29.4

[28] National Diffusion Tube Bias Adjustment Factor Spreadsheet Version 04/20. Available at: https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html [Accessed: May 2020]

Background air quality mapping

8.7.14 Defra publishes background pollutant mapping[29] for every 1km x 1km grid square across the UK. Background pollutant mapping has been reviewed for those grid squares in which the proposed development lies and is presented in Table 8.11. Predicted background pollutant concentrations at the proposed development in 2019 are well below the annual mean objectives of 40µg/m^3 for NO_2 and PM_{10}, and 25µg/m^3 for $PM_{2.5}$.

Table 8.11: Defra estimated background pollutant concentrations for the proposed development gird squares

OS Grid Square		2019 Concentrations (µg/m^3)			
X	**Y**	**NOx**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
324500	181500	13.9	19.4	13.1	8.7
325500	181500	12.9	17.8	12.6	8.1
325500	180500	10.9	14.7	11.0	7.4
324500	180500	13.1	18.1	12.1	8.1
Average		**12.7**	**17.5**	**12.2**	**8.1**

8.7.15 Defra's predicted concentrations can be compared with urban background monitoring carried out at Site 2 (Harrison Drive), located approximately 0.3km to the west of the proposed development. Table **8.12** presents the comparison of the Defra background NO_2 concentration grid square for this location against the monitored concentration at the urban background site.

Table 8.12: Comparison between 2019 annual mean monitored NO_2 and Defra background concentrations

Site	Defra predicted background concentration (µg/m^3)	Annualised average concentration* (µg/m^3)	Difference (µg/m^3)	Difference (%)
Harrison Drive	13.1	15.1	-2.1	-13.6%
*Bias adjusted				

8.7.16 The comparison in Table 8.12 shows that the Defra predicted background concentration is slightly lower than the monitored concentration. However, given the extent of the study area, there will be significant variation in background concentrations. Defra predicted background concentration has therefore been used in this assessment as it can provide the spatial variation required.

8.7.17 In order to avoid double counting, the contribution from motorways, trunk A road and primary A roads within each grid square, were removed from the total background concentrations of NOx, PM_{10} and $PM_{2.5}$ and NO_2, using the NO_2 Adjustment for NO_x Sector Removal Tool[30].

[29] Defra, Background Pollutant Mapping, Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017
[30] Defra sector removal tool Available at: https://laqm.Defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxsector (version 7.0 May 2019)

8.7.18 The background concentrations for NO_2, PM_{10} and $PM_{2.5}$ at each sensitive receptor for 2019, 2022 and 2028 are presented in Appendix F2.

8.8 Assumed construction practices

8.8.1 An outline construction environmental management plan (CEMP) has been prepared for the proposed development (Appendix A2). The mitigation measures include those for minimising the emissions of dust and particulate matter through the prevention or reducing at source.

8.8.2 The outcome of the assessment will feed into the CEMP to ensure that the CEMP includes all the necessary mitigation measures based on the risk of dust soiling, human health and ecological impact from the construction of the proposed development.

8.9 Embedded mitigation

8.9.1 The proposed development also seeks to improve sustainable transport infrastructure with the provision of a new railway station and modern bus stops. This proposed infrastructure will encourage a local and regional modal shift away from single occupancy car trips.

8.9.2 Crossings for pedestrians and cyclists on Cypress Drive and on roads within the proposed development will encourage active travel and reduce the increase in road traffic. The reduction in traffic because of this measure is already incorporated into the traffic data used in this assessment.

8.9.3 A junction improvement scheme will be delivered at the A48/Cypress Drive roundabout to improve the capacity of the junction. This will mitigate the potential for queueing of traffic which has higher emissions relative to free-flowing traffic. The nature, extent and mechanisms for the improvements to the junction will be agreed through the determination of the application.

8.9.4 In accordance with Planning Policy Wales 10, 10% of parking spaces will be designed for EV charging. Passive provision is proposed for the remaining 90% of car parking so they can be easily converted in response to market or regulatory demand.

8.9.5 Travel Plans are also proposed for the business district and railway station. A Travel Plan provides a developer with the opportunity to actively commit towards creating a development that encourages modal shift towards sustainable transport.

8.10 Assessment of effects

Model verification

8.10.1 Model verification was carried out by comparing the modelled output with the monitoring data from CC, NCC and the scheme-specific monitoring programme. All local monitoring within 200m of the road network was investigated and those deemed representative were chosen to be included in the model verification.

8.10.2 There was a clear difference in the model performance in the St. Mellons/Llanrumney area and that along the major A-roads and motorway.

8.10.3 Through comparison of the modelled output with the monitoring data, an adjustment factor of 1.780 has been applied to modelling outputs at receptors in the St. Mellons/Llanrumney area, as the model under-predicted the NO_2 concentration at the chosen verification sites in this area.

8.10.4 No adjustment factor has been applied to modelling outputs at receptors within 200m of the motorway and the major A roads as there was no systematic over-/underprediction between the local authority monitoring sites and the model.

8.10.5 Details of the verification sites used, and the performance of the model can be found in Appendix F3.

Assessment of effects from construction

Construction dust

8.10.6 The impact and effect of earthworks, construction and trackout from the construction phase have been considered. No demolition will take place at the site. The dust emission magnitude from the earthworks, construction and trackout have been derived as ‘large’ based on the type and level for each activity. The overall risk for each activity was determined by considering both the emissions magnitude and the sensitivity of the area to dust soiling, health and ecological impact. The overall risk of impact is high for dust soiling, low for human impacts and medium for ecological impacts. Table 8.13 provides the summary of dust risk prior to mitigation. Full details of the assessment can be found in Appendix F3.

Table 8.13: Summary dust risk table prior to mitigation

Activity	Dust soiling	Human health	Ecological
Earthworks	High risk	Low risk	Medium risk
Construction	High risk	Low risk	Medium risk
Trackout	High risk	Low risk	Low risk

Construction traffic

8.10.7 A summary for the assessment results for both route options of the construction traffic are provided below. The detailed results for each assessment can be found in Appendix F3.

Human receptors – Route option 1

8.10.8 The predicted NO_2 concentrations are below the annual mean air quality objective (40µg/m^3) at all receptor locations. The largest impact from the construction of the proposed development on existing sensitive receptors is an increase in concentration of 0.4µg/m^3 at receptor R22. This receptor is located along Cypress Drive by the roundabout with A48 and B4487 which is the main access road for both construction traffic route options. The annual mean NO_2 concentration at this receptor is predicted to be 21.5µg/m^3. The maximum concentration predicted during the construction phase of the proposed development is 33.7µg/m^3 at receptor R34 (Bassaleg Road/M4). Exceedance of the short term NO_2 objective is not predicted at any receptors as the annual mean concentration predicted is well below 60µg/m^3.

8.10.9 All receptor locations in the AQMAs are below the NO_2 annual mean air quality objective (40µg/m^3) with the construction of the proposed development using route option 1. The largest predicted concentration in an AQMA with construction is 33.7µg/m^3 at receptor R34 (Bassaleg Road/M4). Receptor R34 is located in the Glasllwch AQMA. All receptors in the AQMAs have an increase in concentration of <0.1µg/m^3 due to the construction of the proposed development using route option 1.

8.10.10 The predicted annual mean concentrations of PM_{10} during construction are predicted to be well below the annual mean air quality objective (40µg/m^3) at all receptors. The maximum change in PM_{10} concentration (0.1µg/m^3) due to the construction of the proposed development is predicted at receptors R7, R11, R17 and R22. Receptor R7 is located by the roundabout of Pentwyn Link Road and the A48, R11 is located by the southern slip road to the A48 and R17 is located by the roundabout with B4487 and A48. During construction the concentrations at these four receptors are predicted to be 15.2µg/m^3 (R7), 14.3µg/m^3(R11), 14.0µg/m^3 (R17) and 13.9µg/m^3(R22). No exceedance of the 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times a year) is predicted.

8.10.11 All receptor locations in the AQMAs are well below the PM_{10} annual mean air quality objective (40µg/m^3) with the construction of the proposed development using route option 1. The largest predicted concentration in an AQMA with construction is 16.0µg/m^3 at receptors R33 and R34 (Bassaleg Road/M4). Receptors R33 and R34 are located in the Glasllwch AQMA. All receptors in the AQMAs have an increase in concentration of <0.1µg/m^3 due to the construction of the proposed development using route option 1.

8.10.12 The annual mean concentrations of $PM_{2.5}$ predicted at each receptor during construction is well below the annual mean air quality objective (25µg/m^3). The maximum increase in $PM_{2.5}$ concentration (0.1µg/m^3) is predicted at receptor R25. Receptor R25 lies on the western boundary of the proposed development. The $PM_{2.5}$ concentration predicted in the construction phase in 2022 is 8.7µg/m^3 for receptor R25.

8.10.13 All receptor locations in the AQMAs are well below the $PM_{2.5}$ annual mean air quality objective (25µg/m^3) with the construction of the proposed development using route option 1. The largest predicted concentration in an AQMA with construction is 10.3µg/m^3 at receptors R33 and R34 (Bassaleg Road/M4). Receptors R33 and R34 are located in the Glasllwch AQMA. All receptors in the AQMAs have an increase in concentration of <0.1µg/m^3 due to the construction of the proposed development using route option 1.

8.10.14 The magnitude of change to annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all receptors, in 2022, as a result of the construction of the proposed development using route option 1 are predicted to be negligible. The overall effect on human receptors for this scenario is considered to be not significant.

Ecological receptors – Route option 1

8.10.15 The critical level is predicted to be exceeded in both DM and DS scenarios using route option 1 at a number of ecological receptors. These receptors included locations at the Glamorganshire Canal LNR (E1_A, E1_B), Howardian LNR (E4_A), ancient woodland along the A48(M) (E5_A, E6_A), Allt-Yr-Yn LNR (E9_12) and Ely Valley SSSI (E12_A, E12_B, E13_A, E13_B). However, the change in ambient annual mean NOx concentration is less than 0.4µg/m^3.

8.10.16 The largest impact from the construction of the proposed development on existing ecological receptors is an increase in concentration of 1.1µg/m^3 at two roadside locations in the Gwent Levels – Rumney and Peterstone SSSI (E7_A, E8_A). During the construction phase of the proposed development using route option 1 these receptors have predicted annual mean NOx concentrations of 20.7µg/m^3 and 15.5µg/m^3 respectively. Even though the increase is greater than 0.4µg/m^3 the DS concentrations are well below the annual mean air quality NOx objective (30µg/m^3). As a result, a detailed assessment in terms of nutrient nitrogen and acid deposition is not considered necessary and the impact predicted on ecological receptors is considered to be insignificant.

Human receptors – Route option 2

8.10.17 The predicted NO_2 concentrations are below the annual mean air quality objective (40µg/m^3) at all receptor locations. The largest impact from the construction of the proposed development using route option 2 on existing sensitive receptors is an increase in concentration of 0.7µg/m^3 at receptor R25. This receptor is located along Cypress Drive south of the junction with Fortran Road which is the main access road for the construction traffic. The annual mean NO_2 concentration at this receptor is predicted to be 16.7µg/m^3. The maximum concentration predicted

during the construction phase of the proposed development using route option 2 is 33.7µg/m^3 at receptor R34 (Bassaleg Road/M4). Exceedance of the short term NO_2 objective is not predicted at any receptors as the annual mean concentration predicted is well below 60µg/m^3.

8.10.18 All receptor locations in the AQMAs are below the NO_2 annual mean air quality objective (40µg/m^3) with the construction of the proposed development using route option 2. The largest predicted concentration in an AQMA with construction is 33.7µg/m^3 at receptor R34 (Bassaleg Road/M4). Receptor R34 is located in the Glasllwch AQMA. All receptors in the AQMAs have an increase in concentration of <0.1µg/m^3 due to the construction of the proposed development using route option 2.

8.10.19 The predicted annual mean concentrations of PM_{10} during construction are predicted to be well below the annual mean air quality objective (40µg/m^3) at all receptors. The maximum change in PM_{10} concentration (0.1µg/m^3) due to the construction of the proposed development is predicted at receptors R7, R11, R17 and R22. During construction the concentrations at these receptors are predicted to be 15.2µg/m^3 (R7), 14.3µg/m^3(R11), 14.0µg/m^3 (R17) and 13.9µg/m^3(R22). No exceedance for the 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times a year) is predicted.

8.10.20 All receptor locations in the AQMAs are well below the PM_{10} annual mean air quality objective (40µg/m^3) with the construction of the proposed development using route option 2. The largest predicted concentration in an AQMA with construction is 16.0µg/m^3 at receptors R33 and R34 (Bassaleg Road/M4). Receptors R33 and R34 are located in the Glasllwch AQMA. All receptors in the AQMAs have an increase in concentration of <0.1µg/m^3 due to the construction of the proposed development using route option 2.

8.10.21 The annual mean concentrations of $PM_{2.5}$ predicted at each receptor during construction is well below the annual mean air quality objective (25µg/m^3). The maximum increase in $PM_{2.5}$ concentration (0.1µg/m^3) is predicted at receptor R25. The $PM_{2.5}$ concentration predicted in the construction phase using router option 2 in 2022 is 8.7µg/m^3.

8.10.22 All receptor locations in the AQMAs are well below the $PM_{2.5}$ annual mean air quality objective (25µg/m^3) with the construction of the proposed development using route option 2. The largest predicted concentration in an AQMA with construction is 10.3µg/m^3 at receptors R33 and R34 (Bassaleg Road/M4). Receptors R33 and R34 are located in the Glasllwch AQMA. All receptors in the AQMAs have an increase in concentration of <0.1µg/m^3 due to the construction of the proposed development using route option 2.

8.10.23 The magnitude of change to annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all receptors, in 2022, as a result of the construction of the proposed development

using route option 2 are predicted to be negligible. The overall effect on human receptors for this scenario is considered to be not significant..

Ecological receptors – Route option 2

8.10.24 The critical level is predicted to be exceeded in both DM and DS scenarios using route option 2 at a number of ecological receptors. These receptors included locations at the Glamorganshire Canal LNR (E1_A, E1_B), Howardian LNR (E4_A), ancient woodland along the A48(M) (E5_A, E6_A), Allt-Yr-Yn LNR (E9_12) and Ely Valley SSSI (E12_A, E12_B, E13_A, E13_B). However, the change in ambient annual mean NOx concentration is less than 0.4µg/m^3.

8.10.25 The largest impact from the construction of the proposed development on existing ecological receptors is an increase in concentration of 1.2µg/m^3 at one of the roadside locations in the Gwent Levels – Rumney and Peterstone SSSI (E10_A). During the construction phase of the proposed development this receptor has a predicted annual mean NOx concentration of 20.7µg/m^3. Even though the increase is greater than 0.4µg/m^3 the DS concentration is below the annual mean air quality NOx objective (30µg/m^3). As a result, a detailed assessment in terms of nutrient nitrogen and acid deposition is not considered necessary and the impact predicted on ecological receptors is considered to be insignificant.

Assessment of effects from operation

Operational traffic

8.10.26 A summary for the assessment results for operational traffic are provided below. The detailed results for each assessment can be found in Appendix F3.

Human receptors

8.10.27 The predicted NO_2 concentrations are below the annual mean air quality objective (40µg/m^3) at all receptor locations. The largest impact from the operation of the proposed development on existing sensitive receptors is an increase in concentration of 1.8µg/m^3 at receptor R18. This receptor is located along Cypress Drive and with the operation of the proposed development has a predicted concentration of 18.2µg/m^3. The maximum concentration predicted in the operational phase of the proposed development is 23.8µg/m^3 at receptor R34 (Bassaleg Road). Due to the junction improvement work at the A48/B4487/Cypress Drive roundabout, there is a reduction in concentration of 2.3µg/m^3 from 19.0µg/m^3 to 16.7 µg/m^3 at receptor R17. Exceedance of the short term NO_2 objective is not predicted at any receptors.

8.10.28 All receptor locations in the AQMAs are below the NO_2 annual mean air quality objective (40µg/m^3) with the operation of the proposed development. The largest predicted concentration in an AQMA with operation is 23.8µg/m^3 at receptor R34 (Bassaleg Road/M4). Receptor R34 is located in the Glasllwch AQMA. The maximum increase in concentration due to the operation of the proposed development is predicted at receptor R38 with a change of 0.2µg/m^3 from

17.0µg/m^3 to 17.2µg/m^3. Receptor R38 is located on Pant Road in the Shaftesbury/Crindau AQMA.

8.10.29 The predicted annual mean concentrations of PM_{10} during operation are predicted to be well below the annual mean air quality objective (40µg/m^3) at all receptors. The maximum increase in PM_{10} concentration (0.4µg/m^3) during operation is predicted at receptor R22. During operation the concentration at this receptor is predicted to be 13.9µg/m^3. As before, due to the junction introduction, receptor R17 predicts a reduction in concentration of 0.4µg/m^3 from 13.6µg/m^3 to 13.2µg/m^3. No exceedance for the 24-hour mean objective is predicted.

8.10.30 All receptor locations in the AQMAs are well below the PM_{10} annual mean air quality objective (40µg/m^3) with the operation of the proposed development. The largest predicted concentration in an AQMA with operation is 15.7µg/m^3 at receptors R33 and R34 (Bassaleg Road/M4). Receptors R33 and R34 are located in the Glasllwch AQMA. All receptors in the AQMAs have an increase in concentration of <0.1µg/m^3 due to the operation of the proposed development.

8.10.31 The annual mean concentrations of $PM_{2.5}$ predicted at each receptor during operation is well below the annual mean air quality objective (25µg/m^3). The maximum increase in $PM_{2.5}$ concentration (0.2µg/m^3) is predicted at receptors R22 and R25. Concentrations predicted in the operational phase in 2028 are 8.9µg/m^3.and 8.5µg/m^3 respectively. A reduction in concentration of 0.2µg/m^3 is predicted at Receptor R17 from 9.1µg/m^3 to 8.9µg/m^3.

8.10.32 All receptor locations in the AQMAs are well below the $PM_{2.5}$ annual mean air quality objective (25µg/m^3) with the operation of the proposed development. The largest predicted concentration in an AQMA with operation is 10.1µg/m^3 at R34 (Bassaleg Road/M4). Receptor R34 is located in the Glasllwch AQMA. All receptors in the AQMAs have an increase in concentration of 0.1µg/m^3 or less due to the operation of the proposed development.

8.10.33 The magnitude of change to annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all receptors, in 2028, as a result of the operation of the proposed development are predicted to be negligible at all receptors except at R17 where the impact is predicted to be minor beneficial due to the junction improvement moving the road further away from the receptor. The overall effect on human receptors for this scenario is considered to be not significant.

Ecological receptors

8.10.34 The critical level is predicted to be exceeded in both DM and DS scenarios at a number of ecological receptors. These receptors included locations at the Glamorganshire Canal LNR (E1_B), ancient woodland along the A48(M) (E5_A, E6_A), Allt-Yr-Yn LNR (E9_12) and Ely Valley SSSI (E13_A). However, the change in ambient annual mean NOx concentration is less than 0.4µg/m^3 at the

majority of these receptors, with the only exception at the ancient woodland (AW) along the A48(M) (E5_A and E6_A).

8.10.35 Transects at 5m spacing were modelled at both the east and west AW sites along the A48. For the site to the west (E5) the critical level is above 30µg/m^3 with a change in ambient annual mean NOx concentration greater than 0.4µg/m^3 due to the operation of the proposed development up to 15m from the roadside. The transect point at 15m from the roadside predicted a DS concentration of 28.1µg/m^3 with a change of 0.7µg/m^3 due to the operation of the proposed development. These exceedances of the critical level (up to 15m) are predicted in both the DM and DS scenario. Therefore, no new areas of exceedance will be created from the operation of the proposed development. The area affected abuts the road and accounts for approximately 15% of the whole AW area.

8.10.36 For the site to the east (E6) the critical level is above 30µg/m^3 with a change in ambient annual mean NOx concentration greater than 0.4µg/m^3 due to the operation of the proposed development up to 10m from the roadside. The transect point at 10m from the roadside predicted a DS concentration of 29.8µg/m^3 with a change of 0.8µg/m^3 due to the operation of the proposed development. These exceedances of the critical level (up to 10m) are predicted in both the DM and DS scenario. Therefore, no new areas of exceedance will be created from the operation of the proposed development. The area affected abuts the road and accounts for approximately 11% of the whole AW area.

8.10.37 There is no relevant critical load information available. Therefore, it is not possible to carry out a further detailed assessment in terms of nutrient nitrogen and acid deposition at the AW site.

8.10.38 Taking into account the small percentage area of the AW sites that would be affected and that no new areas of exceedance being created by the operation of the proposed development, it has been agreed with the project's ecologist that the overall effect on the AW is considered to be not significant.

Sensitivity tests of construction and operational phases

8.10.39 Summary of the findings from the sensitivity tests are provided below. Details of the results for these tests for construction and operational traffic assessments can be found in Appendix F3.

8.10.40 The use of 2019 emission factors and background concentrations for the future prediction of 2022 construction and 2028 operational traffic impacts is considered to be conservative, as there is likely to be improvement in vehicle emissions and background pollutant concentrations as a result of local and national initiatives in future years. The results for the sensitivity test are considered to be not

representative but the test was requested by CC, they are presented for information only.

8.10.41 The pollutant concentrations were predicted to be higher due to the higher emission factors and background concentrations used.

Human receptors – construction traffic route option 1

8.10.42 The predicted NO_2 concentrations are below the annual mean air quality objective (40µg/m^3) at all receptor locations except at R33 and R34 in the Glasllwch AQMA along the M4 (41.2µg/m^3 and 41.4µg/m^3 in the DS scenario respectively). The concentrations are predicted to increase by <0.1µg/m^3 at both receptors.

8.10.43 All other receptor locations in the AQMAs are well below the annual mean objectives for NO_2, PM_{10} and $PM_{2.5}$. All locations in the AQMAs (including R33 and R34) predicted a change in concentrations due to the construction of the proposed development using route option 1 <0.1µg/m^3.

8.10.44 The magnitude of change to annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all receptors, in the sensitivity test of the construction route option 1 of the proposed development are predicted to be negligible. The overall effect on human receptors for this scenario is considered to be not significant.

Ecological receptors – construction traffic route option 1

8.10.45 The critical level is predicted to be exceeded and the change in ambient annual mean NOx concentration is predicted to be more than 0.4µg/m^3 at the ancient woodland along the A48(M) using route option 1. The exceedance of both criteria is predicted up to 10m on the west AW (E5) and up to 5m on the east AW (E6).

8.10.46 The critical level is predicted to be exceeded without the proposed development. No new areas of exceedance will be created from the construction of the proposed development using route option 1. The area affected abuts the road and accounts for 12% (west) and 4% (east) of the whole AW area.

8.10.47 Taking into account the small percentage area of the AW sites that would be affected and that no new areas of exceedance being created during the construction of the proposed development, it has been agreed with the project's ecologist that the overall effect on the AW is considered to be not significant

Human receptors – construction traffic route option 2

8.10.48 The predicted NO_2 concentrations are below the annual mean air quality objective (40µg/m^3) at all receptor locations except at R33 and R34 in the Glasllwch AQMA along the M4 (41.2µg/m^3 and 41.4µg/m^3 in the DS scenario respectively). The concentrations are predicted to increase by <0.1µg/m^3 at both receptors.

8.10.49 All other receptor locations in the AQMAs are well below the annual mean objectives for NO_2, PM_{10} and $PM_{2.5}$. All locations in the AQMAs (including R33

and R34) predicted a change in concentrations due to the construction of the proposed development using route option 2 <0.1µg/m^3.

8.10.50 The magnitude of change to annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all receptors, in the sensitivity test of the construction route option 2 of the proposed development are predicted to be negligible. The overall effect on human receptors for this scenario is considered to be not significant.

Ecological receptors – construction traffic route option 2

8.10.51 The critical level is predicted to be exceeded and the change in ambient annual mean NOx concentration is predicted to be more than 0.4µg/m^3 at the ancient woodland along the A48(M) using route option 2. The exceedance of both criteria is predicted up to 10m on the west AW (E5) and up to 5m on the east AW (E6).

8.10.52 The critical level is predicted to be exceeded without the proposed development. No new areas of exceedance will be created from the construction of the proposed development using route option 2. The area affected abuts the road and accounts for 12% (west) and 4% (east) of the whole AW area.

8.10.53 Taking into account the small percentage area of the AW sites that would be affected and that no new areas of exceedance being created during the construction of the proposed development, it has been agreed with the project's ecologist that the overall effect on the AW is considered to be not significant

Human receptors – operational traffic

8.10.54 The predicted NO_2 concentrations are below the annual mean air quality objective (40µg/m^3) at all receptor locations except receptors R33 and R34 in the Glasllwch AQMA along the M4. No new exceedances of the annual mean air quality objective are expected during operation.

8.10.55 All other receptor locations in the AQMAs are well below the annual mean objectives for NO_2, PM_{10} and $PM_{2.5}$. The largest change in concentration in an AQMA is 0.3µg/m^3 at receptor R38 on Pant Road in the Shaftesbury/Crindau AQMA. The predicted concentration at this receptor with the operation of the proposed development is 30.2 µg/m^3. All locations in the AQMAs (including R33 and R34) predicted a change in PM_{10} and $PM_{2.5}$ concentration due to the opertaion of the proposed development of 0.1µg/m^3 or less.

8.10.56 Moderate adverse impact is predicted at receptor R18 due to the bigger magnitude of change and higher concentrations in both DM and DS scenarios.

8.10.57 It should be noted that the predictions made in this scenario are conservative and the adverse impact predicted is not considered to be representative. The use of 2019 emission factors and background concentrations for the 2028 operational phase are unrealistic as the vehicle emissions are expected to improve in the future due to local and national policies, especially over a period of nine years. No new exceedance of the air quality objective is also created. As a result, the overall

effect on human receptors from the operation of the proposed development is considered to be not significant.

Ecological receptors – operational traffic

8.10.58 The critical level is predicted to be exceeded and the change in ambient annual mean NOx concentration is predicted to be more than 0.4µg/m3 at the ancient woodland along the A48(M), Allt-Yr-Yn LNR and at the Gwent Levels - Rumney and Peterstone SSSI. The exceedance of both criteria is predicted for all points of the transects for the AW and LNR sites. The critical level is predicted to be exceeded without the proposed development at the AW and LNR sites. Therefore, no new areas of exceedance will be created from the operation of the proposed development.

8.10.59 The critical level at Gwent Levels - Rumney and Peterstone SSSI is above 30µg/m^3 with a change in ambient annual mean NOx concentration greater than 0.4µg/m^3 due to the operation of the proposed development up to 10m from the roadside. The transect point at 10m from the roadside predicted a DS concentration of 27.3µg/m^3 with a change of 4.2µg/m^3 due to the operation of the proposed development. The area affected abuts the site access road and accounts for 0.1% of the whole SSSI area.

8.10.60 It has been agreed with the project's ecologist that the overall effect on the ecological sites is considered to be not significant

8.11 Mitigation and enhancement

Mitigation of effects from construction

8.11.1 Mitigation measures for construction dust risk will follow the recommendations from the IAQM guidance[10]. The appropriate measures, based on the risk determined, are detailed in Appendix F4. These measures have been incorporated in the CEMP and will form part of the planning condition.

8.11.2 No mitigation measures are required for the construction traffic.

Mitigation of effects from operation

8.11.3 No mitigation measures are required for the operational traffic.

8.11.4 With regards to the proposed boilers, they should meet a NOx emission rate of a maximum of 40mg/kWh. The design for the future buildings should ensure that

the flue stacks for the boilers are located at the roof of the buildings away from ventilation inlets. The measures will form part of the planning condition.

8.11.5 Ventilation inlets for the proposed buildings should be avoided at low level (i.e. near ground level where car parking will be provided).

8.12 Residual effects

Residual effects from construction

8.12.1 Without any appropriate mitigation in place, there is expected to be a high risk for dust soiling, low risk for human health and medium risk for ecological. However mitigation measures have been identified based on the risks derived. According to the IAQM guidance[10], with the effective implementation of these appropriate mitigation measures for construction dust, the residual effect from the construction activities is considered to be ‘not significant’.

Residual effects from operation

8.12.2 No significant adverse impact is predicted based on the operational traffic assessment carried out and hence no mitigation measures are required for this particular element.

8.12.3 Other non-traffic related design mitigation measures are recommended, as detailed in 8.11.4 and 8.11.5 above. On the assumption that these measures are committed and applied appropriate, no significant residual effect is predicted.

8.13 Assessment summary matrix

Potential Effect	**Receptor (s)**	**Sensitivity of Receptor**	**Magnitude (prior to mitigation)**	**Significance (prior to mitigation)**	**Mitigation**	**Magnitude (following mitigation)**	**Significance (following mitigation)**
Effect from construction activities on human and ecological receptors	Existing human receptors along the perimeter of the proposed development site. Ecological site (Gwent Levels - Rumney and Peterstone SSSI) at the proposed development site.	High for human receptors Medium for ecological receptor	High risk for dust soiling Low risk for human health Medium risk for ecological	N/A[31]	Mitigation measures for general site management, as well as specific measures for construction, earthwork and trackout, are identified. These are detailed in Appendix F4.	N/A	Not significant
Construction traffic	Existing human and ecological receptors along the roads used by the construction vehicles for the proposed development.	Sensitive to changes in ambient pollutant concentrations	Negligible impact	Not significant	None required	Negligible impact	Not significant
Operational traffic	Existing human and ecological receptors along the roads used by the operational vehicles for the proposed development.	Sensitive to changes in ambient pollutant concentrations	Minor beneficial to negligible impact	Not significant	None required	Negligible impact	Not significant

[31] Air quality guidance, Institute of air quality management, Construction Dust, 2014, p.28, Section 9, 3rd paragraph) recommends that "*that significance is only assigned to the effect after considering the construction activity with mitigation.*" Therefore, no level of significance is given prior to mitigation.