14 AIR QUALITY

14 AIR QUALITY

14.1 Introduction

14.1.1 This chapter presents the Air Quality Impact Assessment and sets out the baseline conditions including an assessment of local air quality, background pollutant concentrations and meteorology.

Summary of 2012 Environmental Statement Chapter

14.1.2 The construction of the approved scheme will involve the following activities relevant to the assessment of air quality impacts:

- excavation and removal of slate to storage areas on the site using heavy machinery;
- mixing and handling concrete and grout;
- rock blasting, crushing and screening;
- excavating and boring tunnels and trenches; and
- HGV (Heavy Goods Vehicle)and other vehicle movements within the site and on local roads.

14.1.3 Potential effects are predominantly associated with the construction phase by the generation and dispersal of dust and airborne particulate matter, emissions from plant on site and emissions from construction traffic.

14.1.4 General mitigation measures were recommended to be used in conjunction with activity-specific measures. The likely residual effects are considered to be minor adverse for both human and ecological exposure and the overall air quality effects will be not significant.

14.1.5 The approved scheme would produce negligible emissions to air during operation and decommissioning.

Scope of 2015 Environmental Statement Chapter

14.1.6 The local air quality effects and dust-generating potential of the Development is not considered to have changed since the assessment was originally completed in 2012. However, the assessment procedures, significance criteria and mitigation control recommendations have been updated in accordance with recent guidance and this is outlined in Section 14.2.

14.1.7 Two of the core guidance documents for this chapter have been updated to incorporate the current understanding of the potential air quality impacts due to construction activity, outline a revised assessment procedure and significance criteria, and to recommend appropriate mitigation measures:

- Institute of Air Quality Management (IAQM), Guidance on the assessment of dust from demolition and construction, January 2014. This replaces the earlier 2012 guidance; and
- Greater London Authority (GLA), The Control of Dust and Emissions during Construction and Demolition, supplementary planning guidance, July 2014. This guidance is generally intended for use in densely populated urban areas (such as London), and so whilst there is no obligation to follow this guidance it is generally considered to represent best-practice for other circumstances. This guidance replaces The Control of Dust and Emission from Demolition and Construction Best Practice Guidance published jointly by London Council's and the Mayor in 2006.

14.1.8 In addition, the presentation and discussion of Local Air Quality Management (LAQM) reporting and ambient air quality monitoring undertaken by Gwynedd Council has been updated to incorporate recent changes.

14.2 Scope of Assessment

14.2.1 Further to the submission of the Scoping Report (in Volume 3, Appendix 2.1), the Senior Development Management Officer at Gwynedd Council specifically requested that air quality be a consideration of the ES and it

should identify potential receptors that may be vulnerable to the effects of construction dust, and to identify measures that may be implemented to control and minimise effects.

14.2.2 A qualitative assessment was conducted to determine the potential dust effects during the construction phase in accordance with the Minerals PPW, TAN1 (Aggregates) (WAG, 2004), and with reference to the methodology set out by the Institute of Air Quality Management (IAQM, 2014) 'Guidance on the assessment of dust from demolition and construction' and Greater London Authority (GLA), The Control of Dust and Emissions during Construction and Demolition, supplementary planning guidance, July 2014. This methodology was followed to determine the risk and significance of the potential effects, and to help determine suitable mitigation measures to control the risk of dust effects to within acceptable levels.

14.2.3 The potential effect due to road vehicle emissions during the construction phase was assessed with reference to the methodology and assessment criteria defined in the Design Manual for Roads and Bridges (DMRB) (HA, 2007). Further details on traffic and transport can be found in Chapter 12 Traffic and Transport.

14.2.4 The Development will produce negligible emissions to air during the operational phase and, therefore, this is not considered further.

14.2.5 Decommissioning of the Development will involve draining of the reservoirs to Llyn Padarn and removal of above ground structures. The penstock, tailrace and spillways will remain with the exception of the Q6 spillway and pumping station. It is therefore unlikely that any significant emissions will be created and so this is not considered further in this assessment.

14.3 Legislation and Policy Framework

National Planning Statement

14.3.1 The overarching National Policy Statement for Energy (EN-1) identifies traffic emissions, air pollution, dust and odour as issues for human health that need to be taken into account in the assessment of any proposed

developments, along with the effects of nuisance on sensitive receptors. In terms of air quality EN-1 states in Paragraph 5.2.7 "*the ES should describe:*

- *Any significant air emissions, their mitigation and any residual effects distinguishing between the project stages and taking account of any significant emissions from any road traffic generated by the project;*
- *The predicted absolute emission levels of the proposed project, after mitigation methods have been applied;*
- *Existing air quality levels and the relative change in air quality from existing levels; and*
- *The risk and impact of potential pollution from the proposed development insofar as this might have an effect on the use of other land and the surrounding environment (the environmental regulatory regime may well have an interest in these issues, particularly if the proposed development would impact on an Air Quality Management Area or a SAC).*
- *Any potential eutrophication impact."*

National Planning Policy

Minerals Technical Advice Note 1 (Aggregates) and the Minerals Planning Policy Wales

14.3.2 The Minerals Technical Advice Note (MTAN) (WAG, 2004) defines the mechanisms for delivery of policies that are set out in the Minerals PPW (WAG, 2001). Whilst the Development is not proposed to be a minerals extraction site, the MTAN provides a framework for this assessment due to the similarity of the issues associated with the types of activities that will occur during the construction phase. Specifically, as stated in the MTAN, it has been noted by COMEAP (Committee on Medical Effects of Air Pollution, 1988) that increased particle concentrations close to opencast sites are associated with earthmoving and excavation, which are both activities that will take place during the construction phase.

14.3.3 In addition to the potential health and nuisance effects of dust from minerals workings, the Minerals Policy Statement (ODPM, 2005) considers the public

perception of dust arising, such as the colour of the deposited material, or deposition in areas that are usually noticeably clean.

Chapter Specific Legislation

National Air Quality Legislation

14.3.4 The provisions of Part IV of the Environment Act 1995 establish a national framework for air quality management, which requires all Local Authorities in England, Scotland and Wales to conduct local air quality reviews. Section 82(1) of the Act requires these reviews to include an assessment of the current air quality in the area and the predicted air quality in future years. Should the reviews indicate that the objectives prescribed in the UK Air Quality Strategy (Defra, 2007) and the Air Quality Standards (Wales) Regulations 2010 (Defra, 2010) (henceforth referred to as the "Air Quality Regulations") will not be met, the Local Authority is required to designate an Air Quality Management Area (AQMA). Action must then be taken at a local level to ensure that air quality in the area improves.

UK Air Quality Strategy

14.3.5 The UK Air Quality Strategy (AQS) (Defra, 2007) identifies nine ambient air pollutants that have the potential to cause harm to human health. These pollutants are associated with local air quality problems, with the exception of ozone, which is instead considered to be a regional problem. The Air Quality Regulations set objectives for the seven pollutants that are associated with local air quality. These objectives aim to reduce the health effects of the pollutants to negligible levels.

Air Quality Objectives and Limit Values

14.3.6 The air quality objectives and limit values currently applicable to the UK can therefore be split into two groups. Each has a different legal status and is therefore handled differently within the framework of UK air quality policy. These are:

- UK air quality objectives set down in regulations for the purposes of local air quality management; and,

- European Union (EU) limits values transcribed into UK legislation for which compliance is mandatory.

Local Air Quality Pollutants of Concern

Fine Particulate Matter

14.3.7 This assessment considers the annual mean and daily mean air quality objectives, as specified in the Air Quality Regulations.

14.3.8 Particulate matter is composed of a wide range of materials arising from a variety of sources, and is typically assessed as total suspended particulates or as a mass size fraction. National objectives and European limit values already apply for the PM_{10} fraction, and objectives and 2015 limit values also now apply for $PM_{2.5}$ These express particulate levels as the total mass size fraction at or below an aerodynamic diameter of 10 and 2.5µm respectively.

14.3.9 Two objectives have been adopted for PM_{10}, which were to be achieved by the end of 2004:

- An annual mean concentration of 40µg/m^3 (gravimetric); and
- A 24-hour mean concentration of 50µg/m^3 (gravimetric) to be exceeded no more than 35 times per year.

14.3.10 One objective has been adopted for $PM_{2.5}$ in England and Wales:

- An annual mean concentration of 25µg/m^3 (gravimetric) to be met by 2015.

14.3.11 Both short-term and long-term exposure to ambient levels of particulate matter is consistently associated with respiratory and cardiovascular illness and mortality as well as other ill-health effects. Particles of less than 10µm in diameter have the greatest likelihood of reaching the thoracic region of the respiratory tract and so are more likely to cause health problems.

14.3.12 It is not currently possible to discern a threshold concentration below which there are no effects on the whole population's health. Recent reviews by the World Health Organisation (WHO) and the Committee on the Medical Effects of Air Pollutants (COMEAP, 1998) have suggested exposure to a

finer fraction of particles ($PM_{2.5}$, which typically make up around two thirds of PM_{10} emissions and concentrations, give a stronger association with the observed ill health effects, although this depends on the type of activity. E.g. rock / slate crushing may be expected to have a larger coarse component). There is evidence that the coarse fraction (between PM_{10} – $PM_{2.5}$) also has some effects on health.

Dust

14.3.13 Dust is defined as all particulate matter up to 75µm in diameter and comprising both suspended and deposited dust, whereas PM_{10} is a mass fraction of airborne particles of diameter of 10µm or less. The health effects associated with dust include eye, nose and throat irritation in addition to the nuisance caused by deposition on cars, windows and property. This may be a specific concern due to slate dust arising, as the sharp edges associated with this material will have specific potential health risks associated with any material inhaled deep into the lungs.

14.3.14 The colour of slate rock in North Wales has specific characteristics, that change with weathering and washing by rainfall. Where new rock is exposed, or dust is released and deposited, it may cause a distinct visual difference to the surroundings.

14.3.15 Dust and PM_{10} emissions arise from a number of sources, so construction activities and emissions from vehicles associated with development should be considered, such as excavation, building or vehicle movements.

Nitrogen Dioxide

14.3.16 The Government and the Devolved Administrations adopted two Air Quality Objectives for Nitrogen Dioxide (NO_2) to be achieved by the end of 2005. Since 2010, mandatory EU air quality limit values for NO_2 have applied in the UK. The EU limit values for NO_2 are the same as the national objectives for 2005:

- An annual mean concentration of 40µg/m^3; and
- An hourly mean concentration of 200µg/m^3, to be exceeded no more than 18 times per year.

14.3.17 NO_2 and Nitric Oxide (NO) are both oxides of nitrogen, and are collectively referred to as NO_X. All combustion processes produce NO_X emissions, largely in the form of NO, which is then converted to NO_2, mainly as a result of its reaction with ozone in the atmosphere. Therefore the ratio of NO_2 to NO is primarily dependent on the concentration of ozone and the distance from the emission source.

14.4 Consultation

14.4.1 The Environmental Health Officer (EHO) at Gwynedd Council Public Protection Department was consulted regarding the Development by telephone on Tuesday 6th March 2012. Further consultation was also undertaken with David A Williams, Environment Officer at Gwynedd County Council by phone and email on Friday 13th April 2012.

14.4.2 Within these discussions, it was agreed that significant effects may occur due to construction vehicle emissions and dust from construction activities. Although the site is fairly remote, the nearby Snowdonia National Park is a potentially sensitive ecological and amenity location, with regard to dust and vehicle emissions, and any potential effects may be perceived to be significant by the public.

14.4.3 Gwynedd Council recommended that monitoring should be proposed in the ES, to determine baseline conditions prior to work going ahead, with additional monitoring to be undertaken during the works to ensure that effects do not breach acceptable thresholds. It was agreed that whilst the techniques would be subject to local conditions, such as availability of electricity, a combination of passive and automatic NO_2 and PM_{10} monitoring should be used.

14.4.4 The Environment Officer at Gwynedd Council, was contacted again in November 2014 to discuss the updated assessment methodology, and to update the baseline conditions. Gwynedd Council had no additional comments or requests.

14.4.5 Public Health England (PHE) submitted a consultation response in March 2015, which included several comments regarding what should be incorporated in the air quality assessment, such as appropriate screening

methods, the pollutants that are considered, background pollutant concentrations, cumulative impacts, and the assessment thresholds.

14.4.6 Furthermore, PHE advised that the EIA should appraise and describe the measures that will be used to control emissions and demonstrate that guideline or health-based values will not be exceeded.

14.5 Methodology

Desk Study

14.5.1 During the construction phase, potential local air quality issues may occur due to vehicle emissions on local roads and from within the site, and also due to the generation of dust caused by various excavation, ground preparation and construction activities. The Development has been divided into the main construction components and areas, which are shown in further detail in Volume 4 Figure 4.1 and are outlined in Chapter 4 Project Description in more details. These are broadly summarised as:

- Q1, upper reservoir, including dam and spillway;
- Q6, lower reservoir, including dam and spillway;
- penstock and tailrace; and,
- power house storing the underground turbine.

14.5.2 The potential for air quality effects have been assessed for the construction phase, during which potential effects may occur due to dust and construction vehicle emissions. Whilst the Development will not be operated as a quarry, the types of activities that will occur during the construction phase are similar to those discussed in the MTAN (Welsh Assembly, 2004). The MTAN advises that the following activities, all of which may take place, may give rise to dust emissions:

- haulage, particularly on internal un-surfaced routes, and on nearby roads;
- crushing and grading operations;
- blasting, including drilling operations prior to blasting;
- surface stripping, including soil and overburden storage; and,

- restoration operations.

14.5.3 According to MTAN and IAQM (IAQM, 2014), the main air quality effects that may arise as a consequence of these activities are:

- dust deposition, resulting in the soiling of surfaces and causing nuisance;
- the contamination of soils and vegetation, affecting ecosystem health;
- visible dust plumes, causing nuisance;
- elevated PM_{10} or $PM_{2.5}$ concentrations, from dust generating activities on site, causing a human health effect; and,
- an increase in concentration of PM_{10} or $PM_{2.5}$ and NO_2 due to exhaust emissions from diesel-powered vehicles and equipment on site, and consequent human health effect.

14.5.4 With consideration of the advice within MTAN, the following steps (1-4), as defined by the IAQM (IAQM, 2014), were followed to determine the risk of effects due to dust and vehicle emissions, appropriate mitigation measures to be adopted, and the significance of residual effects:

STEP 1: Screen the requirement for a detailed assessment

14.5.5 Sensitive receptors were identified and the distance to the Development site and potential construction routes were determined. Sensitive receptors were identified and the distance to the site and construction routes were determined according to the examples of sensitivity shown in Table 14-1.

14.5.6 According to the IAQM, an assessment will normally be required where there are sensitive receptors within 350 meters (m) of the boundary of a site and/or within 50 m of route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance. A human receptor, as considered within the IAQM guidance, is any location where a person or property may experience:

- The annoyance impacts of airborne dust or dust soiling e.g. dwellings, industrial or commercial premises such as a vehicle showroom, food manufacturers, electronics manufacturers, amenity areas and horticultural operations; or

- Exposure to PM_{10} over a period relevant to the air quality objectives (1 day / 1 year).

14.5.7 The sensitivity of workers to health effects due to exposure to dust particulates is covered by Health and Safety at Work legislation.

14.5.8 Ecological receptors within 50 m of the boundary of the site or routes used by construction vehicles on the public highway, up to 500m from the site entrance, also need to be identified. An ecological receptor refers to any sensitive habitat affected by dust soiling and includes locations with a statutory designation e.g. Sites of Special Scientific Interest (SSSI) and Special Areas of Conservation (SAC). Some non-statutory sites and/or locations with very specific sensitivities may also be considered, if appropriate, such as horticultural operations.

Table 14-1 Criteria Examples of Dust Sensitive Receptors

Sensitivity	Dust Soiling	Human Health	Ecological
High	• Dwellings, • Museum and other culturally important collections, • Medium and long term car parks • Car showroom.	• Residential properties. • Hospitals, • Schools • Residential care homes	• Locations with an international or national designation (e.g. SAC) and the designated features may be affected by dust soiling
Medium	• Parks • Places of work.	• Office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.	• Locations with a national designation (e.g. SSSI) where the features may be affected by dust deposition.
Low	• Playing fields • Farmland (unless commercially-sensitive horticultural), • Footpaths, • Short term car parks • Roads	• Public footpaths, • Playing fields, • Parks • Shopping streets.	• Locations with a local designation where the features may be affected by dust deposition local Nature Reserve with dust sensitive features.

STEP 2: Assess the risk of dust effects

14.5.9 The risk of dust arising in sufficient quantities to cause annoyance and / or health or ecological effects was determined based on the potential activities that may occur on site, using three risk categories: low, medium or high risk. The site was allocated a risk category based on:

- the scale and nature of the works, which determines the potential dust emission classification as small, medium or large; and,
- the proximity and sensitivity of receptors, whereby ecological and human receptors are considered separately.

14.5.10 It should be noted that where detailed information was not available to inform the risk category, professional judgement and experience was used and a precautionary approach adopted, in accordance with good practice.

14.5.11 Activities on construction sites are classified into four types to reflect their different potential effects:

- demolition;
- earthworks;
- construction; and
- track-out (the transportation of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network).

Demolition

14.5.12 No significant demolition works are proposed, and so this classification has not been considered further.

Earthworks

14.5.13 Earthworks will involve excavating material, crushing, haulage, tipping and stockpiling. The criteria in Table 14-2 were used to determine potential dust emission classes. Factors such as seasonality, works duration and scale were also taken into consideration.

Table 14-2 Potential Earthworks Dust Emission Class Criteria	
Potential Dust Emission Classes	**Criteria**
Large	• Total site area: > 10,000m^2 • Potentially dusty soil type (e.g. clay) • >10 heavy earth moving vehicle active at any one time • Formation of bunds >8m in height • Total material moved >100,000 tonnes
Medium	• Total site area: 2,500 - 10,000m^2 • Moderately dusty soil type (e.g. silt) • 5 -10 heavy earth moving vehicle active at any one time • Formation of bunds 4 – 8m in height • Total material moved 20,000 – 100,000 tonnes
Small	• Total site area: < 2,500m^2 • Soil type with large grain size (e.g. sand) • < 5 heavy earth moving vehicle active at any one time • Formation of bunds < 4m in height • Total material moved < 10,000 tonnes • Earthworks during wetter months

14.5.14 With reference to the derived dust emission class (Table 14-2) and distance to sensitive receptors identified in Step 1, the following criteria presented in Table 14-3 were used to determine the risk category from earthworks activity with no mitigation applied.

Table 14-3 Risk Category from Earthworks Activities				
Distance to Nearest Receptor (m)		**Dust Emission Class**		
Dust Soiling and PM_{10}	**Ecological**	**Large**	**Medium**	**Small**
< 20	-	High Risk Site	High Risk Site	Medium Risk Site
20 – 50	-	High Risk Site	Medium Risk Site	Low Risk Site
50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Negligible
200 - 350	40 - 100	Low Risk Site	Low Risk Site	Negligible

Construction

14.5.15 The key issues when determining the potential dust emission class during construction phase includes the size of the building(s) / infrastructure, method of construction, construction materials and duration of build. The criteria in Table 14-4 were used to determine the potential dust emission classes. Factors such as seasonality, building type, duration and scale were also taken into consideration.

Table 14-4 Potential Construction Dust Emission Criteria	
Potential Dust Emission Classes	**Criteria**
Large	• Total construction volume > 100,000m^3 • Piling, on site concrete batching, sandblasting
Medium	• Total construction volume 25,000 – 100,000m^3 • Potentially dusty construction material (e.g. concrete) • Piling, on-site concrete batching
Small	• Total construction volume < 25,000m^3 • Construction material with low potential for dust release (e.g. metal cladding or timber)

14.5.16 With reference to the derived dust emission class (Table 14-4) and distance to sensitive receptors identified in Step 1, the following criteria presented in Table 14-5 were used to determine the risk category from construction activity with no mitigation applied.

Table 14-5 Risk Category from Construction Activities

Distance to Nearest Receptor (m)		Dust Emission Class		
Dust Soiling and PM_{10} [A]	**Ecological**	**Large**	**Medium**	**Small**
< 20	-	High Risk Site	High Risk Site	Medium Risk Site
20 – 50	-	High Risk Site	Medium Risk Site	Low Risk Site
50 – 100	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
100 – 200	20 – 40	Medium Risk Site	Low Risk Site	Negligible
200 - 350	40 - 100	Low Risk Site	Low Risk Site	Negligible

Note: A human exposure, representing dust annoyance due to deposition or health effects due to fine dust fractions

Track-out

14.5.17 Track-out is the transport of dust and dirt from the site onto the public road network, where it may be deposited and then re-suspended by vehicles using the local road network. The criteria in Table 14-6 were used to determine the potential dust emission class. Factors such as vehicle size, speed, numbers, geology and duration were also taken into consideration.

Table 14-6 Potential Track-out Dust Emission Criteria

Potential Dust Emission Classes	Criteria
Large	• 100 HDV (>3.5t) trips in any one day • Potentially dusty surface material • Unpaved road length > 100 m

Table 14-6 Potential Track-out Dust Emission Criteria	
Potential Dust Emission Classes	**Criteria**
Medium	• 25 – 100 HDV (>3.5t) trips in any one day • Moderately dusty surface material • Unpaved road length 50 – 100 m
Small / Medium	• < 25 HDV (>3.5t) trips in any one day • Surface material with low potential for dust release • Unpaved road length <50 m

14.5.18 With reference to the derived dust emission class (Table 14-6) and distance to sensitive receptors identified in Step 1, the following criteria presented in Table 14-7 were used to determine the risk category from track-out activity with no mitigation applied.

Table 14-7 Risk Category from Track-out				
Distance to Nearest Receptor (m)		**Dust Emission Class**		
Dust Soiling and PM_0 [A]	**Ecological**	**Large**	**Medium**	**Small**
< 20	-	High Risk Site	Medium Risk Site	Medium Risk Site
20 – 50	<20	Medium Risk Site	Medium Risk Site	Low Risk Site
50 – 100	20 - 100	Low Risk Site	Low Risk Site	Negligible

Note: A human exposure, representing dust annoyance due to deposition or health effects due to fine dust fractions

14.5.19 In addition to the dust effects due to track-out, emissions from road vehicles associated with the Development may have a detrimental effect on sensitive locations near the local road network. Such effects were considered with reference to the criteria for an affected road defined in the Highways Agency Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 1 HA 207/07 (HA, 2007):

- road alignment will change by 5m or more; or,

- daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) movements or more; or,
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or,
- daily average speed will change by 10km/hr or more; or,
- peak hour speed will change by 20km/hr or more.

14.5.20 For construction sites, this is interpreted by the IAQM (formerly EPUK) 2010 guidance as 'Large, long-term construction sites that would generate large HGV flows (>200 movements per day) over a period of a year or more.'

STEP 3: Identify the need for site-specific mitigation

14.5.21 Based on the risk of effects determined in Step 2 for each activity (above), appropriate site-specific mitigation measures were identified. The most appropriate and widely recognised mitigation measures to control dust in the UK are set out in 'The Control of Dust and Emissions during Construction and Demolition (GLA, 2014). This guidance is aimed mainly at construction projects in urban areas, although many of the principles and techniques are transferrable and are considered to be appropriate to this site.

14.5.22 The IAQM considers that where suitable construction dust mitigation controls are implemented it will ensure that potential significant adverse effects will not occur and there should be no significant residual effects.

14.5.23 Subject to the risk of the Development, monitoring may be advised in accordance with the GLA (2014) guidance, whereby higher risk sites should include more substantial monitoring to ensure the mitigation controls are effective.

Table 14-8 Site Monitoring Protocols

Low Risk Sites	Medium Risk	High Risk
Take into account the impact of air quality and dust on occupational exposure standards to minimise worker exposure and breaches of air quality	As Low Risk sites. Determine the prevailing wind direction across the site using data from a nearby weather station measuring air	As Medium Risk sites. Determine prevailing wind direction, as for medium risk sites, or by setting up a weather station on site to measure local wind direction and

Table 14-8 Site Monitoring Protocols		
Low Risk Sites	**Medium Risk**	**High Risk**
objectives that may occur outside the site boundary, such as by visual assessment. Keep an accurate log of complaints from the public, and the measures taken to address any complaints, where they were required.	quality across the site according to the direction of the prevailing wind. Operate a minimum of two automatic particulate monitors to measure PM_{10} levels.	speed Carry out a visual inspection of site activities, dust controls and site conditions and record in a daily dust log. Identify a responsible trained person on- site for dust monitoring who can access real-time PM_{10} data from automatic monitors. Agree a procedure to notify the local authority, so that immediate and appropriate measures can be put in place to rectify any problem. Alert mechanisms could include email, texts or alarm systems.

STEP 4: Define effects and their significance

14.5.24 The overall significance of the Development was determine through reference to the outcome from the matrices, discussed above, and professional judgement as:

- ‘Adverse’ or ‘Beneficial’;
- ‘Likely’ or ‘Unlikely’; and,
- ‘Major’, ‘Moderate’ ‘Minor’ or ‘Negligible.

14.5.25 Any effects of Moderate or Major will be classed as **Significant**. Any below will be defined as **Not Significant.**

14.6 Baseline Conditions

Local Air Quality Management

14.6.1 Gwynedd Council undertakes local Air Quality Management (LAQM) responsibilities. The Council reporting has indicated that there are currently

no air quality issues near the Development site or on local roads. The Council have not declared any Air Quality Management Area (AQMA).

14.6.2 The Council undertook a detailed monitoring and assessment campaign during 2006 in Llanberis for PM_{10}, due to emissions from engines operating on the Snowdon Mountain railway, which is based in the town. The assessment identified discrete locations near the railway, which may be exposed to elevated concentrations of fine particulate matter. Monitoring is ongoing in this area to determine the extent and significance of the exposure, although it is not near the Development site and is also unlikely to be representative of conditions in the wider area.

Local Air Quality Monitoring

14.6.3 The Council undertake monitoring using passive NO_2 diffusion tubes at locations throughout the administrative area. One location was historically operated adjacent to the A4086, approximately 200m north of the development site. This was designated as a roadside location, and the annual mean concentration of NO_2 recorded at this site was consistently well below the NO_2 annual mean objective of 40$\mu g/m^3$. This site was closed after 2010. These data are provided in Table 14-9. No other monitoring is undertaken near the Development site.

Table 14-9 Local Air Quality Monitoring Near the Development Site

ID	Location	OS Grid Coordinates	Type	Annual Mean NO_2 Concentration, ($\mu g/m^3$)		
				2008	2009	2010
GCC/014	A4086 Llanberis	256669, 361192	Roadside	17.9	18.3	21.0

Background Pollutant Concentrations

14.6.4 The Council do not undertake any background monitoring near the Development site. However, estimated background pollutant concentrations are published by Defra on the on-line Local Air Quality Management resource (Defra, 2014). These data are estimated using the national network of air quality monitoring stations operated by Defra and local

authorities, and are considered to be broadly representative of the annual mean pollutant concentrations within each 1km grid square of the UK.

14.6.5 The data in Table 14-10 were downloaded in November 2014, and are based on the regional annual mean pollutant concentrations recorded in 2010 for the grid square centred at 256500, 360500. These values are clearly well-below the relevant objectives, and indicate that air quality is generally very good in the area. Pollutant concentrations are also generally predicted to decrease in the future due to increasingly stringent emissions regulations.

Table 14-10 Estimated Background Pollutant Concentrations Near Development Site

Pollutant	Annual Mean Concentration ($\mu g/m^3$)
	2014 Base Year
NO_X	5.8
NO_2	4.6
PM_{10}	11.3
$PM_{2.5}$	7.0

Meteorology

14.6.6 Prevailing wind direction and speed, and rainfall will affect the dispersion of dust from the site. The data presented in Plate 14-1 and Table 14-11 was recorded at the Rhyl meteorological station during 2009. This recording station is located approximately 60km to the north east of the Development, but is considered to be broadly representative of the regional prevailing conditions, despite being in a more coastal location.

14.6.7 The prevailing wind direction is from the south west, which is typical for the UK, and will relatively increase the likelihood of effects at receptor locations downwind of the site towards the north east. However, the valley is oriented north west to south east, which is perpendicular to the prevailing wind, which makes predictions of local air flow fairly complex. In addition, the slope of the hill faces north east down towards Llyn Padarn, and the majority of the works will be within the quarry pits, so overall the setting

should provide some shelter and further reduce the effects of high winds, especially near the base of the valley.

14.6.8 The dispersion of dust from the site will be subject to meteorological factors such as wind speed and direction, whereby strong winds are more likely to suspend dust and carry it further. For example, erosion of soil or stockpiles typically occurs with winds in excess of 5.4m/s (QUARG, 1996).

Plate 14-1 Example of Regional Wind Speed and Direction, Rhyl 2009

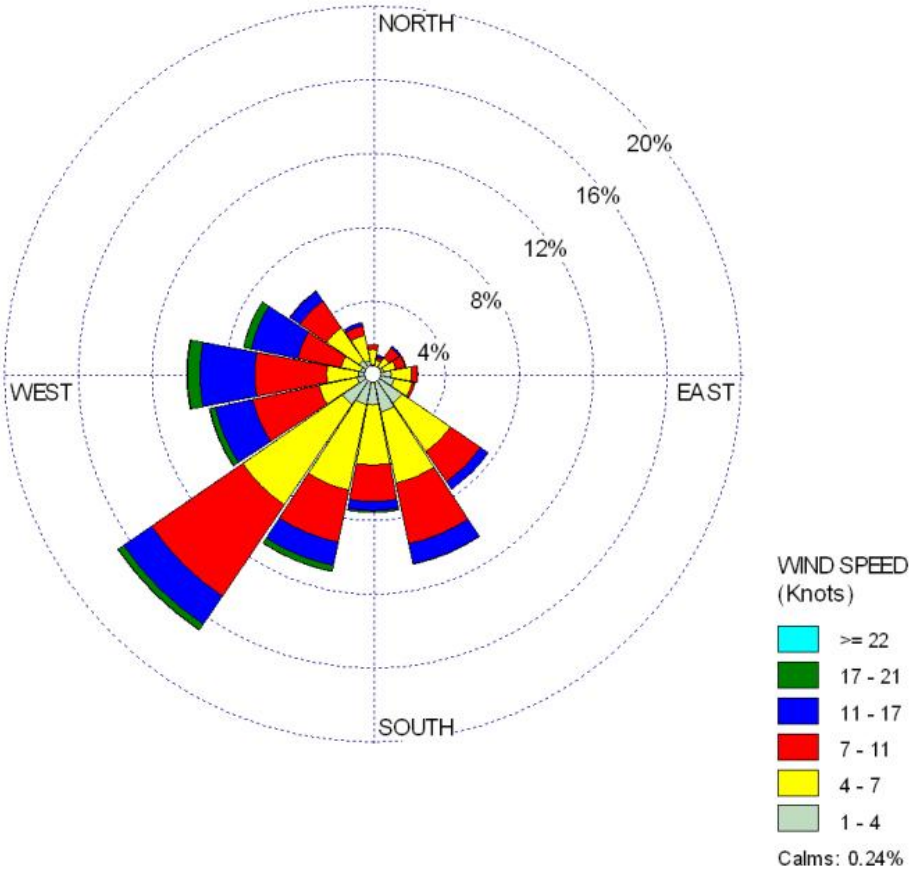

Table 14-11 Rhyl Meteorological Data, 2009													
Mean wind speed (m/s)	Mean wind direction (deg true) (%)												
	316 to 345	346 to 15	16 to 45	46 to 75	76 to 105	106 to 135	136 to 165	166 to 195	196 to 225	226 to 255	256 to 285	286 to 315	Total
	North			East			South			West			
0 to 2	1.2	1.2	0.5	0.8	1.5	1.8	3.0	2.3	2.8	1.5	1.1	1.2	19
2 to 4	3.1	1.3	0.9	1.1	1.6	2.0	7.6	5.2	11.0	5.7	3.5	2.6	45
4 to 6	0.7	0.1	0.2	0.6	0.3	0.1	3.7	1.8	3.7	5.1	4.7	2.8	24
6 to 8	0.2	0.0	0.1	0.0	0.0	0.0	0.9	0.4	1.3	1.4	2.6	1.6	9
8 to 10	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.7	0.4	1.1	0.5	3
10 to 12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0
over 12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Total	5	3	2	3	3	4	15	10	20	14	13	9	

14.7 Potential Effects

Construction Dust

14.7.1 As discussed in Section 14.5, a four step process was followed to determine the risk of potential effects during the construction phase. Where details were unknown, a cautious approach was adopted when assigning a dust emission class for each activity.

14.7.2 The construction phase is anticipated to involve the following activities with potential to cause an air quality or dust effect:

- excavation and removal of slate to storage areas on the site using heavy machinery;
- delivery or mixing of concrete and grout on the site by HGVs/in-situ concrete mixers;
- rock crushing and screening;
- drilling and rock blasting, subject to ground investigations and design requirements;
- excavating and boring tunnels and trenches using specialist heavy equipment or penstock excavation and movement of slate materials from Q6 to Q1;
- delivery of steel reinforcement, linings and other materials by HGV;
- staff transportation; and,
- managing excavation waste through storage, reuse and removal; and delivery of sections of pipe and materials by HGV on local roads and within the site.

14.7.3 Whilst the durations of work may be subject to change, it is anticipated that it will occur in several phases over a period of approximately 4 years, with the majority of the work taking place during the initial 24 months.

<u>STEP 1: Screen the requirement for a more detailed assessment</u>

14.7.4 All sensitive receptors within 500m of the Development site are identified in Table 14-12 and shown in Volume 4 Figure 14.1. As discussed above

according to MTAN potential effects may occur within 200m of the works, although the IAQM (IAQM, 2014) consider that receptors within 350m of the boundary of the site are typically considered to be at risk from dust effects. Furthermore, the IAQM states that potential effects may occur up to 500m from a site entrance. Therefore, given the scale of the Development and the uncertainties regarding the precise locations of works within the site, receptors within 500m have been identified to ensure a robust assessment.

Tale 14-12 Sensitive Locations near Construction Activities						
ID	OS Grid Coordinate		Location	Type	Approximate Distance to Activity (m) [A]	
	X	Y			Construction / Excavation / Stockpiling	Temporary Depot Site
1	255796	360922	Llys Ellen	Residential	-	-
2	256092	360927	Ty-newydd	Residential	410 (Q6)	-
3	256074	361017	Ty-newydd	Residential	455 (Q6)	-
4	256172	361033	Ty-newydd	Residential	375 (Q6)	500 (Turbine)
5	256187	361121	Groeslon	Residential	420 (Q6)	-
6	255566	361221	Pen-draw	Residential	-	-
7	256977	360447	Siemens	Hi-Tech	360 (Q6)	400 (Turbine)
8	257082	360458	Siemens	Hi-Tech	390 (Q6)	450 (Turbine)
9	257280	360842	Ynys-wen	Commercial	375 (Q6) 280 (Spillway)	460 (Depot)
10	257201	360884	Pen-gilfach	Industrial	300 (Q6) 200 (Spillway)	450 (Turbine) 370 (Depot)
11	257120	360945	Gallt-y-glyn	Hotel	240 (Q6) 100 (Spillway)	390 (Turbine) 270 (Depot)
12	257141	361013	DMM Engineering	Industrial	280 (Q6) 65 (Spillway)	440 (Turbine) 285 (Depot)
13	257015	361134	Mountain Centre	Amenity	190 (Q6) 70 (Spillway)	390 (Turbine) 200 (Depot)

Tale 14-12 Sensitive Locations near Construction Activities						
ID	OS Grid Coordinate		Location	Type	Approximate Distance to Activity (m) [A]	
	X	Y			Construction / Excavation / Stockpiling	Temporary Depot Site
14	256970	361130	Mountain Centre	Amenity	160 (Q6) 90 (Spillway)	360 (Turbine) 170 (Depot)
15	256824	361150	Glyn Peris	Residential	60 (Q6) 130 (Spillway)	300 (Turbine) 75 (Depot)
16	256866	361139	Glyn Peris	Residential	85 (Q6) 115 (Spillway)	300 (Turbine) 100 (Depot)
17	257273	361063	Car Park	Amenity	420 (Q6) 0 (Spillway)	360 (Depot)
18	256618	361211	Lake View Hotel	Hotel	180 (Q6) 300 (Spillway)	200 (Turbine) 360 (Depot)
19	256540	361193	Off A4086	Commercial	185 (Q6) 360 (Spillway)	245 (Turbine) 380 (Depot)
20	256449	361427	Hafod Wen	Residential	430 (Q6)	475 (Depot)
21	256452	361458	Tan-y-ffynnon	Residential	450 (Q6)	500 (Depot)
22	257123	360363	Ael-y-Glyn	Residential	490 (Q6)	-
23	-	-	Llyn Padarn	SSSI	0 (Spillway)	-
24	257070	360700	Permitted caravan park	Residential / Amenity	200 (Q1) 300 (Spillway)	320 (Turbine)

Note: [A] Blank distance indicates no specific activities were identified within 500 m

14.7.5 The distances shown in Table 14-12 are derived from the overall red-line boundary of the Development site and the proposed locations of specific activities, in accordance with MTAN guidance discussed above (WAG, 2004). Specific construction activities, depots and haulage routes will be located throughout the development area during the different phases of the Development, which will each have a different level of dust-generating potential. These predominantly include the ground-preparation, extraction and construction areas and the depot and storage areas for equipment and materials.

14.7.6 In addition, there will be haulage routes and temporary or final stockpiling areas throughout the site. The approximate distance of receptors to the proposed working area are provided, although at the time or writing it was not possible to determine proximity to transport routes or stockpiles, as these will be subject to further detailed design and operational requirements.

14.7.7 According to Table 14-12, the nearest sensitive receptor location to the Development site is a residential property within 60m of Q6 (Receptor 15). Further from the Order Limits, the closest properties are the residential properties, lake and commercial businesses to the north (near Ffordd Clegir) and north east (near the A4086), shown as Receptors 16 to 22.

14.7.8 The distribution of sensitive receptors is clearly concentrated to the north east around the Q1 working area and the turbine building. There are no specific sensitive receptor locations near the Q6 working area, although this area is within close proximity to Snowdonia National Park (see Section 14.7.10 below).

14.7.9 The nearest designated ecological site is Llyn Padarn SSSI. This is over 100m from Q6 construction area, although the Q6 spillway will feed directly into Llyn Padarn. The SSSI has been designated due to the freshwater environment, not the dry land around the shore, and so it is considered unlikely to be significantly affected by deposited dust.

14.7.10 In addition to the locations shown in Table 14-12, the Development is in close proximity to Snowdonia National Park. Whilst this would not normally be considered as highly sensitive to dust effects, it is a popular amenity area and any perceived effect due to the Development may cause a disproportionate public concern. The Mineral Policy Statement (ODPM, 2005) considers that perceived nuisance may occur due to:

- deposition on a surface which is usually expected to remain free from dust;
- the colour contrast between the deposited dust and the surface upon which it settles;
- the nature of the illumination of the surface – 'dinginess';
- the presence of a nearby clean 'reference' surface against which comparisons may be made;
- the identity of the area and the composition of the local community;
- social factors, such as lifestyle and patterns of working;
- the personal experiences and expectations of the observer; and,
- adverse publicity influencing the expectations of the observer.

14.7.11 The sensitivity to dust soiling effects is considered to be **Medium** as there are < 10 receptors within 20 m of any potential haulage or working areas. The sensitivity of human health impacts is considered to be **Low** as there are < 10 receptors within 20 m, and the background PM_{10} concentration is < 24 µg/m^3.

14.7.12 With regard to the national park, this does not fall into any of the ecological receptor categories, but is considered to be potentially **Medium** sensitivity due to the perceived effects that may occur and the high profile of the region.

STEP 2: Assess the risk of dust effects

Demolition

14.7.13 No demolition works are proposed to take place.

Earthworks

14.7.14 The total potential Development encompasses approximately 97 ha and will take place over time period longer than 12 months. Therefore it is well within the **Large** potential dust emission classification. It should be noted however, that despite the large size of the site, dust generating activities during the earthworks will be predominantly restricted to works around Q1 and Q6. It should also be considered that the earthworks and main construction activity will be below the surface level including the quarry stabilisation, drilling of the penstock and excavation of the turbine hall. The only above ground works are the temporary

storage of slate material excavated and the deposition of the permanent slate tips near Q1. Potential dust generating activities are discussed below.

14.7.15 The Development site is a former slate quarry, which will fracture and generate very sharp particulate matter and dust, which has specific health implications and potentially greater health risks if inhaled. Furthermore, the colour of the rock is very distinctive and, with reference to Section 14.4.1 and the MTAN, where new rock is exposed or dry dusty material is deposited on surrounding land it may temporarily increase visible of the works to observers.

Stabilising Q1 and Q6

14.7.16 The dust generating activities will occur within the quarries, around the quarry perimeters and on access roads and depot sites. The works within the Q1 construction boundary include excavation and construction activity, and will also encompass the route for moving spoil from temporary storage in the construction compound where it will be graded and either used in the dam construction or landscaping, or incorporated into the existing slate mounds to the south west of Q1. This will be moved around either by HGV or conveyor. The working area will also encompass a construction compound within the order limits in the most suitable location.

14.7.17 The construction area around Q6 will include the power house (see below), a temporary construction compound and the access facilities from the A4086.

14.7.18 The material extracted from Q1 and Q6 will be crushed by equipment on the quarry floor, and will be preferentially used to create the dams. Excess material will be relocated to temporary storage mounds within the Q1 and Q6 construction compounds.

14.7.19 Material generated from Q6 works will be incorporated into the dam construction and also internal reservoir works.

14.7.20 The potential dust generating activities in and around Q1 and Q6 include:

- drilling (anticipated to last up to 6 months);
- blasting (intermittent and infrequent but anticipated to be required for up to 12 months between both quarries;

- bulk removal of blasted and excavated material from Q6 to Q1 by conveyor belt;
- rock drilling and bolting;
- injection grouting on quarry walls and around the perimeters;
- crushing of excavated material, which will occur within the quarry;
- redistribution of crushed material by conveyor to the dam sites, existing slate spoil mounds and landscaped.; and,
- partial removal of existing spoil heap at Q1 dam site to excess spoil mound.

Penstock & Tailrace Tunnel

14.7.21 The penstock and tailrace will be bored using a Tunnel Boring Machine (TBM) or alternative drilling method, so the main dust generating activities will occur underground within the tunnel.

14.7.22 The excavation activity will occur underground, which will significantly reduce the risk of effects. However, air and dust will be extracted and ventilated at each end, and excavated material will be stockpiled nearby before being relocated elsewhere on the site. The penstock could lead from within Q1 to the base of the turbine chamber in Q6 (or vice versa), which will effectively reduce the potential dispersion of dust.

14.7.23 Potential emissions will be restricted to the ends of the tunnel due to the following potential dust generating activities:

- extensive excavation of materials;
- extraction of ventilation air and entrained dust from the tunnel workings;
- creation of temporary stockpiles; and,
- redistribution of excess material by conveyor and HGV, where possible, to reduce removal from site.

Power house

14.7.24 The turbines will be installed in a subterranean chamber, with the generator house and ancillary facilities constructed on top, approximately 70m below the existing ground level. The excavation of the turbine chamber will require blasting and excavation, which has a high dust-generating potential. Specifically, where

blasting is proposed to occur, it will significantly increase the likelihood of creating fine dust fractions dispersed over a larger area, as well as potentially generating larger dust fractions and rock-fly (WAG, 2004).

14.7.25 The power house construction will occur at the lower end of the site within the Q6 working area. The potential dust generating activities include:

- excavation;
- rock blasting; and,
- redistribution of excess material for the construction and landscaping of the Q6 dam or potentially inside the quarry.

Track-out and excavated material transport

14.7.26 It is proposed that material will be excavated from Q1 and Q6 (taking account of the bulking factor). As discussed in Section 14.7.19, it is proposed that excavated material from the quarries and slate spoils will be preferentially used to construct the dams, although excess spoil will be incorporated into existing slate spoil mounds and landscaped appropriately.

14.7.27 As the excavated material will not be removed from site it will therefore require on-site storage in stockpiles before being redistributed around the site to the required final destination. Consequently, repeated handling and extensive stockpiling will occur, which may potentially generate further localised dust emissions.

Summary of Earthworks

14.7.28 The risk of dust effects occurring during the earthworks is categorised as **Medium,** based on the total size of the site, proximity of sensitive receptors and the proposed activities. However, as discussed above earthworks will be restricted to specific areas, and therefore the actual risk at receptors will be subject to their location and the type and duration of activities undertaken.

Construction

14.7.29 The Development includes the construction of the power house, spillways, penstock and tailrace, dams and turbine house. As discussed in Table 14-3, of particular importance in terms of assigning a potential dust emission class for these aspects is to consider the construction materials and size of

buildings/structures. The turbine house and power house are relatively small in size, and will have pitched corrugated roofs and clad using local materials, i.e. slate.

14.7.30 The spillway towers will be concrete, which will require a local batching plant and storage and handling of dusty materials. However, the structure will be located within the quarry, which will shelter it from wind, and ensure it is not near the site perimeter.

14.7.31 The construction of the penstocks will use the tunnelling technique, rather than an open trench. The pipes will be constructed during the excavation works, and will require concrete and grout, which will be batched above-ground near the tunnel entrances.

14.7.32 With reference to Table 14-3, the potential dust emission classification is **large** for all proposed construction activities. Based on the distance of the nearest receptors and reference to Table 14-4 the risk of effects varies for different areas of the site, although overall the risk of effects was regarded as **high** at a few locations in proximity to specific activities, the overall risk of effects is considered to be **medium**.

Track-out

14.7.33 Throughout the duration of the project, the number of HGV (vehicles >3.5t) movements will vary depending on the activities undertaken. Table 14-13 provides a summary of the approximate number of HGVs that are anticipated to be required for each activity and the duration of each.

Table 14-13 Daily Vehicle Movements

	Baseline		Construction Traffic											
			Month 1-6		Month 7		Month 8-28		Month 29		Month 30-36		Month 37-49	
	2016	2017	Car	HGV	Car	HGV	Car	HGV	Car	HGV	Car	HGV	Car	HGV
Waunfawr Crossroads														
Green Road (east of crossroads)	298	305	43	2	181	51	153	19	178	71	53	0	14	0
Green Road	499	510	43	2	181	51	153	19	178	71	53	0	14	0

Table 14-13 Daily Vehicle Movements

	Baseline		Construction Traffic											
			Month 1-6		Month 7		Month 8-28		Month 29		Month 30-36		Month 37-49	
	2016	2017	Car	HGV	Car	HGV	Car	HGV	Car	HGV	Car	HGV	Car	HGV
(west of crossroads)														
A4085 Waunfawr														
Green Road	685	701	43	2	181	51	153	19	178	71	53	0	14	0
A4085 (W)	3440	3519	43	2	181	51	153	19	178	71	53	0	14	0
A4085 (E)	3069	3139	0	0	0	0	0	0	0	0	0	0	0	0
A4086 / Glynn Rhonwy														
Glynn Rhonwy	811	830	47	15	252	41	187	26	220	46	63	24	21	23
A4086 (W)	6188	6329	45	15	216	41	170	26	199	46	58	24	17	23
A4086 (E)	5716	5847	3	0	42	0	24	0	28	0	5	0	3	0
A4086 / A422														
A4244	6800	6956	0	18	0	92	0	45	0	118	0	24	0	23
A4086 (W)	6533	6683	45	2	216	51	170	19	199	71	58	0	17	0
A4086 (E)	6571	6721	45	15	216	41	170	26	199	46	58	24	17	23

14.7.34 It is proposed that the majority of excavated material will be re-used on site in the construction of the dams, which will reduce the amount of dusty material being removed from site and reduce the risk of off-site dust emissions. Nevertheless, a cautious approach has been applied and the potential dust emission class has been assigned as **medium**, although due to the phasing of the development it may be lower at certain periods.

14.7.35 The access routes to the site will use the A4244 from the north, or through Llanberis to the South. The local air quality within Llanberis is currently well within the annual mean air quality objectives. However, it is a small town with narrow streets, and potentially susceptible to congestion and associated local air quality effects.

14.7.36 With reference to Table 14-13, it should be noted that the number of HGVs will not exceed the criteria defined by the DMRB, Volume 11, Section 3, Part 1 HA

207/07 (HA, 2007) (see Sections 14.5.18 and 14.5.19) and therefore a quantitative assessment is not required. Furthermore, the effects due to vehicle emissions during this phase are temporary and, therefore, the predominant effects due to road traffic will be dust effects, due to vehicles tracking mud and dust off the site and causing suspension of dry, fine material.

14.7.37 Taking into consideration the distance to the nearest receptors to the access route, which are immediately adjacent to the road near the site, the risk of dust effects is described as **medium.**

14.7.38 The Council has raised a concern about vehicle emissions, and so appropriate monitoring and mitigation is recommended in Section 14.8, below.

Summary

14.7.39 As described in Section 14.5, Steps 1 and 2 of the IAQM methodology (IAQM, 2014) determines the risk of effects occurring based on the potential dust emission class and sensitivity of the area, if no mitigation measures were adopted. Step 3 identifies the need for site-specific mitigation and Step 4 defines the significance of any residual effects.

14.7.40 With reference to Tables 14-2, 14-4 and 14-6, the potential dust emission classification is **large** for all proposed earthworks and construction activities around Q1, Q6, penstocks and power house, and **medium** for the track-out. However, based on the distance of the nearest receptors, the risk of effects varies for different areas of the site, with the greatest nuisance and/or human health risks most likely to occur around the Q6 working area and the turbine house, whilst the activity around Q1 may affect the surrounding Snowdonia National Park. The effects without mitigation were deemed to be **likely moderate adverse** for both human health and ecological effects to the National Park land.

14.7.41 Therefore, the overall potential unmitigated significance is considered to be a **likely, major, adverse** for both human and ecological exposure during construction.

14.8 Mitigation, Compensation and Enhancement Measures

14.8.1 A number of mitigation measures can be adopted to reduce the production and/or dispersal of dust to lessen the nuisance and human health effects. Ideally

dust should be controlled at the source, as once airborne it is difficult to suppress. The most appropriate mitigation controls are discussed in the following guidance documents:

- BRE, 2003a: Guidance on the Control of Dust from Construction and Demolition Activities;
- BRE, 2003b: Controlling Particulates, Vapours and Noise Pollution from Construction Sites;
- Greater London Authority (GLA) (2014), The Control of Dust and Emissions during Construction and Demolition, supplementary planning guidance; and
- Institute of Air Quality Management (IAQM) (2014), Guidance on the assessment of dust from demolition and construction.

14.8.2 Construction dust usually responds well to appropriate measures as long as a co-ordinated CoCP (Code of Construction Practice; or equivalent) is implemented. Identifying potential dust generating activities and good site planning is essential to prevent unnecessary dust production and should be conducted prior to commencing work.

14.8.3 Where appropriate, dust generating activities should be undertaken off-site, however, where this is not possible these activities should be located away from sensitive receptors.

14.8.4 This especially applies to construction compounds, storage areas and stockpiling areas, as these may be operated independently from the construction work and may be located away from the site boundary or any specifically sensitive receptor locations.

14.8.5 With regard to the regional meteorology, stockpiles and compounds should not be located near the site boundary or upwind of nearby sensitive receptors, i.e. they should be located away from the north east boundary. During high winds, extended dry periods or after recent movement of material, stockpiles should be stabilised and/or covered to prevent wind-blown dust. Short-term or temporary controls may include water sprays, although sheeting, grass seeding or high fences may be more suitable depending on the proposed use of the material. The shape of the stockpiles should also be considered, whereby several smaller piles should reduce wind-blown material compared to few, larger piles.

14.8.6 DCO Requirements may be considered to be appropriate to provide a framework under which effects can be minimised. Due to the similarity of the activities to minerals workings, the conditions discussed by MTAN (WAG, 2004) are considered to provide a reasonable guide to specific controls that may be implemented:

- an adequate and appropriate monitoring programme, including periodic checks and continuous monitoring;
- ameliorative measures to mitigate effects, such as the provision of wheel-wash facilities, road cleansing, speed restrictions, sheeting of vehicles; and,
- working programmes/site design and layout, with the location of dust emission sources away from sensitive development, protection of loading/unloading activities and materials storage areas, control of soil handling and overburden stripping including timing to suit weather conditions.

14.8.7 Due to the size of the Development, it is possible that concrete batching will occur on site, for example during the construction of the dams. Such equipment should be operated in accordance with Process Guidance Note 3/1 (04) and is regulated under the Environmental Permitting Regulations 2010.

14.8.8 Gwynedd Council has specifically requested that monitoring should be undertaken, as discussed in Section 14.5, including records of baseline conditions prior to work going ahead, with additional monitoring to be undertaken during the works to ensure that effects do not breach acceptable thresholds. The planning permission for the approved scheme included the following condition with regard to air quality monitoring:

- *To demonstrate that the Air Pollution Management Plan is adequate and compliance with the PM_{10}, $PM_{2.5}$ and NO_2 air quality targets it is required that the applicant should monitor the air quality during the duration of the construction period… Meteorological information to include wind speed, direction and rainfall is also required to be reported as part of this monitoring.*
- *The level of dust produced by the development shall not exceed the limit detailed (as 200 mg/m^2/day, averaged over 1-month and reported as an annual mean) at any property (domestic, commercial or industrial) outside the development site.*

14.8.9 Therefore, the specific methods will require further discussion and liaison with Gwynedd Council as part of the approval of the CoCP, due to constraints relating to site security, safe access and reliable power supplies. For example, whilst it is provisionally recommended that one or two automatic dust monitors should be operated, in accordance with the best-practice IAQM and GLA guidance, this will require access to a secure electrical supply, which may not be feasible. Therefore, passive monitoring, such as 'frisbee' or 'sticky pad' deposition gauges may be used to measure dust, and passive diffusion tubes used to measure NO_2, as these techniques do not require an electrical supply, but will require good access and potential additional security measures.

14.8.10 Detailed and activity specific mitigation measures will be outlined as an Air Pollution Control Management Plan in the CoCP, which must be enforced and adhered to.

14.9 Residual Effects

14.9.1 There are properties in close proximity to the Development, it is adjacent to a national park and any effect, either real or perceived, due to the Development may cause public concern. Therefore, as the main industry in the area is tourism, the sensitivity of the area is categorised as **high**.

14.9.2 Appropriate mitigation has been discussed in Section 14.8 to reduce the magnitude of the potential impacts. The IAQM considers that where suitable construction dust mitigation controls are implemented it will ensure that potential significant adverse effects will not occur and there should be no significant residual air quality or dust effects. The consideration of human exposure includes both health and dust-soiling effects. The overall potential effect is considered to be a **likely, minor, adverse** effect for both human and ecological exposure.

14.10 Evaluation of Significance

14.10.1 Table 14-14 presents a summary of the residual air quality impacts for the Development, accounting for the effects of mitigation measures on the worst-case impacts as determined within this assessment.

14.10.2 With reference to the residual effects discussed in Section 14.9 and the assessment criteria discussed in section 14.6, the overall potential effect is considered to be **not significant**.

Table 14-14 Summary of Assessment

Description of Receptor		Description of Potential Effect					Description of Residual Effect			Change since 2012 Chapter
Receptor	Value / Sensitivity	Effect	Nature of Effect	Duration	Magnitude	Potential Significance	Summary of Mitigation	Residual Effect	Residual Significance	
Residential and Holiday Properties	High	Deposited dust	Nuisance	3.5-4 years	Medium / Large	Likely, major, adverse	An adequate and appropriate monitoring programme, including periodic checks and continuous monitoring. Ameliorative measures to mitigate effects, such as the provision of wheel-wash facilities, road cleansing, speed restrictions, sheeting of vehicle. Working programmes/site design and layout, with the location of dust emission sources away from sensitive development, protection of loading/unloading activities and materials storage areas, control of soil handling and overburden stripping including timing to suit weather conditions.	likely, minor, adverse	Negligible	No Change
		Increased concentrations of atmospheric fine particulates	Health	3.5-4 years	Medium / Large	Likely, major, adverse		likely, minor, adverse	Negligible	No Change
Snowdonia National Park	Medium	Deposited dust	Discoloration	3.5-4 years	Medium / Large	Likely, major, adverse		likely, minor, adverse	Negligible	No Change
		Deposited dust	Ecological harm	3.5-4 years	Medium / Large	Likely, major, adverse		likely, minor, adverse	Negligible	No Change
Designated Ecological Sites	High / Medium	Deposited dust	Ecological harm	3.5-4 years	Medium / Large	Likely, major, adverse		likely, minor, adverse	Negligible	No Change

14.11 Summary and Conclusions

14.11.1 A qualitative assessment was conducted to determine the potential dust effects during the construction phase of the Development, with reference to proposed activities, duration of works, baseline conditions and proximity of potential sensitive locations.

14.11.2 The potential effects due to road vehicle emissions during the construction phase were also assessed and deemed to be **not significant.**

14.11.3 It is proposed that earthworks and construction works will be undertaken to stabilise Q1 and Q6 and construct the dams, penstocks, turbine house and power house. Specific dust generating activities are proposed, including drilling, blasting, rock bolting, bulk excavation, crushing of excavated material and partial removal of existing spoil heaps.

14.11.4 The assessment concludes the following:

- The Llyn Padarn SSSI is located adjacent to where the water outfall pipe will be constructed, but is otherwise over 100m from activities. However, this is a wet environment, and so the risk of effects due to dust were considered to be **negligible** and **not significant** (no other designated ecological sites are located with 100m of the Development site).
- The site is in close proximity to Snowdonia National Park, which is a popular amenity area and whilst it is not considered to be specifically sensitive to dust, any perceived effect due to the Development may cause public concern.
- Based on the proximity of the nearest sensitive receptor and potential dust emission class, the risk of effects during the earthworks, construction works and track-out was considered to be a **likely, major, adverse** effect, if **no** mitigation measures are adopted.
- General mitigation measures are recommended to be used in conjunction with more detailed, activity specific measures. The overall significance of the residual effects are determined to be a **likely, minor, adverse** effect for both human and ecological exposure.

- Therefore, overall the Development effects will be **not significant**, with regard to air quality.

14.11.5 Mitigation should be secured through the DCO requirements as follows:

- The works must be undertaken in accordance with a Dust Management Plan (DMP) and CoCP.
- Air quality and dust monitoring should be installed before, and during, the construction phase to ensure that implementation of the CoCP is managing dust properly. The monitoring plan should be formulated and agreed with Gwynedd Council.

14.12 References

Air Quality Framework Directive (96/62/EC).

BRE 2003a, Guidance on the Control of Dust from Construction and Demolition Activities

BRE 2003b. Controlling Particulates, Vapours and Noise Pollution from Construction Sites

COMEAP 1988, The Quantification of the Effects of Air Pollution on Health in the United Kingdom

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