A465 Blaenau'r Cymoedd
Adrannau 5 + 6: Dowlais Top – Hirwaun

A465 Heads of the Valleys
Sections 5 + 6: Dowlais Top – Hirwaun

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Welsh Government

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A465 Heads of the Valleys Sections 5 and 6: Dowlais Top to Hirwaun

Environmental Statement Supplement Volume 1: Main Text
March 2018

Contents

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1. Introduction

This Environmental Statement (ES) Supplement has been prepared to provide additional environmental information. It is submitted to provide additional information to that set out in the original ES dated July 2017. It should be read alongside the July 2017 ES.

This ES Supplement addresses the following design development and changes in the proposed scheme since the publication of the Draft Orders. These key changes are as follows:

1) A revision of the traffic model that used TEMPRO software to predict future traffic flows; this revision necessitated associated revisions to the air quality and noise models. This resulted in changes to the assessment of air quality impacts and noise and vibration impacts.
2) As a result of the changes to the air quality model, the impacts on designated nature conservation sites sensitive to air quality needed to be re-assessed.
3) Modifications to the design of the Croesbychan junction to remove one of the roundabouts and replace it with a T-Junction. Details of this design change are set out in the amended Chapter 5: Proposed Scheme Description of the ES Supplement.
4) Minor modifications to the width of the on and off-slips to junctions, due to revised traffic flows predicted by the TEMPRO model.
5) Minor modifications to the environmental barriers along the proposed scheme as a result of the revisions to the noise and vibration assessment.
6) The visual impact assessment relating to inclusion of variable message signage.

This supplement is structured in the same order as the original ES, with consistent Section, Figure and Table numbering for ease of reference. Some of the specialist technical areas remain unchanged and this is indicated in the text where this is the case. Where major amendments have been made to a section the whole revised section has been included. Where minor amendments have been made to a section the new text is indicated by red bold text, with removed text indicated by strikethrough formatting.

The following changes have been made to Chapter 1 – Introduction:

In S**ection 1.10.11** reference to the Conservation of Habitats and Species Regulations 2010 should now refer to the Conservation of Habitats and Species Regulations 2017, the 2017 Regulations consolidate previous amendments to the 2010 Regulations. This change in legislation has no implications for the July 2017 published Statement to Inform Appropriate Assessment. The July 2017 Statement to Inform the Appropriate Assessment is compliant with the new 2017 Habitats Regulations.

In **Section 1.10.12** remove the final paragraph and replace with the following:

In accordance with the Well-being of Future Generations (Wales) Act 2015, the Welsh Government published its well-being objectives in 'Taking Wales Forward' (Welsh Government, 2016d). **These objectives have been subsequently updated by Prosperity for All: the national strategy (Welsh Government, 2017a).** The Sustainable Development Report Supplement, currently in preparation, will consider the extent to which the proposed scheme contributes to these well-being objectives. The Sustainable Development Report Supplement will be published ahead of the proposed Public Local Inquiry to the proposed scheme in April 2018.

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2. Legislative and Policy Context

Since the publication of the Environmental Statement and Statement to Inform the Appropriate Assessment in July 2017, new EIA Regulations and Habitats Regulations have come into force. These are the Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017 and the Conservation of Habitats and Species Regulations 2017.

The July 2017 Environmental Statement and the February 2018 ES Supplement accord with the 2017 EIA Regulations. The July 2017 Statement to Inform the Appropriate Assessment, although prepared whilst previous legislation was extant, still accords with the 2017 Regulations and no revisions or updates to that document have been prepared.

The following changes are required to this chapter; none of these changes have a material effect on the conclusions of the July 2017 Environmental Statement.

Insert new Section 2.2.4a

2.2.4a Prosperity for All: the national strategy

Prosperity for All: the national strategy was published by the Welsh Government in September 2017. The four key themes of this strategy are the same as those in the 2016 *Taking Wales Forward,* focusing on a Wales which is prosperous and secure, healthy and active, ambitious and learning, and united and connected.

In October 2017, the Welsh Government published a Draft Budget 2018-19 Detailed Proposals document (Welsh Government, 2017b), which sets out how they intend to support the objectives within *Prosperity for All*. Under the Economy and Infrastructure heading there was a restated commitment to deliver the A465 dualling project (Sections 5 and 6) through the Mutual Investment Model.

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3. The Need for Proposed Scheme

Amend text within *Section 3.1.5 Accidents on the A465* and replace *Table 3.2* in its entirety:

An accident report has been prepared that considers accidents on the A465 covering a five year period from ~~2011~~ **2012** to ~~2015~~ **2016**. During this period there were ~~six~~ **three** fatal, 11 serious and ~~99~~ **100** slight accidents on the A465 between Hirwaun and Dowlais Top. The key accident locations are shown in Table 3.2.

Table 3.2: Key accident locations on the A465 (Sections 5 and 6) between 2012 and 2016

Location	Accident history	Likely effect of the proposed scheme
Dowlais Top	25 collisions	Grade separation would reduce traffic through roundabouts and therefore accidents.
A465 / A470 Roundabout	14 collisions	Grade separation would reduce traffic through roundabouts and therefore accidents.
A465 / Swansea Road junction	11 collisions	Junction would be closed on A465 removing accidents caused by leaving and joining the A465.
Trewaun Roundabout	8 collisions	Junction would be removed from A465 and would have reduced accidents.
Hirwaun / Rhigos Road Roundabout	17 collisions	Grade separation would reduce traffic through roundabouts and therefore accidents.

The most common contributory factors in accidents were a failure to look properly, drivers being careless or reckless, drivers failing to judge another's path or speed, and a loss of control of the vehicle.

There are two main reasons why the proposed scheme would improve the resilience of the A465 route as a result of the expectation that it would reduce the severity of accidents. The first is that the new central reservation and barrier separating traffic would reduce head-on collisions particularly when one car has lost control and has veered to the right. The second is that, with the grade separation of junctions along the route and the expansion of the road to a dual carriageway in both directions, there would be less slowing and stopping in the carriageway reducing the likelihood of some accidents.

Both the grade separation and the inclusion of a central reservation within the design of the proposed scheme would prevent accidents from occurring as well as reduce the severity of those that do.

Remove *Section 3.1.6 Traffic projections to 2037* in its entirety and replace with the following text:

The development of the proposed scheme has taken into account the long-term projected increases in traffic along the A465 in order to ensure that the improvements would address the issues regarding the existing resilience of the A465 as well as the future needs of road users.

A Traffic Forecast Report has been prepared which has assessed the projected traffic flows along the A465 between Hirwaun and Dowlais Top. The traffic model is based on SATURN software and has considered two future dates, 2022 (which is the intended opening year of the proposed scheme) and 2037 (the design year of the proposed scheme). Existing traffic data, which was obtained through automatic traffic count data, was used in the model along with roadside interviews and mobile phone data. **The modelled traffic increase has been calculated as 2-way demand traffic flows between the A470 and Swansea Road Junctions.**

Table 3.1 : Modelled increase in traffic flows on the A465 (LGV - Light Goods Vehicle)

Type of vehicle	2015 - 2022	2015 - 2037
Morning Peak (8am – 9am)		
Cars	**27%**	**39%**
LGV	**19%**	**62%**
HGV	**5%**	**16%**
Total	**24%**	**40%**
Inter-Peak (10am – 4pm)		
Cars	**40%**	**76%**
LGV	**20%**	**59%**
HGV	**6%**	**16%**
Total	**33%**	**66%**
Evening Peak (5pm – 6pm)		
Cars	**33%**	**52%**
LGV	**19%**	**58%**
HGV	**6%**	**19%**
Total	**30%**	**52%**

As the volume of traffic increases over time the need for the proposed scheme increases as the road safety concerns related to the number of junctions on the existing A465 would become more pronounced. The delays associated with the congestion at peak times at the roundabouts is expected to increase by up to **5 and a half minutes** by 2037 should the proposed scheme not progress. The degree of frustration experienced by drivers as a result of lack of overtaking opportunities would also increase.

As the volume of traffic increases the need for alternative provision for NMUs increases, both in the form of new cycle / pedestrian routes parallel to the road as well as improved crossing provision at junctions and across bridges to avoid pedestrians crossing the road at grade.

In *Section 3.1.7 Economic assessment* the final two paragraphs should be replaced in their entirety:

A value for money assessment was conducted following WelTAG guidance **based on the information available at the time of the publication of the 2017 ES**. A Benefit Cost Ratio (BCR) was constructed based on the economic benefits and costs. The overall benefit cost analysis **identified a** ~~returns a~~ medium BCR of 1.05:1 and a net present value (NPV) of £16.1m showing that the monetised benefits are higher than the estimated costs for the proposed scheme at this stage. However, the BCR is based only on monetised benefits in the 'core' BCR.

The proposed scheme is seen as, in part, a regeneration project. As a result, it is important to consider the wider impacts in conjunction with metrics such as BCR. For the economic assessment of this proposed scheme additional benefits have been quantified including impacts on cycling, agglomeration, increase in output in imperfectly competitive markets and the impact on taxes arising from labour market impacts. Having taken into account all the benefits of this proposed scheme on the wider economic area the proposed scheme ~~returns~~ **returned** a BCR of 1.2:1 and NPV of £88.2m **based on the July 2017 calculations**.

The BCR for the proposed scheme is being recalculated to take account of the revised traffic flow modelling, the revised Air Quality and Noise assessments set out in this ES Supplement and the change in accident reporting dates from 2011-2015 to 2012-2016.

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4. Design Developments and Alternatives Considered

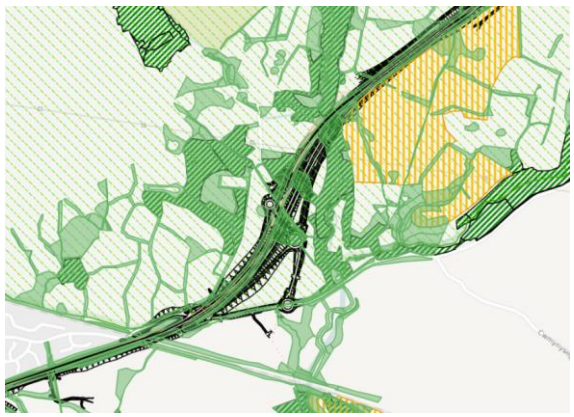
Section 4.6.1.3 Croesbychan junction **requires amendment due to the modifications to the proposed scheme design since July 2017:**

Table 4.7: Design development of Croesbychan junction

The text 'Proposed Scheme' in column 3 should now read '**published scheme in July 2017'**

An additional *'Table 4.7a: Design development of Croesbychan junction since Draft Orders'* should be inserted:

Table4.7a : Design development of Croesbychan junction since publication of Draft Orders in July 2017

February 2018


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5. Proposed Scheme Description

The following amendments are required as a result of the revised traffic model and scheme design changes to the Croesbychan junction since July 2017.

Remove *Table 5.1: Section locations on proposed scheme* in its entirety and replace with the revised *Table 5.1* below.

Table 5.1 : Section locations on the proposed scheme

Section	Start chainage	Finish chainage
Hirwaun junction	0	2500
Hirwaun junction to Croesbychan junction	2500	~~4450~~ **4400**
Croesbychan junction	~~4450~~ **4400**	5550
Croesbychan junction to Baverstock junction	5550	7200
Baverstock junction	7200	8550
Baverstock junction to A470 junction	8550	9800
A470 junction	9800	11200
A470 junction to Prince Charles Hospital junction	11200	12550
Prince Charles Hospital junction	12550	14000
Prince Charles Hospital junction to Dowlais junction	14000	15300
Dowlais junction	15300	17700

Amend Section heading *5.2.1.4 Existing Trewaun junction to Croesbychan (ch. 3200 to ~~4450~~ 4400)*

Amend Section heading *5.2.1.5 Croesbychan junction (ch. ~~4450~~ 4400 to 5550)*

Remove *Section 5.2.1.5 Croesbychan junction (ch. 4400 to 5500)* in its entirety and replace with the following text:

A new grade separated junction would replace the existing staggered junction at Croesbychan. Through this junction the A465 mainline would be on embankment with the junction roundabouts, which would be arranged in a dumbbell arrangement, below the carriageway in order to minimise the visual impact of the road on the wider landscape. The junction configuration would comprise on and off slips from the A465 which extend approximately 100 m from the mainline A465 and the roundabout.

Access from the eastern residential areas of Hirwaun along the local road network at Swansea Road in Hirwaun to the south of the A465 would be routed under the A465, rather than involving the existing staggered junction. Access from Hirwaun onto the A465 would require drivers to go under the A465 (ch. 4650) and then use a roundabout to link to the main dumbbell arrangement of the Croesbychan junction. A 'T' junction to the north would provide access to a minor road. To the south of the A465 at ch. 4850 a roundabout would provide links between Hirwaun, the A465 and the existing road network, to provide the local link to Crematorium Road in Llwydcoed.

Public rights of way (PRoW) that cross the existing A465 at grade would be diverted through the junction with a new non-motorised user (NMU) bridge across the railway being provided.

The centre line of the road would vary from being at the level of the existing A465 road at the railway bridge, to 10 m above the existing ground level between the railway and Nant Melyn Mainline Viaduct.

Remove *Section 5.6 Signage* and replace in its entirety with the following text:

Road signage would be erected on posts in the highways verge and would be bilingual (Welsh and English). **Variable Message Signage would be provided at five locations. Two westbound and Two eastbound on the A465 and one southbound of the A470.**

Remove original *Table 5.7: Location of proposed environmental barriers* and replace in its entirety with the revised *Table 5.7* below.

Table 5.7: Location of proposed environmental barriers

Carriageway	Location description	Approximate chainage	Height	Length	Proposed material
Eastbound	Between Trewaun overbridges (N)	3125 - 3230	2 m	83 m	Weathering steel panels
Westbound	Trewaun South East Retaining Wall 1 (S)	3250 - 3350	2 m	92 m	Weathering steel panels
Eastbound	Trewaun North East Retaining Wall (N)	3250 – 3540	2 m	288 m	Weathering steel panels.
Westbound	Trewaun South East Retaining Wall 2 (S)	3350 - 3410	2 m	66 m	Weathering steel panels with clear acrylic top panels
Westbound	Croesbychan junction (E)	4830 - 5305	1 m	485 m	Steel panels
Eastbound	Taf Fawr Mainline Viaduct	10850 – 11040	2 m	187 m	Steel panels
Westbound	Taf Fawr Slip Road 1 (S)	10950 - 11050	3 m	94 m	Weathering steel panels with clear acrylic top panels
Westbound	Taf Fawr Slip Road 2 (S)	11050 - 11140	2 m	87 m	Weathering steel panels and natural stone masonry in part.
Eastbound	Cefn Coed High Street Overbridge to Taff Trail Footbridge (N)	11160 – 11270	2 m	100 m	Natural stone masonry
Westbound	Cefn Coed High Street Overbridge to Taf Fechan Viaduct (Widened) (S)	11160 – 11380	2 m	207 m	Natural stone masonry
Westbound	Taf Fechan viaduct (Widened) (S)	11430 – 11561	1 m	131 m	Steel panels
Westbound	Taf Fechan **(S)**	11561 - 11780	1 m	219 m	Steel panels

Carriageway	Location description	Approximate chainage	Height	Length	Proposed material
Westbound	Gurnos Farm Underpass to Prince Charles Hospital junction 1 (S)	12305 - 12710	3 m	405 m	Weathering steel panels with clear acrylic top panels
Westbound	Gurnos Farm Underpass to Prince Charles Hospital junction 2 (S)	12710 - 12780	4 m	80 m	Brick faced masonry wall at base, weathering steel panels with acrylic top panels
Westbound	Gurnos Farm Underpass to Prince Charles Hospital junction 3 (S)	12780 - 12960	**3** ~~1~~ m	177 m	Weathering steel panels
Westbound	Pant Road Bridge to Jones Street Bridge (N)	14810 – 15030	**1** ~~3~~ m	**271** ~~220~~ m	Steel panels with clear acrylic top panels
Westbound	Beacons View (Dowlais) (S)	14850 – 14890	2 m	44 m	Weathering steel panels
Westbound	Cross Houlson Street (Dowlais) (S)	14890 – 14970	2 m	81 m	Steel panels with clear acrylic top panels
Westbound	Jones Street (Dowlais) (S)	14970 - 15450	3 m	478 m	Steel panels with clear acrylic top panels
Westbound	Dowlais Top Slip Road (S)	15650 – 16080	1 m	431 m	Weathering steel panels
Westbound	Dowlais Top Mainline (S)	15860 - 16070	1 m	206 m	Steel panels

Remove existing *Table 5.12 Traffic Flows in Opening and Design Year* and replace in its entirety with the revised *Table 5.12* and New *Table 5.12a* below:

Table 5.2: Traffic flows in opening year (2022)

Section 5 and its Catchment Area	DM		DS		DS-DM	
Name of Section	**AADT (Both Directions)**	**%HGV**	**AADT (Both Directions)**	**%HGV**	**Flow Diff.**	**%HGV**
A465 Swansea Road to A470 RBT	30505	6.2%	31250	5.0%	744	-1%
Swansea Road	3605	3.9%	6353	6.5%	2,748	3%
A470 Southbound	27585	3.8%	26671	2.6%	- 914	-1%
A465 Grawen Lane to Galon Uchaf	20482	6.2%	27952	4.7%	7,470	-1%

Section 5 and its Catchment Area	DM		DS		DS-DM	
Name of Section	**AADT (Both Directions)**	**%HGV**	**AADT (Both Directions)**	**%HGV**	**Flow Diff.**	**%HGV**
A4102 High Street (Merthyr Tydfil)	8229	2.6%	8792	2.9%	563	0%
A4102 High Street (Merthyr Tydfil)	10939	4.8%	11002	5.0%	63	0%
A465 Galon Ucahf to Dowlais Top	23126	5.6%	25121	4.9%	1,995	-1%
A4060	18137	5.4%	18173	5.4%	36	0%
A465 Dowlais Top (old)	20988	4.8%	12945	3.7%	- 8,043	-1%
A465 Dowlais Top to Llechryd	35708	6.2%	38808	5.8%	3,100	0%
Section 6 and its Catchment Area	**DM**		**DS**		**DS-DM**	
Name of Section	**AADT (Both Directions)**	**%HGV**	**AADT (Both Directions)**	**%HGV**	**Flow Diff.**	**%HGV**
A465 Glynneath to Hirwaun	21160	6.7%	24352	5.9%	3,192	-1%
A465 Rhigos RBT to A4059 RBT	26417	7.1%	8567	5.4%	-	-
A465 South of Hirwaun (New Section)	-	-	23451	5.8%	5,600	4%
A465 A4059 RBT to Croesbechan	21968	7.3%	23451	5.8%	1,483	-1%
A4059 A465 RBT to Penywaun	15981	5.3%	13415	5.1%	- 2,567	0%
A4059 North of Aberdare	8487	5.6%	8274	7.3%	- 213	2%
A465 Croesbechan to Baverstock	22377	6.8%	24427	5.4%	2,050	-1%
B4276 Merthyr Road	7844	4.5%	10968	4.6%	3,124	0%
A465 Baverstock to Swansea Road	30864	6.2%	31250	5.0%	386	-1%
New section of Swansea Road	-	-	4969	7.5%	5355	6%

Insert New *Table 5.12a Traffic Flows in Design Year as below:*

Table 5.12a: Traffic Flows in design year (2037)

Section 5 and its Catchment Area	DM		DS		DS-DM	
Name of Section	**AADT(Both Directions)**	**%HGV**	**AADT(Both Directions)**	**%HGV**	**Flow Diff.**	**%HGV**
A465 Swansea Road to A470 RBT	35729	5.8%	45536	4.0%	9,807	-2%
Swansea Road	4013	3.7%	5424	7.3%	1,411	4%
A470 Southbound	30380	3.8%	32739	2.5%	2,359	-1%
A465 Grawen Lane to Galon Uchaf	26284	5.4%	40890	3.7%	14,605	-2%
A4102 High Street (Merthyr Tydfil)	8226	2.7%	8424	3.1%	198	0%
A4102 High Street (Merthyr Tydfil)	11897	4.7%	12305	4.9%	409	0%
A465 Galon Ucahf to Dowlais Top	28005	5.1%	35571	3.9%	7,566	-1%
A4060	22551	4.6%	22957	4.5%	406	0%
A465 Dowlais Top (old)	25722	4.2%	15607	3.1%	- 10,115	-1%
A465 Dowlais Top to Llechryd	45469	5.3%	52665	4.6%	7,196	-1%
Section 6 and its Catchment Area	**DM**		**DS**		**DS-DM**	
Name of Section	**AADT (Both Directions)**	**%HGV**	**AADT (Both Directions)**	**%HGV**	**Flow Diff.**	**%HGV**
A465 Glynneath to Hirwaun	28908	5.4%	33339	4.8%	4,431	-1%
A465 Rhigos RBT to A4059 RBT	30621	6.7%	7981	6.4%	-	-
A465 South of Hirwaun (New Section)	-	-	30115	5.0%	7,475	5%
A465 A4059 RBT to Croesbechan	26429	6.6%	30115	5.0%	3,686	-2%
A4059 A465 RBT to Penywaun	21221	4.4%	12363	6.0%	- 8,858	2%
A4059 North of Aberdare	10873	4.9%	13841	5.7%	2,968	1%
A465 Croesbechan to Baverstock	27109	6.1%	43270	3.3%	16,161	-3%
B4276 Merthyr Road	8727	4.4%	5346	7.4%	- 3,381	3%
A465 Baverstock to Swansea Road	36166	5.7%	45536	4.0%	9,370	-2%
New section of Swansea Road	-	-	4155	8.5%	13525	7%

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6. Consultation during Proposed Scheme Development

No changes to Chapter 6 are required.

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7. Environmental Assessment Methodology

No changes to Chapter 7 are required.

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8. Air Quality

The table below summaries the changes in Chapter 8 of this ES Supplement.

Feature	Issue	Summary
Local air quality	Revised traffic model and revised air quality model	No significant effect on local air quality during the operational phase of the proposed scheme.
Twynyrodyn Road Air Quality Management Area (AQMA)	Revised traffic model and revised air quality model	No significant effect on the AQMA is predicted.

The revised Appendices and Figures issued in this ES Supplement that are associated with this chapter are listed below. These directly replace the corresponding Appendices or Figures issued in the July 2017 ES.

Appendices (ES Supplement Volume 2)

Appendix 8A Construction Phase Assessment

Appendix 8B Baseline Monitoring

Appendix 8C Air Dispersion Model Process

Appendix 8D Air Quality Human Receptor Results

Appendix 8E Designated Site Assessment

Figures (ES Supplement Volume 3)

Figure 8.1 EPUK Construction Dust Assessment

Figure 8.2 NO_2 Monitoring Locations

Figure 8.3 Sensitive Ecological Receptors

Figure 8.4 Predicted Change in NO_2 Concentrations Between DM and DS Scenarios for 2022

Figure 8.5 Predicted Change in PM_{10} Concentrations Between DM and DS Scenarios for 2022

The majority of this chapter has been updated. Remove corresponding sections in July 2017 ES Volume 1 Chapter 8 and replace with text provided below.

8.1 Summary

An air quality assessment was undertaken for the construct ion and operational phases of the proposed scheme following Design Manual for Roads and Bridges (DMRB) and the Institute of Air Quality Management (IAQM) guidance.

It is considered that with an appropriate Construction Environmental Management Plan (CEMP) implemented, there would be no unacceptable dust nuisance to receptors during the construction phase and potential effects would be ‘not significant’.

There is not considered to be a significant effect on local air quality during the operational phase of the proposed scheme, and there are no receptors in exceedance of the relevant Air Quality Objectives (AQOs) (i.e. annual average nitrogen dioxide (NO_2) and particulate matter (PM_{10})) AQOs) in either the Do Minimum (DM) (existing alignment without any changes) or Do Something (DS) (with the proposed scheme in place) scenarios in 2022.

The Twynyrodyn Road Air Quality Management Area (AQMA), as shown on Figure 8.2 (ES Supplement Volume 3), is more than 200 m away from the proposed scheme's affected road network. Therefore, it is not expected that the AQMA would be affected with the proposed scheme in place.

There are 14 identified nature conservation sites that are predicted to exceed the annual mean oxides of nitrogen (NO_x) AQO in the opening year (2022) for either the DM or DS scenario and which are predicted to experience changes in pollutant concentrations greater than imperceptible (> 0.4 µg/m^3 magnitude change). These sites have the potential for nutrient nitrogen and / or acid deposition impacts. These results, and associated proposed mitigation, are discussed in Chapter 11: Nature Conservation. However, no national or internationally designated sites exceed the annual mean NOx AQO and therefore, based on DMRB, no nature conservation sites are classed as significant.

In terms of compliance with the EU air pollution limit values, there are no links identified by DEFRA as at risk of compliance within or close to the study area, therefore it is considered that the scheme will not affect the UK's compliance with the EU air pollution limit values.

8.2 Introduction

No change.

8.3 Legislation, Policy and Guidance

There are a number of international, national and local legislation, policy and guidance, which are relevant to air quality. The key legislation, planning policy and guidance relevant to the air quality assessment are provided in this section.

8.3.1 Legislation

No change.

8.3.2 Planning policy

The proposed scheme passes through four planning authority areas. The relevant national and local plans and policies (and how these relate to the air quality assessment) are described in Table 8.3.

***Table 8.3 Summary of key policy* amended to include *Prosperity for All: The National Strategy* under National Policy as below:**

Table 8.3: Summary of key policy

Document	Description	Relevant policies
National Policy		
Prosperity for All: The National Strategy (Welsh Government, 2017a)	*The Prosperity for All: The National Strategy* (Welsh Government, 2017a) is part of *Taking Wales Forward – The Programme for Government 2016 – 2021* (Welsh Government, 2016d). Delivering prosperity for all is the mission of this Welsh Government. In this	The first air quality related 'Well-being Objective' is to build healthier communities and better environments. Within this objective Welsh Government states that the contribution made by the environment to good health cannot be overstated. Air quality, good housing, access to green spaces and energy efficiency schemes each have a part to play in creating the right conditions for better health, well-being and greater physical activity. Welsh

Document	Description	Relevant policies
	document the Welsh Government sets out the four key themes to achieve 'Prosperity for All' in Wales, each of these themes has three 'Well-being Objectives'. Out of these 12 themes, two are related to air quality.	Government commits through planning, infrastructure, regulation, and health communication measures to reduce emissions and deliver vital improvements in air quality. The second 'Well-being Objective' related to air quality is to deliver modern and connected infrastructure. Within this objective Welsh Government states that they will invest in the 21st century connections they need to thrive and compete, joining up people, communities, businesses and services to drive prosperity. The objective states that attitudes to, and expectations of, transport are likely to change in ways that we cannot currently anticipate. With the geography of Wales and the needs of sparsely populated rural communities, cars will remain important, but new powers over buses and the rail franchise mean that we can take a more joined up view across all types of transport, enabling us to reduce our carbon emissions, promote active travel, and get the most from our spending on public transport. Welsh Government will: • deliver a single National Transport Plan supporting improvements to all the transport infrastructure for Wales, balancing travel needs with the aim of reducing emissions; • create an integrated public transport network, covering the rail and bus networks, which is safe, reliable, affordable and low carbon; and • support increased use of low emissions vehicles, through investing in a network of charging points.

8.3.3 Guidance

The air quality assessment was undertaken in line with the key guidance summarised in Table 8.4.

Table 8.4: Summary of key guidance that informed the air quality assessment **amended to include further guidance below:**

Table 8.4: Summary of key guidance that informed the air quality assessment

Document	Description
Environment Agency Air Emissions Risk Assessment for your Environmental Permit (Environment Agency, 2016)	This is part of the Environment Agency guidance (adopted by Natural Resources Wales (NRW)) on risk assessment and gives advice on assessing the effect of releases to air from listed activities when applying for an Environmental Permit. This document includes technical guidance on modelling environmental standards (i.e. AQOs, environmental assessment levels (EALs) and critical loads) and criteria for helping to identify the significance of air quality effects.
Environment Agency AQTAG06 updated version (approved March 2014)	Technical Guidance on detailed modelling approach for an appropriate assessment for emissions to air.

No further changes to this section.

8.4 Methodology

This section outlines the methodology including data collation, consultation and impact assessment criteria that were used in the air quality assessment.

The assessment methodology is unchanged from the 2015 Environmental Scoping exercise. ADMS Roads dispersion modelling software has been upgraded and the DEFRA Emissions Factor Toolkit (EFT) updated since then. The latest ADMS roads model (version 4.1) and EFT emission factors (version 7.0) were used in this assessment along with the most recently published deposition values on the Centre for Ecology and Hydrology's (CEH) Air pollution and Information System (APIS) website (Centre for Ecology and Hydrology, 2017).

8.4.1 Data sources

The assessment was undertaken with reference to a number of information sources, as detailed in Table 8.5.

Table 8.5: Key information sources

Data source	Reference	Information obtained
Rhondda Cynon Taf County Borough Council (RCTCBC)	RCTCBC, 2014: *2014 Progress Report & Further Assessment of Nitrogen Dioxide*.	LAQM information and air quality monitoring data.
Rhondda Cynon Taf County Borough Council (RCTCBC)	RCT, 2015: *2015 Air Quality Updating and Screening Assessment for Rhondda Cynon Taf County Borough Council*.	
Rhondda Cynon Taf County Borough Council (RCTCBC)	RCTCBC, 2016: *Rhondda Cynon Taf County Borough Council Air Quality Progress Report, November 2016*.	
Merthyr Tydfil County Borough Council (MTCBC)	MTCBC, 2014: *2015 Air Quality Progress Report for Merthyr Tydfil County Borough Council*.	
Merthyr Tydfil County Borough Council (MTCBC)	MTCBC, 2017: *Merthyr Tydfil County Borough Council 2016 Air Quality Progress Report*	
Caerphilly County Borough Council (CCBC)	CCBC, 2014: *Air Quality Progress Report for Caerphilly County Borough Council*.	
DEFRA's LAQM Support Tools	Local Air Quality Management 1 km x 1 km grid background pollutant maps. https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html (accessed 31 August 2017).	Mapped background pollutant concentrations.
Centre for Ecology and Hydrology, Air Pollution Information System (APIS)	http://www.apis.ac.uk/ (Accessed October 2017).	Nutrient nitrogen and acid deposition information, and critical loads for the designated ecological sites considered in this assessment.

8.4.2 Study area

8.4.2.1 Construction phase

Various activities at construction sites can give rise to vehicle exhaust emissions from construction vehicles and plant. There is also the potential for dust nuisance at receptors in the vicinity of construction sites and haulage routes associated with the proposed scheme. This nuisance, which is separate from adverse effects on health, can arise through annoyance caused by the soiling of windows, cars, washing and other property or harm to sensitive vegetation.

Potential air quality impacts were considered at selected representative receptor locations within 50 m from the edge of the local access roads up to 500 m from the site entrance(s), and at the following distances from dust raising activities (distances from the site boundary), in accordance with IAQM guidance (IAQM June 2016) and shown in Figure 8.1 (ES Supplement Volume 3):

- 0 to 20 m;
- 21 to 50 m;
- 51 to 100 m; and
- 101 to 350 m.

In line with the IAQM guidance, the assessment also considers ecological receptors up to 50 m from the respective site boundary.

8.4.2.2 Operational phase

In accordance with the Highway Agency's DMRB HA 207/07 Guidance (Highways Agency, 2007a) potential air quality impacts were considered at a local and regional level.

The local assessment considered changes in key pollutant concentrations (NO_x, NO_2 and PM_{10}) as a result of the proposed scheme, at representative sensitive receptor locations. Sensitive receptors are, for example, residential locations, schools, hospitals or sensitive habitats and ecosystems (designated or identified as sites of material consideration) located within 200 m of affected roads and which may be adversely affected by any changes in local air quality. More detail about sensitive receptors is outlined in Section 8.4.5.8.

Affected roads were identified by qualifying criteria published in DMRB HA 207/07 (Highways Agency, 2007a), based on changes between Do Minimum (DM) and Do Something (DS) scenarios, as follows:

- road alignment will change by 5 m or more;
- daily traffic flows will change by >=1,000 Annual Average Daily Traffic (AADT);
- heavy Duty Vehicle (HDV) flows will change by >=200 AADT;
- daily average speed will change by >=10 kilometres per hour (kph); or
- peak hour speed will change by >=20 kph.

The regional assessment used the same study area as for local air quality and examined the change in pollutant emissions (NO_x, CO_2 and PM_{10}) as a result of the proposed scheme.

8.4.3 Baseline assessment

RCTCBC, MTCBC and CCBC have published a series of air quality Review and Assessment documents in accordance with the LAQM process (references are provided in Table 8.5). These documents were obtained and reviewed in order to establish the existing conditions within the study area.

Background NOx, NO_2 and PM_{10} concentrations (for the relevant assessment year) corresponding to the 1 km x 1 km grid squares covering the study area were obtained from the LAQM support tools provided by DEFRA for use in air quality assessment (references are provided in Table 8.5).

To further characterise the environmental baseline within the study area NO_2 diffusion tube monitoring was undertaken by Jacobs over a six month period between July 2015 and February 2016. This included co-location with the automatic NO_2 analyser at Broadway, Pontypridd. Results of the Jacobs six month monitoring survey were adjusted to provide an annual mean concentration using the approach set out in Box 7.9 of DEFRA guidance LAQM.TG16 (DEFRA, 2016).

8.4.4 Construction phase

Air quality modelling of construction traffic was not undertaken as construction traffic data was not available at the time of the study. Consequently, in accordance with DMRB HA 207/07 the effect of construction plant and vehicle emissions was considered qualitatively (i.e. whether the proposed scheme is likely to have a marginal improvement or marginal deterioration in emissions based on the number of HDV movements per Phase (all of which were under 200 HDVs)).

An assessment of potential impacts of dust emissions associated with the construction phase was undertaken in accordance with the IAQM guidance (IAQM, June 2016). The assessment provides a qualitative risk-based appraisal with reference to the proposed scheme in relation to sensitive locations, the planned process and site characteristics.

Full details of the assessment methodology, including consideration of significance is provided in ES Supplement Volume 2 Appendix 8A. A summary is provided in Table 8.6.

Table 8.6: Construction dust methodology summary (further details are in Appendix 8A)

Step	Methodology summary
Step 1	Screen the need for a detailed assessment.
Step 2a	Assess the risk of dust impacts.
Step 2b	Define the Sensitivity of the Area, which includes: 1) sensitive receptor sensitivity based on distance from source; and 2) sensitivity of the construction area to human health.
Step 2c	Define the risk of impacts, based on the risk and sensitivity conclusions from Step 2a and 2b.
Step 3	Site specific mitigation (if required).
Step 4	Determine significant effects.

8.4.5 Operational phase

The air quality impact of vehicle exhaust emissions associated with the proposed scheme was assessed using DMRB HA 207/07 guidance (Highways Agency, 2007a) and associated Interim Advice Notes (IANs), and LAQM TG(16) (DEFRA, 2016). A detailed assessment was carried out, taking into account diurnal changes in traffic flows using Cambridge Environmental Research Consultant Ltd (CERC) Atmospheric Dispersion Modelling System for Roads (ADMS-Roads) v4.1. Details of the modelling and results are provided in ES Supplement Volume 2 Appendix 8B to 8E.

8.4.5.1 Assessment scenarios

The assessment of the proposed dualling of the A465 has considered the following scenarios:

- Baseline 2014;
- Do Minimum (DM) 2022; and
- Do Something (DS) 2022.

In addition to these, Design Year scenarios 15 years after opening (2037) were considered for regional emissions. The assessment covers different pollutants, as follows:

- local air quality, focusing only on the pollutants NO_2 and PM_{10}; and
- regional air quality, focusing on NO_x, PM_{10} and CO_2 emissions.

8.4.5.2 Traffic data

Traffic data for the modelling scenarios was provided from the traffic models produced by Jacobs on behalf of the Welsh Government. The base year air quality modelling uses traffic data, pollution measurements and meteorological measurements from 2014. Committed developments for the opening year (2022) were considered and are included in the traffic predictions for the proposed scheme.

Traffic data representing the average conditions occurring over specified time periods was provided for modelling use and are presented in Table 8.7.

Table 8.7: Traffic data used in modelling

Traffic period	Time period
Annual Average Daily Traffic (AADT)	00:00 – 00:00
Annual Average Weekday Traffic (AAWT)	00:00 – 00:00
AAWT AM Peak (AM)	07:00 – 10:00
AAWT Inter-Peak (IP)	10:00 – 16:00
AAWT PM Peak (PM)	16:00 – 19:00
AAWT Off Peak (OP)	19:00 – 07:00

For each time period, the following traffic data parameters were provided:

- total traffic flow, defined as vehicles / hour;
- percentage HDV; and
- vehicle speed, in kph.

For all detailed air pollution modelling peak hours, inter-peak and off-peak were modelled and used to represent each relevant hours of all days.

8.4.5.3 Local air quality assessment methodology

The assessment of the potential air quality effects of the proposed scheme was undertaken using the ADMS-Roads v4.1 Software, which has been developed by CERC. It is an atmospheric modelling system that focuses on road traffic as a source of pollutant emissions, and is a recognised tool for carrying out air quality impact assessments. The model has been comprehensively validated by both the model developers and independently. It is used both by regulatory authorities and commercially to assist in decisions related to air quality and traffic management, urban planning and public health in many countries around the world. Version 4.1 (March 2017) was used for this assessment. This is an updated version of the ADMS-Roads model used in the March 2017 draft Environmental Statement for the proposed scheme.

It should be noted that dispersion models provide an estimate of concentrations arising from input emissions and historical meteorological data. The estimates produced, while appropriately representing the complex factors involved in atmospheric dispersion, are subject to uncertainty.

Whilst the predictions provided by the models should not be regarded as definitive statements of concentrations that will arise in the future, they are the most reasonable, robust and representative estimates available. The estimates are composed of calculations of the impact of all the modelled emission sources at a single point or location referred to as a receptor.

8.4.5.4 Vehicle emissions

Emission rates were taken from the EFT Version 7.0 (DEFRA, 2016) for Light Duty Vehicles (LDV, less than 3.5 tonnes) and Heavy Duty Vehicles (HDV, greater than 3.5 tonnes) travelling at a certain speed or driving condition along a section of road over an average hour, based on the road traffic data. The emission data for all hours was then used as a key input into ADMS-Roads, along with meteorological data and receptor locations.

8.4.5.5 Model verification

Model verification is the process of adjusting model outputs to improve the consistency of modelling results with respect to available monitored data. In this assessment, model uncertainty was minimised following DEFRA and DMRB HA 207/07 guidance and model verification was undertaken using suitable monitoring data within the study area. Details of the verification process and adjustment factors applied to the modelled output are detailed within ES Supplement Volume 2 Appendix 8C.

8.4.5.6 Background concentrations

DEFRA publishes mapped background pollutant concentrations based on 1 km by 1 km grid squares across the UK; the most recent 2013-based background maps have been used. The mapped data were obtained from the website for the extent of the study area, and for the relevant assessment years (2014 and 2022). The 2014 background maps were compared to available background monitoring sites for NO_x and NO_2, and an adjustment factor of 1.464 was applied to mapped background NOx concentrations following guidance in LAQM.TG(16). Further details are provided in ES Supplement Volume 2 Appendix 8C.

To avoid double counting of road traffic emissions, a step called ‘sector removal’ was undertaken. This is where the contribution from relevant road sectors pertinent to the study area are removed from the total grid square mapped background pollutant concentration. Appropriate adjustments were also made to the mapped background NO_2 concentrations using DEFRA’s NO_2 adjustment for NO_x sector removal tool v5.1.

8.4.5.7 Prediction of environmental concentrations (including adjustment for long term trends in NO_x and NO_2)

The ADMS model was used to predict the road traffic contributions to NO_x and PM_{10} concentrations at specified receptors. Adjustments were applied to the model predictions based on a comparison against measured air quality concentrations, in a process known as model verification and adjustment. Discrepancies between modelled and measured concentrations can arise due to the presence of inaccuracies and / or uncertainties in model input data, modelling and monitoring data assumptions. Model verification and adjustment was undertaken to improve the consistency of modelling results with respect to available monitored data.

The model was then used for predicting air quality concentrations in the future years. A further adjustment step was undertaken to account for the observed trends in the under-prediction of ambient roadside NO_x and NO_2 following Highways Agency IAN 170/12v3 (Highways Agency, 2013c), known as Long Term Trends (LTT) or gap analysis. The current LTTE6 factors (Highways Agency, 2013c) were developed using an older set of road traffic emission factors from EFTv6, which typically predicted lower emission rates than the UK EFT v7. Therefore, use of the LTTE6 factors is likely to result in a conservative approach to the resulting concentrations than a UK EFT v7 consistent long term trends dataset (which didn’t exist at the time of the assessment). The verification and adjustment processes are discussed in more detail in ES Supplement Volume 2 Appendix 8C.

8.4.5.8 Identification of sensitive receptor locations

Within the study area, two types of sensitive receptors were considered:

- human receptors including residential properties and other sensitive receptors (such as schools, nursing homes, etc.); and
- ecological receptors (designated sites at International, European or National level).

The Ordnance Survey Address Layer dataset was used to identify building use within the study area and potentially sensitive human receptor locations. Representative sensitive receptors were then selected based on their proximity to road links affected by the proposed scheme, where the potential effect of the proposed scheme-related traffic emissions on local air pollution would be most significant, and likelihood of exceedance of AQOs.

A total of 96 receptors representative of human health exposure, and 41 ecological receptor transects, (comprising of receptor points at 10 m intervals from the site boundary up to 200 m from the emission source) were modelled to capture the potential effects of the proposed scheme within the study area.

DMRB HA 207/07 (Highways Agency, 2007a) states that consideration of air quality effects on sensitive designated sites, such as Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar locations. This assessment has also considered nationally protected sites and areas identified by the ecologist as being of 'material consideration', which included ancient woodlands (AW), Sites of Interest for Nature Conservation (SINC) and Marsh Fritillary (MF).

A list of receptors included within the air quality model including results are provided in ES Supplement Volume 2 Appendix 8D and 8E and are presented in Figure 8.3 and Figure 8.4 (ES Supplement Volume 3).

Nature conservation boundaries were obtained in Geographic Information System (GIS) format from Natural Resources Wales (NRW, 2016). The ecological receptors of interest within the study area are presented in Figure 8.3 (ES Supplement Volume 3).

8.4.6 Assessment significance criteria

8.4.6.1 Construction phase

The assessment criteria associated with the construction phase impacts on local air quality and dust was based on the IAQM guidance (IAQM, June 2016). Full details of the construction phase assessment methodology including consideration of significance are provided in ES Supplement Volume 2 Appendix 8A.

8.4.6.2 Operational phase

8.4.6.2.1 Human receptors

The AQOs for NO_x, NO_2, and PM_{10} were used as benchmarks in the assessment of NOx, NO_2 and PM_{10} monitored and modelled NO_x, NO_2 and PM_{10} concentrations for all scenarios. The relevant AQOs are detailed in Table 8.2. In order to convey the level of impact of the proposed scheme, it is necessary to determine its significance. The 'significance' of an environmental impact is a function of the 'sensitivity' of the receptor and the 'scale' of the impact. Full details of the operational phase assessment methodology including consideration of significance are provided in ES Supplement Volume 2 Appendix 8C (dispersion modelling methodology), 8D (air quality human receptor results) and 8E (designated site assessment).

The model results were used to assess the potential for significant effects as a result of the proposed scheme.

Highways England's (HE - formerly the Highways Agency) approach to evaluating significant air quality effects is set out in IAN 174/13 (Highways Agency, 2013a). This IAN is intended to reflect the change in England's National Planning Policy Framework 2012 (NPPF) and is in line with the Welsh Government's Planning Policy (PPW).

HE's approach to air quality assessment identifies and assesses sensitive receptors near roads where air quality could potentially be affected. Consequently, areas where AQOs have been shown to already exceed or have the

potential to exceed are considered, such as AQMAs. The model results were used to identify those receptors which are in exceedance of AQOs in either the DM or DS scenario. These are the only receptors which are considered in the judgement of significance. The change in predicted concentration is then calculated as the difference between DS and DM model results at these receptors.

Where the difference in concentrations are less than 1% of the AQO (e.g. less than 0.4 µg/m³ for annual average NO_2) then the change at these receptors is considered to be imperceptible and can be scoped out of the judgement on significance.

HE has developed a framework to provide guidance on the number of receptors for each of the magnitude of change categories that might result in a significant effect. These are guideline values only, and are to be used to inform professional judgement on significant effects of the proposed scheme. The guideline bands are based on the HE considered opinion and are intended to help provide consistency across all HE schemes.

A receptor with a predicted change in concentration greater than 'imperceptible' (i.e. greater than a magnitude of 0.4) is assigned to one of six categories (large, medium and small for either worsening or improvement) where there is a predicted AQO exceedance and then aggregated. If any exceedances are found, then the aggregated values for each category are be compared to guideline ranges provided in IAN 174/13 as presented in Table 8.8.

Table 8.8: Guidance to number of properties constituting a significant effect

Magnitude of change in PM_{10} and NO_2 (µg/m³)	Number of receptors with:	
	Worsening of AQO already above objective or creation of a new exceedance	Improvement of an AQO already above objective or the removal of an existing exceedance
Large (>4)	1 to 10	1 to 10
Medium (>2 to 4)	10 to 30	10 to 30
Small (>0.4 to 2)	30 to 60	30 to 60

Where values are equal to or less than the lower limit of a given category it is considered that the route option is likely to have a 'not significant' effect. Where values are equal to or greater than the upper limit of the range for a given category it has been considered that the potential impact of the route option is likely to cause a 'significant' effect. Where values lie between the guideline ranges for a given category, further consideration based on a balanced judgement of the overall impacts across the whole study area should be undertaken, including consideration of both worsening and improvement.

Greater significance is attributed to magnitudes of change, the higher above the air quality thresholds the prediction is, and to predicted exceedances of short-term air quality thresholds than long-term exceedances.

Proposed scheme effects would be more likely to be significant where:

- there are no / few receptors with any improvements;
- PM_{10} annual averages are also affected by small, medium or large deteriorations; and
- short term exceedances may be caused or worsened by the proposed scheme for either NO_2 or PM_{10}.

Proposed scheme effects are more likely to be not significant where:

- there are receptors with small, medium or large improvements;
- PM_{10} annual averages are not affected by small, medium or large deteriorations; and
- short term exceedances are not caused or worsened by the proposed scheme for either NO_2 or PM_{10}.

The establishment of overall air quality significance for the proposed scheme should also consider:

- whether the proposed scheme detracts or supports measures set out in relevant local authority AQAPs;
- if the proposed scheme represents a low or high compliance risk with the EU directive on air quality; or
- if any designated site(s) are affected and potential effective mitigation.

The establishment of overall air quality significance for the proposed scheme should also consider the EU Directive on Ambient Air Quality and Clean Air for Europe (2008/50/EC). The purpose of the Directive is to protect human health, and the environment as a whole. DEFRA reports annually (on behalf of the UK government) on the status of air quality to the European Commission (EC).

Where predicted changes in NOx concentrations as a result of the proposed scheme are greater than 0.4 µg/m^3 in magnitude at designated sites, significance is determined by the proposed scheme ecologist based on their professional judgement in accordance with IAN 174/13.

8.4.6.2.2 Ecological receptors

In accordance with DMRB IAN 174/13 where predicted NO_x concentrations are greater than the AQO, the magnitude of change has been considered. Where the change is considered to be imperceptible, it is predicted that the effects of the proposed scheme are likely to be not significant. Where the change is greater in magnitude of 0.4 µg/m^3, this information, along with changes in nutrient nitrogen and acid deposition were provided to the proposed scheme ecologist to determine the significance of effects based on their professional judgement and are not discussed further in this chapter (please refer to ES Chapter 11: Nature Conservation). The full methodology and results for the ecological assessment are presented in ES Supplement Volume 2 Appendix 8E.

8.4.7 Uncertainties and limitations

The predicted results from a dispersion model may differ from measured concentrations as outlined in ES Supplement Volume 2 Appendix 8C. In this assessment model uncertainty was minimised following DEFRA and DMRB guidance, which included model verification, background adjustment and adjustment for long term trends in NOx and NO_2.

8.5 Current Baseline Knowledge

8.5.1 Introduction

The baseline conditions provide a reference level against which any potential change in air quality can be assessed and are used to make a judgment as to whether the proposed scheme is appropriate for the area.

The proposed scheme is located within Merthyr Tydfil County Borough Council (MTCBC) and Rhondda Cynon Taf County Borough Council (RCTCBC) and borders western Caerphilly County Borough Council (CCBC). Each Borough has a responsibility to fulfil the requirements for compliance with the AQOs.

8.5.2 Industrial processes

Natural Resources Wales are responsible for regulating large polluting industrial Part A1 processes. Part A1 processes include larger industrial processes such as refineries, intensive farming activities, hazardous waste treatment and waste incineration. Local Authorities are responsible for regulating emissions to air, land and water from less polluting Part A2 installations and emissions to air of all smaller Part B installations.

Emissions to air from these processes are likely to be included in monitored data and background pollutant concentrations used in this assessment.

8.5.3 Local air quality management

MTCBC and RCTCBC undertake review and assessments of air quality as required by the LAQM regime. The most up to date reports at the time or writing are discussed below.

There is currently one AQMA within the administrative boundary of MTCBC declared (on 30 January 2017) for exceedance of the annual mean NO_2 AQO. The AQMA encompasses Twynyrodyn Road from the roundabout at the Western end (Tesco's) to the crossroads between Gilfach-Cynon and Arfryn Place. It is not located within the study area for this assessment (as it is more than 200 m from affected road links in accordance with DMRB guidance). Traffic modelling indicates that in the Do-Something scenario there will be a reduction in AADT of approximately 500 vehicles using Twynyrodyn Road.

Insert level 4 heading '2017 LAQM Progress Report for MTCBC'

The 2017 LAQM Progress Report for MTCBC, reporting on 2016, concluded that AQOs were likely to be achieved in respect of all prescribed pollutants except NO_2. All exceedances of the NO_2 annual mean objective occurred within the Twynyrodyn AQMA. No new or significantly changed sources of NO_2 were identified apart from two proposed developments: the bus station and the Trago Mills retail development.

An air quality assessment was undertaken to support the planning application for the bus station, and diffusion tube monitoring was proposed to be undertaken near the Trago Mills retail development in 2017. It was concluded that there was no need to progress to a detailed assessment in the Progress Report.

8.5.3.1 2016 LAQM Progress Report for RCTCBC

The 2016 LAQM Progress Report for RCTCBC, reports on 2016 monitoring data and other updates to air quality. There are currently 15 AQMAs within the administrative boundary of RCTCBC declared for exceedance of the annual mean NO_2 AQO (the 1-hour mean AQO for NO_2 is likely to be breached within the Cilfynydd AQMA which may need to be amended). None of these AQMAs are within the study area for this assessment; the closest is the Aberdare Town Centre AQMA located greater than 4 km south of the proposed scheme.

The 2016 LAQM Progress Report for RCTCBC reported that air quality is good for the majority of Rhondda Cynon Taf, with AQOs likely to be achieved in respect of all prescribed pollutants, except NO_2. However, some small areas (all within AQMAs) experience elevated levels of NO_2 which exceed the annual mean NO_2 AQO. Poor air quality in these areas is associated with busy urban road junctions, the regional road network or specific local sources. No new or significantly changed sources of NO_2 were identified and it was concluded that there was no need to progress to a detailed assessment in the Progress Report.

There were no CCBC AQMAs of relevance to the proposed scheme.

8.5.4 Air quality monitoring

8.5.4.1 Nitrogen Dioxide (NO_2)

CCBC, MTCBC and RCTCBC undertake ambient monitoring of NO_2 across their administrative areas using automatic monitoring stations and a network of passive diffusion tubes. Table 8.9 presents five years of results at MTCBC locations (CCBC and RCTCBC locations were outside the study area), data have been bias adjusted and details are provided in the relevant MTCBC reports.

Table 8.9: Annual mean NO_2 concentrations at MTCBC diffusion tube sites within the study area

ID (Local Authority ID)	Location	OS Grid Reference		Type	Annual mean NO_2 concentration ($\mu g/m^3$)				
		X	Y		2012	2013	2014	2015	2016
MT_DT_15 (WAQF31)	Gellideg	303360	206822	Suburban	11.5	14.0	11.5	11.9	12.6
MT_DT_02 (WAQF2)	Merthyr Tydfil	304743	206261	Urban Background	16.7	21.8	19.4	16.4	18.1
MT_DT_03 (WAQF15)	Merthyr Tydfil	304866	206137	Urban Centre	20.9	26.2	24.3	23.6	22.9
MT_DT_16 (36)	Tywynroydn	305001	205763	Roadside	38.2	32.8	28.7	26.5	23.5
MT_DT_01 (WAQF1)	Merthyr Tydfil	305044	206534	Roadside	24.1	26.3	23.1	23.2	22.2
MT_DT_19 (44)	Tywynroydn	305141	205940	Roadside	19.0	23.4	19.7	19.7	19.8
MT_DT_08 (29b)	Tywynroydn AQMA	305147	205906	Roadside	28.0	33.1	33.4	33.4	31.5
MT_DT_09 (29D)	Tywynroydn AQMA	305149	205906	Roadside	28.4	31.2	30.6	29.6	31.1
MT_DT_20 (42)	Tywynroydn	305181	205954	Roadside	24.4	19.7	17.1	16.3	17.0
MT_DT_07 (29A)	Tywynroydn AQMA	305217	205880	Roadside	29.2	32.6	29.1	28.5	25.9
MT_DT_21 (43)	Tywynroydn	305240	205965	Roadside	15.4	20.4	17.8	17.7	17.7
MT_DT_10 (29E)	Tywynroydn AQMA	305316	205872	Roadside	21.7	24.7	22.2	22.2	21.5
MT_DT_17 (38)	Tywynroydn AQMA	305382	205872	Roadside	-	**54.8**	**43.3**	**42.5**	**40.9**
MT_DT_18 (39)	Tywynroydn AQMA	305382	205873	Kerbside	-	**49.0**	35.4	36.7	36.0
MT_DT_05 (WAQF29)	Tywynroydn AQMA	305410	205869	Roadside	**41.9**	**49.8**	**45.7**	**44.6**	**43.2**
MT_DT_06 (29J)	Tywynroydn AQMA	305410	205869	Roadside	**-**	**57.0**	**47.5**	**47.1**	**44.0**
MT_DT_12 (29G)	Tywynroydn AQMA	305415	205856	Roadside	22.5	26.0	23.1	23.5	24.5
MT_DT_13 (29I)	Tywynroydn AQMA	305431	205863	Roadside	34.7	38.0	36.5	38.0	37.8
MT_DT_14 (ECC)*	Tywynroydn AQMA	305431	205863	Roadside	-	-	**52.3**	**46.1**	39.7
MT_DT_11 (29F)	Tywynroydn	305521	205836	Roadside	18.7	22.9	22.3	21.0	23.2

ID (Local Authority ID)	Location	OS Grid Reference		Type	Annual mean NO_2 concentration ($\mu g/m^3$)				
		X	Y		2012	2013	2014	2015	2016
MT_DT_04 (WAQF25)	Dowlais	307171	207915	Roadside	22.7	28.7	26.1	25.3	26.4
				NO_2 Annual Mean AQO					**40**

*** = automatic monitoring site. Bold text denotes an exceedance of the AQO.**

An exceedance of the annual mean NO_2 was reported in 2014 and 2015 at the automatic monitoring location (MT_DT_14). The 1 hour mean objective for NO_2 was not exceeded at this automatic site and is unlikely to be exceeded at the diffusion tube sites, because annual mean concentrations less than 60 $\mu g/m^3$ are unlikely to result in exceedances of the 1 hour objective (DEFRA, 2016).

Exceedances of the annual mean NO_2 AQO were also reported at roadside sites along Twynyrodyn Road (WAQF29, 29J, 38 and 39). These exceedances are consistent with declared AQMAs. There have been no exceedances of the annual mean NO_2 at any other monitoring locations between 2012 and 2016.

A six month project specific NO_2 diffusion tube survey was undertaken within the study area, to inform the baseline study and to support the model verification process. The annualised and bias adjusted results are presented in Table 8.10. More detail on the monitoring survey can be found in ES Supplement Volume 2 Appendix 8B.

Table 8.10: Annual mean (2014) NO_2 diffusion tube concentrations ($\mu g/m^3$) from Jacobs sites

ID	Location	OS Grid Reference		Type	Annual Mean (2014) NO_2 Concentration ($\mu g/m^3$)*
		X	y		
J_DT_17	Hirwaun	295089	205532	Roadside	23.7
J_DT_19	Hirwaun	295487	205311	Roadside	22.1
J_DT_16	Hirwaun	295625	205025	Background	18.9
J_DT_18	Hirwaun	295661	205244	Roadside	25.1
J_DT_15	Hirwaun	296113	205098	Roadside	20.6
J_DT_14	Hirwaun	296235	205097	Roadside	35.1
J_DT_20	Hirwaun	296344	205244	Intermediate	17.8
J_DT_21	Hirwaun	296499	205189	Intermediate	15.6
J_DT_22	A465 near Croesbychan	296899	205396	Roadside	19.3
J_DT_23	A465 near Croesbychan	297125	205489	Roadside	39.2
J_DT_11	A465 near Clwydyfagwyr	298320	206561	Kerbside	**43.7**
J_DT_13	Hirwaun	300451	207336	Roadside	10.5
J_DT_12	A465 near Clwydyfagwyr	301718	207185	Roadside	13.6
J_DT_10	A465 near Trefechan	302936	207981	Kerbside	22.2
J_DT_09	A465 near Trefechan	303305	208114	Roadside	20.8
J_DT_07	A465 near Trefechan	303498	208200	Roadside	26.1

ID	Location	OS Grid Reference		Type	Annual Mean (2014) NO_2 Concentration (µg/m³)*
		X	y		
J_DT_08	A465 near Trefechan	304309	208515	Roadside	27.7
J_DT_06	A465 near Pant	305641	208445	Roadside	36.4
J_DT_04	A465 near Pant	306606	208517	Roadside	23.1
J_DT_05	A465 near Pant	306650	208585	Kerbside	17.9
J_DT_03	A465 near Pant	306790	208471	Roadside	20.4
J_DT_02	Dowlais Top A465 Roundabout	307654	208151	Kerbside	34.0
J_DT_24A	Broadway, Pontypridd	307846	189619	Roadside	32.2
J_DT_24B	Broadway, Pontypridd	307846	189619	Roadside	33.0
J_DT_24C	Broadway, Pontypridd	307846	189619	Roadside	31.2
J_DT_01	Dowlais Top A465 Roundabout	307977	208421	Roadside	31.5
NO_2 Annual Mean AQO					**40**

* Annualised NO_2 concentrations from 6 months monitoring data in accordance with DEFRA Guidance (LAQM.TG(16))
Bold text denotes an exceedance of the AQO.

The annualised measured 2015 annual mean NO_2 concentrations were below the annual mean AQO at all Jacobs monitoring sites with the exception of site J_DT_11 (site J_DT_23 was just below the AQO). Monitoring site J_DT_11 is a kerbside site, and site J_DT_23 is a roadside site adjacent to the A465 where AADT flows may be higher than at other locations within the study area. Elevated NO_2 concentrations would be expected at these locations.

The locations of NO_2 diffusion tubes used for verification purposes, within the study area, for this assessment are presented in Figure 8.2 (ES Supplement Volume 3).

8.5.4.2 Particulate Matter (PM_{10})

There are no PM_{10} monitoring sites within the study area. MTCBC report that PM_{10} concentrations have consistently stayed below the long and short term PM_{10} AQOs at a suburban automatic monitoring site outside the study area and that '*PM_{10} is not considered to pose a problem within Merthyr Tydfil*' (MTCBC 2017 Air Quality Progress Report). There are no monitoring sites for CCBC or RCTCBC within the study area.

8.5.4.3 Mapped background pollutant concentrations

The mapped background pollutant concentrations (derived from the DEFRA background maps at a 1 km^2 resolution) were applied to this assessment at each receptor specific location. A comparison between mapped and measured NO_x concentrations was undertaken and the mapped backgrounds adjusted accordingly, the approach is outlined in ES Supplement Volume 2 Appendix 8C. Background concentrations were added to the modelled concentrations to derive the total air pollution concentration at each receptor location. The background concentrations in and around the proposed scheme are well below AQOs for the pollutants of interest. Table 8.11 presents the range of background pollutant concentrations at modelled receptor locations across the study area. Receptor locations are shown in Figure 8.4 (ES Supplement Volume 3).

Table 8.11: Mapped background pollutant concentrations (µg/m^3) at modelled receptor locations across the study area

Pollutant	Annual Mean Pollutant Concentration (µg/m^3) range	
	2014	2022
NO_x	8.0 to 20.4	5.9 to 14.6
NO_2	6.1 to 14.6	4.6 to 10.7
PM_{10}	11.6-17.0	10.9 to 16.1

8.5.5 Ecosystems acid and nutrient nitrogen deposition rates

Site specific nutrient nitrogen and acid deposition information has been taken from APIS (Centre for Ecology and Hydrology, 2017) and are presented in Table 8.12 and Table 8.13. Where more than one habitat is present per ecological site, the most stringent critical loads (CL) are presented. All sites, considered in this assessment are presented below. It is noted that acid and nutrient nitrogen deposition rates currently exceed their relevant Critical Loads at some of these areas. Exceedance of CL is common at designated sites across the UK.

Table 8.12: Site specific critical loads (CL) for nutrient deposition

Site name	Designation	Boundary location		Habitat	Min CL (kg/ha/yr)	Existing N deposition (kg/ha/yr)
		X	Y			
Coedydd Nedd a Mellte	SAC	291832	207530	Broadleaved deciduous woodland	10	31.64
Blaen Cynon_A	SAC	294289	206336	Acid Grassland	10	21.98
Blaen Cynon_B	SAC	295137	205776	Acid Grassland	10	27.58
Dyffrynoedd Nedd a Mellte a Moel Penderyn	SSSI	291832	207530	Semi natural woodland	10	31.6
Cors Bryn-y-gaer_A	SSSI	294289	206336	Acid Grassland	10	23.8
Cors Bryn-y-gaer_B	SSSI	295137	205776	Acid Grassland	10	27.6
Tir Mawr a Dderi Hir, Llwydcoed	SSSI	298456	206616	Neutral Grassland	20	27.6
Bryncarnau grasslands, Llwydcoed	SSSI	300055	206736	Acid Grassland	10	27
Cwm Taf Fechan woodlands_B	SSSI	303712	207627	Broadleaved deciduous woodland	10	37.24
Cwm Taf Fechan woodlands_A	SSSI	303842	208469	Broadleaved, mixed and yew woodland	10	37.2

Site name	Designation	Boundary location		Habitat	Min CL (kg/ha/yr)	Existing N deposition (kg/ha/yr)
		X	Y			
Cwm glo a glyndyrys	SSSI	304822	205070	Acid Grassland	10	27
Hirwaun Industrial Estate	SINC	293545	206570	Fen, marsh and swamp	10	23.8
Hirwaun Ponds	SINC	294920	205527	Marshy Grassland	10	23.8
Hirwaun Common	SINC	294967	205540	Acid Grassland	15	23.8
Proposal - Hirwaun Common_B	SINC	295761	205154	Acid Grassland	15	27.58
Hirwaun Ironworks	SINC	296757	205331	Neutral Grassland	20	27.58
Proposal - Upper Cynon Floodplain	SINC	296766	205320	Broadleaved, mixed and yew woodland	10	36.54
Nant Hir Gywddel	SINC	299104	204990	Broadleaved, mixed and Yew Woodland	10	38.5
Proposal - Nant Hir Valley & Reservoir	SINC	299420	207063	Broadleaved, mixed and yew woodland	10	36.54
East Llwydcoed	SINC	299512.9	204328.4	Neutral Grassland	20	28.7
Bryn Defaid Heath	SINC	300174	205723	Acid Grassland	10	27.02
Aberdare Mountain	SINC	300448	206140	Coniferous woodland	5	37.24
Winchfawr West	SINC	301233	207326	Dwarf shrub heath	10	25.48
Coed Meurig Pastures	SINC	301883	207331	Acid Grassland	15	27.02
Gellideg North Fields	SINC	302668	207120	Neutral Grassland	20	27.02
Cilsanws Common	SINC	302858	208377	Acid grasslands	10	27.02
Cwm Ffwrdd	SINC	302965	207572	Broadleaved, mixed and yew woodland	10	37.24
Cwm Taf Fields & Cefn Coed Tip	SINC	303037	207544	Broadleaved, mixed and yew woodland	10	37.24

Site name	Designation	Boundary location		Habitat	Min CL (kg/ha/yr)	Existing N deposition (kg/ha/yr)
		X	Y			
Cyfarthfa Park	SINC	304107	207837	Broad leaved, mixed and yew woodland	10	37.24
Gurnos Wood	SINC	304539	208645	Broadleaved, mixed and yew woodland	10	35.42
Afon Taf	SINC	304832	205714	Broadleaved, mixed and yew woodland	10	37.24
Bryniau_A	SINC	305113	208561	Acid Grassland	10	24.92
Bryniau_B	SINC	305621	208768	Acid Grassland	10	24.92
Pan March and Traed y Milwyr, Llechryd	SINC	308913	208896	Acid Grassland	10	24.92
Ancient Semi Natural Woodland_13689	AW	298593	206831	Broadleaved, mixed and yew woodland	10	36.54
Ancient Woodland_21419	AW	303866	207804	Broadleaved, mixed and yew woodland	10	37.24
Restored Ancient Woodland Site_21423	AW	304050	208381	Broadleaved, mixed and yew woodland	10	37.24
Proposal - Hirwaun Common_A	MF	295561	205249	Acid Grassland	15	27.58
Marsh Fritillary_FID10	MF	296289	205025	Marshy Grassland	10	27.58
Marsh Fritillary	MF	297159	205592	Neutral Grassland	20	27.58
Llwydcoed Slopes	MF	299567	207051	Neutral Grassland	20	27.58

Table 8.13: Site specific critical levels (CL) for acid deposition

Site name	Habitat	Critical Load (CL) (KEqH+/ha/yr)			Estimated acid deposition (KEqH+/ha/yr)	
		CL MaxS	CL MinN	CLmaxN	Existing deposition (N)	Existing deposition (S)
Coedydd Nedd a Mellte	Broadleaved deciduous woodland	0.500	2.957	2.457	2.26	0.55
Blaen Cynon_A	Acid Grassland	0.581	1.161	0.580	1.70	0.49
Blaen Cynon_B	Acid Grassland	0.438	2.208	1.770	1.97	0.57
Dyffrynoedd Nedd a Mellte a Moel Penderyn	Semi natural woodland	0.500	2.957	2.457	2.26	0.55
Cors Bryn-y-gaer_A	Acid Grassland	0.581	1.161	0.580	1.70	0.49
Cors Bryn-y-gaer_B	Acid Grassland	0.438	2.208	1.770	1.97	0.57
Tir Mawr a Dderi Hir, Llwydcoed	Neutral Grassland	0.581	1.201	0.620	1.97	0.57
Bryncarnau grasslands, Llwydcoed	Acid Grassland	0.581	1.201	0.620	1.93	0.53
Cwm Taf Fechan woodlands_B	Broadleaved deciduous woodland	0.357	4.052	3.695	2.66	0.62
Cwm Taf Fechan woodlands_A	Broadleaved, mixed and yew woodland	0.285	2.044	1.759	2.66	0.62
Cwm glo a glyndyrys	Acid Grassland	0.438	2.208	1.770	1.93	0.53
Hirwaun Industrial Estate	Fen, marsh and swamp	Not sensitive to acidity			1.70	0.49
Hirwaun Ponds	Marshy Grassland	Not sensitive to acidity			1.70	0.49
Hirwaun Common	Acid Grassland	0.580	1.161	0.580	1.70	0.49
Proposal - Hirwaun Common_B	Acid Grassland	0.438	2.208	1.770	1.97	0.57
Hirwaun Ironworks	Neutral Grassland	1.071	5.119	4.048	1.97	0.57
Proposal - Upper Cynon Floodplain	Broadleaved, mixed and yew woodland	0.357	4.120	3.763	2.61	0.65
Nant Hir Gywddel	Broadleaved, mixed and Yew Woodland	0.500	3.172	2.672	2.75	0.67
Proposal - Nant Hir Valley & Reservoir	Broadleaved, mixed and yew woodland	0.500	3.188	2.688	2.61	0.65
East Llwydcoed	Neutral Grassland	0.856	4.904	4.048	2.05	0.58
Bryn Defaid Heath	Acid Grassland	0.581	1.201	0.620	1.93	0.53

Site name	Habitat	Critical Load (CL) (KEqH+/ha/yr)			Estimated acid deposition (KEqH+/ha/yr)	
		CL MaxS	CL MinN	CLmaxN	Existing deposition (N)	Existing deposition (S)
Aberdare Mountain	Coniferous woodland	0.500	3.149	2.649	2.66	0.62
Winchfawr West	Dwarf shrub heath	0.860	1.490	0.630	1.82	0.58
Coed Meurig Pastures	Acid Grassland	0.581	1.201	0.620	1.93	0.53
Gellideg North Fields	Neutral Grassland	1.214	5.262	4.048	1.93	0.53
Cilsanws Common	Acid grasslands	0.223	1.243	1.020	1.93	0.53
Cwm Ffwrdd	Broadleaved, mixed and yew woodland	0.500	3.161	2.661	2.66	0.62
Cwm Taf Fields & Cefn Coed Tip	Broadleaved, mixed and yew woodland	0.357	4.052	3.695	2.66	0.62
Cyfarthfa Park	Broad leaved, mixed and yew woodland	0.357	4.012	3.655	2.66	0.62
Gurnos Wood	Broadleaved, mixed and yew woodland	0.360	4.030	3.670	2.53	0.67
Bryniau_A	Acid Grassland	0.438	2.168	1.730	1.78	0.48
Bryniau_B	Acid Grassland	0.438	2.168	1.730	1.78	0.48
Pan March and Traed y Milwyr, Llechryd	Acid Grassland	0.581	1.131	0.550	1.67	0.44
Ancient Woodland_21419	Broadleaved, mixed and yew woodland	0.357	4.052	3.695	2.66	0.62
Restored Ancient Woodland Site_21423	Broadleaved, mixed and yew woodland	0.357	4.016	3.659	2.66	0.62
Proposal - Hirwaun Common_A	Acid Grassland	0.438	2.208	1.770	1.97	0.57
Marsh Fritillary_FID10	Marshy Grassland	Not sensitive to acidity			1.97	0.57
Marsh Fritillary	Neutral Grassland	1.071	5.119	4.048	1.97	0.57
Llwydcoed Slopes	Neutral Grassland	1.214	5.262	4.048	1.97	0.57
Blaen Cynon_A	Acid Grassland	0.581	1.161	0.580	1.70	0.49
Blaen Cynon_B	Acid Grassland	0.438	2.208	1.770	1.97	0.57

8.5.6 Baseline air quality

The ADMS model was used to estimate contributions of vehicle exhaust emissions to annual NO_2 and PM_{10} concentrations for the 'baseline' scenario (2014). A total of 96 sensitive human receptors were selected to represent 'worst case' locations across the study area and to highlight the spatial variability of predicted concentrations with (Do Something) and without (Do Minimum) the proposed scheme. These are outlined in ES Supplement Volume 2 Appendix 8D and presented in Figure 8.4 (ES Supplement Volume 3).

A total of 41 sites representing areas of ecological sensitivity were selected for consideration in this assessment. Point locations along transects (at 10 m intervals), from the ecological site boundary and extending out by up to 200 m have been modelled and are outlined in ES Supplement Volume 2 Appendix 8E and presented in Figure 8.3 (ES Supplement Volume 3). Table 8.14 show receptors results for those above 30 µg/m^3 annual average NO_2 in 2014.

Table 8.14: Predicted NO_2 and PM_{10} annual mean concentrations (2014) at sensitive receptors

Receptor ID	Annual mean pollutant concentration (µgm-3) – 2014)	
	NO_2	PM_{10}
R014	34.2	18.8
R017	32.9	17.3
R024	34.2	17.0
R025	31.5	17.6
R030	35.7	18.8
R032	**44.7**	20.6
R036	39.4	19.8

Predicted annual mean NO_2 concentrations for the base year (2014) were below the annual mean AQO (40 µgm^{-3}) at all sensitive human receptors modelled with the exception of R032 near Galon Uchaf and R036 was also close to the AQO near Pen-y-wern.

Based on DEFRA guidance, it may be assumed that exceedances of the 1-hour mean AQO for NO_2 are unlikely where predicted annual mean concentrations are less than 60 µg/m^3.

The highest annual mean NO_2 concentrations were predicted at Receptors R014, R030, R032 and R036 which are near the A465. R017, R024, and R025 are all on roads leading to the A465. R032 is located on the current A465 junction near Galon Uchaf, near the southern roundabout.

Concentrations of PM_{10} are well below the annual mean AQO (40µgm^{-3}) at all locations. Similarly, the 24-hour mean PM_{10} Objective is predicted to be met at all identified receptor locations as the predicted annual mean concentrations are less than 32 µg/m^3.

8.5.7 Future Baseline Conditions

Between 2012 and 2016 annual mean NO_2 concentrations decreased at the majority of monitoring sites, as presented in Table 8.9. It is likely that future NO_2 concentrations at these sites will experience similar trends i.e. a slight decreasing or flat trend.

Annual mean NO_2 concentrations are predicted to decrease at all modelled sensitive receptor locations between the base year 2014 and 2022 (do minimum scenario). Modelled results are outlined in ES Supplement Volume 2 Appendix 8D.

8.6 Impact Assessment

8.6.1 Construction phase

There is the potential for dust nuisance during the construction phase of the proposed scheme. The level and distribution of construction dust emissions will depend on where within the application site the dust raising activity takes place, the nature of the activity and controls, and meteorological dispersion conditions.

A qualitative assessment of construction phase dust and PM_{10} emissions was carried out in accordance with the latest IAQM guidance (IAQM, June 2016). Full details of the methodology and dust assessment undertaken are provided in ES Supplement Volume 2 Appendix 8A.

The assessment has identified that there are potentially high-sensitivity dust receptors located in the vicinity of the construction boundary, as set out in Table 8A.7 in ES Supplement Volume 2 Appendix 8A. Given the distribution of the receptors around the proposed scheme there is the potential for dust generated on-site to be blown towards receptors, with receptors to the north-northeast and northeast being downwind more frequently.

A summary of the risk of dust impact on both dust soiling and human health effects of PM_{10}, and ecological receptors for each construction activity before mitigation are summarised in Table 8.15. It should be noted the risks presented in Table 8.15 represents the worse-case (i.e. the highest risk) for each phase of the proposed scheme and assessed ecological receptors. A full description of the assessment of dust from demolition and construction including the assigned risk for each stage of the proposed scheme and ecological receptors is provided in ES Supplement Volume 2 Appendix 8A.

Phase 1 of the construction works would be between Hirwaun junction (chainage (ch.) 0) and Nant Melyn Mainline Viaduct (ch. 5450). This would comprise approximately 4.5 km of online widening and 1.5 km of new offline road construction. The route would be upgraded to dual-two running (D2AP) under TTM (temporary traffic management) at all online sections. There would be three major road junction upgrades, demolition and replacement of a live railway crossing, construction of a significant viaduct structure at Nant Melyn as well as several smaller road bridges and underpasses.

Phase 2 of the works would be between Nant Melyn Mainline Viaduct and the A470 junction and would comprise approximately 4.5 km of online widening and 0.5 km of new offline road construction. The route would be upgraded to dual-two running (D2AP) under TTM at all online sections. There would be two major road junction upgrades including a cutting operation at Baverstock and new mainline viaduct structure approximately 180 m long at Taf Fawr. As well as an additional reservoir crossing at Nant Hir and local underpass to Nant Moel Reservoir.

Phase 3 of the works would be between A470 junction and Dowlais junction and comprise approximately 4.5 km of online widening and approximately 1 km of new offline road construction. The route would be upgraded to dual-two running (D2AP) under TTM at all online sections. There would be three major grade separated junctions, road bridges / underpasses and several retaining walls.

Details of construction activities for each phase of the proposed scheme are provided in the A465 Constructability and Phasing Report (Jacobs, 2017c).

Table 8.15: Summary of dust risk at human and ecological receptors

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Phase 1 between Hirwaun Ponds and Nant Melyn.				
Dust Soiling	High Risk	High Risk	Medium Risk	High Risk
Human Health	Medium Risk	Low Risk	Low Risk	Low Risk
Ecological	High Risk	High Risk	Medium Risk	High Risk
Phase 2 between Nant Melyn Mainline Viaduct and the A470 junction.				
Dust Soiling	High Risk	High Risk	Medium Risk	Medium Risk
Human Health	Medium Risk	Low Risk	Low Risk	Low Risk
Ecological	High Risk	High Risk	Medium Risk	High Risk
Phase 3 between the A470 junction and Dowlais junction.				

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High Risk	High Risk	Medium Risk	High Risk
Human Health	Medium Risk	Low Risk	Low Risk	Low Risk
Ecological	High Risk	Medium Risk	Low Risk	Low Risk

The dust risks summarised in Table 8.15 for each activity and each phase of work were used to identify the recommended level of good practice mitigation and control measures as part of the dust assessment (ES Supplement Volume 2 Appendix 8A). The proposed mitigation measures to be implemented would be set out in a Construction Environmental Management Plan (CEMP).

The proposed scheme is a fairly large construction site, but not unusual in scale in comparison with other major infrastructure projects in the UK. There are mitigation methods already available that have been successfully applied on other schemes to manage emissions of dust, such that significant off-site effects have not occurred. Such measures are considered to be normal good practice that would be adopted by any contractor meeting the requirements of a CEMP. It is considered that there are no potentially dust generating activities proposed that could not be managed using normal good practices (IAQM, June 2016) so as to prevent significant effects at any off-site receptor, including those located within 20 m of the construction boundary of the proposed scheme. This should be considered in conjunction with the analysis of local climatic and soil conditions, which shows that the likelihood of dust being emitted by wind erosion and being transported to off-site receptor locations is relatively low.

The IAQM guidance (IAQM, June 2016) notes that, with the application of good practice mitigation measures of the type available for use on the proposed scheme, the environmental effect would not be significant at any off-site receptor. IAQM guidance (IAQM, June 2016) notes that, even with a rigorous package of mitigation measures in place, such as is proposed to be included in the CEMP and set out in ES Supplement Volume 2 Appendix 8A, occasional impacts may occur. A CEMP would be developed to provide a framework by which the level of mitigation is adapted to respond proactively to the changing risk of dust emissions, so that significant effects are prevented.

With the mitigation measures applied (set out in ES Supplement Volume 2 Appendix 8A), to be specified in a CEMP, the likely effect of dust emissions on human health, amenity and ecological receptors during construction is concluded to be not significant.

8.6.2 Operational phase

8.6.2.1 Assessment of local air quality effects

This section presents the effects of the proposed scheme in the operation phase on local air quality along affected roads in the study area. The results presented throughout this section are based on the values predicted using the Long Term Trends (LTT_{E6}) for NOx and NO_2 (for further information see Section 8.4.5). The Long Terms Trends method is not relevant for PM_{10}.

The biggest impacts are outlined below:

- At the eastern end of the proposed scheme, near Dowlais Top, due to the relocation of the existing junction at Galon Uchaf, the traffic model predicts some re-routing of vehicles along High Street and Victoria Street to access the Pant area and Pontsticill Road to / from the Brecon Beacons. There is a predicted increase in vehicles of between 1500 and 2600 on these road sections, and a subsequent increase in predicted annual mean NO_2 concentrations of between 2-5 μgm^{-3} at receptors in close proximity to these roads. The greatest increase in NO_2 concentrations are predicted to occur here, however, there are no predicted exceedances of the annual average NO_2 AQO within the study area as a result of the proposed scheme.

- Receptors modelled within close proximity to sections of the A465 between Galon Uchaf and Gurnos ring road (close to Prince Charles hospital), are predicted to experience small increases (2.7 to 3.3 μgm^{-3}) in annual mean NO_2 concentrations which is largely a result of increased traffic flowing past this area as a result of the A465 dualling. The new junction near Pen-Y-Dre High School is also expected to attract more traffic.
- Away from the proposed A465 dualling there are predicted increases in pollutant concentrations due to re-routing. The replacement of the existing Trewaun junction with a flyover has resulted in alternative routing of traffic to access the A465, through Llwydcoed. An increase of 33% in AADT is anticipated, which is predicted to result in an increase of 2.3 μgm^{-3} of NO_2 concentration at R017. There is potential for the increase to be mitigated in the future depending on whether the proposed Cynon Valley Gateway goes ahead.
- The remaining impacts are mainly beneficial with reductions in concentrations of annual mean NO_2 between 2 and 3 μgm^{-3}. This can mainly be attributed to the re-alignment of the road resulting in sensitive human receptors being further from the traffic. The clearest example of this is the proposed offline section south of Hirwaun which routes the A465 traffic away from Hirwaun and decreases through traffic on Brecon Road.

Modelled annual mean NO_2 and PM_{10} results and changes in pollutant concentrations between the Do Minimum (DM) and Do Something (DS) scenarios for 20 selected human heath receptor locations across the study area experiencing the greatest change in NO_2 concentrations (more than 2 $\mu g/m^3$) are presented in Table 8.16. Results for all 96 modelled receptors are provided in ES Supplement Volume 2 Appendix 8D. The change in NO_2 concentrations across the study area at all modelled human health receptors are presented in Figure 8.4 (ES Supplement Volume 3).

Concentrations of PM_{10} and NO_2 are predicted to be below the AQOs at all modelled human health receptors in 2022 and there are no predicted exceedances due to the introduction of the proposed scheme.

Of the 96 human health receptors modelled annual mean NO_2 concentrations are predicted to improve at 21 receptors, deteriorate at 74 receptors with no change at 1 receptor once the proposed scheme is operational (DS) compared to the Do-minimum (DM) scenario. Results for all receptors can be found in ES Supplement Volume 2 Appendix 8D.

Table 8.16: Predicted 2022 annual mean NO_2 and PM_{10} concentrations (µg/m3) at selected locations

Receptor	Address	DM 2022		DS 2022		Change in Concentration (DS-DM)	
		NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}
R006	Bron-Gelli, Swansea Road, Merthyr Tydfil	18.6	14.9	20.8	15.3	2.1	0.4
R010	Station House, Rhymney Common Road, Merthyr Tydfil	24.3	15.7	21.5	14.6	-2.9	-1.1
R013	Newlands, Johnson Park, Hirwaun	22.6	17.2	19.4	16.2	-3.2	-1.0
R014	1 Trewaun, Hirwaun	29.8	18.4	24.4	16.9	-5.3	-1.5
R017	18 Miners' Row, Aberdare	29.0	17.0	31.3	17.4	2.3	0.4
R021	Coed Meurig Farm, Swansea Road, Merthyr Tydfil	21.2	15.3	18.0	14.1	-3.2	-1.2
R024	82 High Street Caeharris, Merthyr Tydfil	28.3	16.2	32.3	17.1	4.0	0.9
R025	3 New Houses, High Street Top Dowlais, Merthyr Tydfil	27.3	17.0	32.3	18.0	5.0	1.0
R026	7 Beacon Heights, Merthyr Tydfil	13.4	13.0	16.1	13.5	2.7	0.5
R031	Unit 35 Pant Industrial Estate, Merthyr Tydfil	19.1	15.8	22.5	16.4	3.4	0.6

Receptor	Address	DM 2022		DS 2022		Change in Concentration (DS-DM)	
		NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}
R036	1 Beacons View, Beacons View, Merthyr Tydfil	33.5	19.3	36.6	18.6	3.1	-0.7
R055	3 Gurnos Farm Cottages, Gurnos Ring Road, Merthyr Tydfil	12.7	14.2	15.1	14.5	2.4	0.3
R065	32 Pen Gurnos, Merthyr Tydfil	17.0	15.1	19.8	15.5	2.8	0.4
R069	6 Wellingtonia Close, Merthyr Tydfil	15.4	14.7	18.7	15.3	3.2	0.6
R075	Jah-Jireh Charity Home, Heads of The Valleys Road, Merthyr Tydfil	15.3	13.4	12.6	12.6	-2.7	-0.8
R081	Dowlais Primary School - Junior Department, High Street Caeharris, Merthyr Tydfil	21.3	14.7	23.4	15.0	2.1	0.3
R090	Pen-Y-Dre School Bungalow, Goitre Lane, Merthyr Tydfil	11.7	13.8	15.0	14.5	3.3	0.7
R093	Pen-Y-Dre High School, Goitre Lane, Merthyr Tydfil	12.7	14.2	15.4	14.7	2.7	0.5
R205	30 Victoria Street, Merthyr Tydfil	20.9	15.9	24.4	16.7	3.4	0.8
R220	Kimberley Bungalow, Pontsarn Road, Merthyr Tydfil	14.2	14.7	18.0	15.5	3.7	0.8

8.6.2.2 Significance of local air quality effects

Based on the Highways England guidelines for the consideration of significant effects (Highways Agency, 2013b), the results for the NO_2 and PM_{10} annual mean AQOs are summarised in Table 8.17.

Table 8.17: Sensitive receptors informing the proposed scheme significance of effect on local air quality

Magnitude of Change in Annual Average NO_2 and PM_{10} ($\mu g/m^3$)	Total number of receptors with:			
	Worsening of AQO already above objective or creation of a new exceedance		Improvement of an AQO already above objective or the removal of an existing exceedance	
	NO_2	PM_{10}	NO_2	PM_{10}
Large (>4)	0	0	0	0
Medium (>2 to 4)	0	0	0	0
Small (>0.4 to 2)	0	0	0	0

Receptors are only included in the overall judgement of significant effects where they exceed the AQOs. Exceedances of AQOs for NO_2 or PM_{10} are not predicted at any modelled human health receptors, therefore there is not considered to be a significant effect on local air quality as a result of the proposed scheme for these pollutants.

It is predicted that the proposed scheme would lead to large magnitude improvement and worsening in annual mean NO_2 concentrations at some receptors as a result of changes in the road alignment and flows, but these receptors are not in exceedance of AQOs.

It is not considered that the proposed scheme would alter the UK's ability to comply with the EU Air Quality Directive, as the nearest links that have been modelled by DEFRA in the study area are the A4054 and A4059. These links have a predicted roadside NO_2 concentrations in 2019 ranging between 11 - 20 µgm^3. These links are not heavily impacted by the proposed scheme and therefore there is no expectation that the proposed scheme will prevent the UK from achieving the EU Air Quality Annual Average NO_2 limit value of 40 µgm^3.

8.6.2.3 Assessment of ecological effects

Sites predicted to exceed the annual mean NO_x AQO (30 µg/m^3) without (DM) and with (DS) the proposed scheme in place have the potential for significant effects to occur and further consideration is given to the magnitude of change at these locations. If the magnitude of change is less than 0.4 µg/m^3, the effects are considered to be imperceptible and unlikely to be significant. Where changes are greater in magnitude than 0.4 µg/m^3, this information along with changes in nutrient nitrogen and acid deposition are passed to the ecologist for the determination of significance based on professional judgment. As DMRB has been followed none of the DMRB defined ecological sites (e.g. Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protection Areas (SPAs) and Ramsars) meet these criteria. However, a number of Sites of Importance for Nature Conservation (SINC), Ancient Woodland (AW) and Marsh Fritillary (MF) sites do exceed the NOx annual mean AQO and have a magnitude of change greater than 0.4 µg/m^3. These are considered further in the Nature Conservation chapter and are shown in Table 8.18. The results from all ecological receptors modelled are presented in ES Supplement Volume 2 Appendix 8E, along with supporting nitrogen and acid deposition information.

It is noted that ecological receptor points, which are removed as a result of the scheme (i.e. built over or affected by construction works) are removed from the determination of significance as they will no longer exist. These areas are shown in Figure 8.3 (ES Supplement Volume 3).

Table 8.18: Predicted annual mean NO_x concentrations

The numerical suffix after the receptor name is indicative of the receptor point distance in 10 m intervals from the site boundary. i.e. 0 represents the site boundary and 1 represents 10 m, 2 represents 20 m etc. from the site boundary.

Receptor name	Annual Mean NO_x Concentration (µg/m³) AQO = 30 (µg/m³)			Determination for further consideration required			Further consideration required (Y/N)
	DM	DS	Change (DS-DM)	DM> AQO	DS> AQO	Change with proposed scheme >+-0.4 (µg/m³)	
Proposal - Hirwaun Common_A_0	51.7	28.2	-23.6	Exceedance	-	Y	Y
Proposal - Hirwaun Common_A_1	30.7	20.6	-10.1	Exceedance	-	Y	Y
Proposal - Hirwaun Common_B_0	41.4	24.7	-16.7	Exceedance	-	Y	Y
Proposal - Hirwaun Common_B_1	30.2	20.7	-9.5	Exceedance	-	Y	Y
Pan March and Traed y Milwyr, Llechryd_0	89.3	84.3	-4.9	Exceedance	Exceedance	Y	Y
Pan March and Traed y Milwyr, Llechryd_1	50.6	53.7	3.2	Exceedance	Exceedance	Y	Y
Pan March and Traed y Milwyr, Llechryd_2	40.0	43.3	3.3	Exceedance	Exceedance	Y	Y
Pan March and Traed y Milwyr, Llechryd_3	33.3	36.3	3.0	Exceedance	Exceedance	Y	Y
Pan March and Traed y Milwyr, Llechryd_4	29.1	31.7	2.6	-	Exceedance	Y	Y
East Llwydcoed_0	48.4	56.4	8.0	Exceedance	Exceedance	Y	Y
East Llwydcoed_1	26.7	30.0	3.4	-	Exceedance	Y	Y

Receptor name	Annual Mean NO_x Concentration (µg/m³) AQO = 30 (µg/m³)			Determination for further consideration required			Further consideration required (Y/N)
	DM	DS	Change (DS-DM)	DM> AQO	DS> AQO	Change with proposed scheme >+-0.4 (µg/m³)	
Cwm Ffwrdd_0	48.9	48.2	-0.7	Exceedance	Exceedance	Y	Y
Cwm Taf Fields & Cefn Coed Tip_0	49.9	48.6	-1.2	Exceedance	Exceedance	Y	Y
Cwm Taf Fields & Cefn Coed Tip_1	32.9	32.5	-0.4	Exceedance	Exceedance	Y	Y
Ancient Woodland_21419_0	32.3	28.3	-4.0	Exceedance	-	Y	Y
Afon Taf_0	31.4	33.5	2.1	Exceedance	Exceedance	Y	Y
Nant Hir Gywddel_0	40.5	51.7	11.2	Exceedance	Exceedance	Y	Y
Proposal - Upper Cynon Floodplain_2	26.2	40.5	14.3	-	Exceedance	Y	Y
Proposal - Upper Cynon Floodplain_3	22.3	30.7	8.4	-	Exceedance	Y	Y
Coed Meurig Pastures_3	21.9	34.1	12.2	-	Exceedance	Y	Y
Bryniau_B_0	27.5	32.3	4.7	-	Exceedance	Y	Y
Bryn Defaid Heath_0	28.2	35.2	7.1	-	Exceedance	Y	Y
Hirwaun Industrial Estate_0	29.0	31.7	2.7	-	Exceedance	Y	Y

Summary

The majority of sites assessed are likely to experience no significant effects as a result of the proposed scheme based on predicted NOx concentrations and the 'imperceptible' magnitude of change.

There are both beneficial and adverse effects predicted at ecological receptors as a result of the proposed scheme, however, there are no European or nationally designated sites predicted to experience an exceedance of the annual mean NOx AQO. For other sites the DMRB IAN174/13 criteria have also been applied and the results are discussed within Chapter 11: Nature Conservation.

8.6.2.4 Assessment of regional air quality effects

An assessment of regional emissions was undertaken using EFT version 7. The results for the baseline 2014, opening year 2022 and design year 2037 scenarios are in presented in Table 8.19 and Table 8.20.

Table 8.19: Regional air quality assessment (Opening Year 2022)

DM vs DS 2022	Total emissions (tonnes per year)		
	NO_x	PM_{10}	CO_2
DM	73.9	12.6	55571.1
DS	81.6	12.4	57687.4
DS-DM	7.7	-0.17	2116
% change	10.4%	-1.3%	3.8%
NAEI UK Emission from Road Transport (Tonnes) 2015	311,367	20,554	110,728,490
% of UK Total Road transport emissions	0.0025%	-0.0008%	0.0019%

Table 8.20: Regional Air Quality Assessment (Design Year 2037)

DM vs DS 2037	Total emissions (tonnes per Year)		
	NO_x	PM_{10}	CO_2
DM	59.5	14.9	64451.6
DS	70.8	15.6	70897.6
DS-DM	11.3	0.7	6446
% change	19.0%	4.7%	10.0%
NAEI UK Emission from Road Transport (Tonnes)	311,367	20,554	110,728,490
% of UK Total Road transport emissions	0.0036%	0.0034%	0.0058%

The proposed scheme is expected to generally increase regional emissions in both the opening and design years. This is due to the major improvements in road access attracting more traffic to the region and the route becoming a viable alternative to the M4 to access Swansea / West Wales from the English Midlands and Northern regions.

NO_x emissions between the opening and the design year decrease on the assumption that emissions from vehicles will decrease in line with legislation at a greater rate than the increase in vehicle based trips. There is not expected to be the same drop in CO_2 and PM_{10} emissions from newer vehicles, so predicted tonnage, increases with the number of vehicles.

The Climate Change Act publishes budgets for the reduction of the emissions of greenhouse gases, with a view to substantial UK reductions being achieved by 2050. Total Welsh emissions are managed and considered by the

Welsh Government. Part 2 of The Environment (Wales) Act 2016 provides the Welsh Ministers with powers to put in place statutory emission reduction targets, including at least an 80% reduction in emissions by 2050 and carbon budgeting to support their delivery. The increase in carbon as a result of the proposed scheme compared to the UK National Emissions[1] shows that overall it forms a very small contribution to carbon.

8.6.3 Overall Significance

A summary of the overall significance of effects during the operation phase of the proposed scheme on human and ecological receptors and the potential impact for exceedances of EU limit values is provided in Table 8.21 and discussed below.

Is there a risk of environmental standards being breached?

Exceedances of AQOs for NO_2 or PM_{10} are not predicted at any modelled human health receptors.

None of the SSSIs, SACs, SPAs or Ramsars within the 'study area would experience an estimated annual average NOx concentration of over 30 µg/m³, the threshold as specified by HA 207/07 (Highways Agency, 2007a) whereby vegetation could be significantly affected. Therefore, no likely significant effect on the ecological sites are predicted to occur.

Will there be a large change in environmental conditions?

It is predicted that some sites will have a large change in NO_2 concentrations at receptors. However, the concentrations are still predicted to be low for NO_2 and PM_{10} relative to the AQOs.

Will the effect continue for a long time?

Due to the nature of the proposed scheme the effects would be long term.

Is there a risk that designated sites, areas, or features will be affected?

Based on the DMRB guidance, there are no sites that need to be considered further.

Will it be difficult to avoid, or reduce or repair or compensate for the effect?

No, as based on the DMRB guidance, there are no significant effects predicted during the operational phase.

On balance is the overall effect significant?

There is not considered to be a significant effect on local air quality as a result of the proposed scheme, either on human receptors or designated ecological sites.

Table 8.21: Overall evaluation of local air quality significance during the operational phase

Key criteria questions	Yes / No
Is there a risk that environmental standards will be breached?	No
Will there be a large change in environmental conditions?	Yes
Will the effect continue for a long time?	Yes
Is there a risk that designated sites, areas, or features will be affected?	No
Will it be difficult to avoid, or reduce or repair or compensate for the effect?	No
On balance is the overall effect significant?	No

[1] http://naei.beis.gov.uk/data/data-selector - Accessed 30th November 2017: Categories selected: 1A3bi-1A3bv

8.7 Mitigation

8.7.1 Construction phase

During the construction phase of the proposed scheme, it would be important to control dust levels for the sources identified.

As discussed in section 8.6, appropriate good practice construction dust mitigation measures are detailed in ES Supplement Volume 2 Appendix 8A, and are based on those outlined in the IAQM guidance (IAQM, June 2016) with a recommendation as to whether or not they should be applied based on the risk levels identified in the dust assessment. These measures should be considered for inclusion in the CEMP. Once the Contractor has compiled the first draft of the CEMP, there would be a period of pre-works discussions with RCTCBC and MTCBC and CCBC to agree the method of works and dust mitigation measures.

Mitigation measures will be agreed with RCTCBC, MTCBC and CCBC early at Key Stage 6 (detailed design phase) of the proposed scheme and would be reviewed on a regular basis during construction to ensure that they are appropriate to the works taking place. The aim of the measures set out in the CEMP would be to achieve zero complaints regarding dust during the construction phase. However, mitigation measures would be kept under review and, where appropriate, adjusted to deal with any complaints received from members of the public.

8.7.2 Operational phase

The results from the operational phase assessment do not indicate a significant air quality effect. Therefore, no mitigation would be required in the operational phase of the proposed scheme. Mitigation for the ecological receptors is dealt with in Chapter 11: Nature Conservation.

8.8 Residual Effect

8.8.1 Construction phase

The IAQM guidance (IAQM, 2016) recommends that the proposed mitigation will ensure that any potential significant adverse effects will not occur, so the residual effects at human and ecological receptors can be considered as ‘not significant’. However, the guidance also suggests that even with a rigorous CEMP in place, it is not possible to guarantee that the mitigation measures would be continuously effective, and if, for example, dust emissions occur under adverse weather conditions due to the failure of a dust-control measure, local receptors may experience infrequent, short-term dust annoyance. The probable scale of this would not usually be considered adequate to alter the conclusion that with mitigation in place, the potential effects would be ‘not significant’.

8.9 Cumulative Impacts

No change.

8.10 Ecosystems Resilience

No change.

8.11 Summary of Effects

A summary of predicted air quality effects associated with construction and operational phases of the proposed scheme is provided in Table 8.22.

Table 8.22: Summary of air quality effects

Description of impact	Sensitivity of receptor	Short / medium / long term effects	Magnitude of impact without mitigation*	Significance of effect without mitigation	Magnitude of impact with mitigation	Significance of effect with mitigation
Construction Phase 1 between Hirwaun Ponds (ch. 900) and Nant Melyn (ch. 5450).						
Dust Soiling	High	Short – Medium Term	High Risk Site	Significant	Negligible Risk	Not Significant
Human Health	Low	Short – Medium Term	Medium Risk Site	Significant	Negligible Risk	Not Significant
Ecological	High	Short – Medium Term	High Risk Site	Significant	Negligible Risk	Not Significant
Construction Phase 2 between Nant Melyn Mainline Viaduct (ch. 5450) and the A470 junction (ch. 10700)						
Dust Soiling	High	Short – Medium Term	High Risk Site	Significant	Negligible Risk	Not Significant
Human Health	Low	Short – Medium Term	Medium Risk Site	Significant	Negligible Risk	Not Significant
Ecological	High	Short – Medium Term	High Risk Site	Significant	Negligible Risk	Not Significant
Construction Phase 3 between the A470 junction (ch. 10700) and Dowlais junction (ch. 17700).						
Dust Soiling	High	Short – Medium Term	High Risk Site	Significant	Negligible Risk	Not Significant
Human Health	Low	Short – Medium Term	Medium Risk Site	Significant	Negligible Risk	Not Significant
Ecological	Medium	Short – Medium Term	High Risk Site	Significant	Negligible Risk	Not Significant
Operational Phase – Entire Scheme						
Local Air Quality Effect	High	Long	Imperceptible to Large Magnitudes of Change	Not Significant	N/A	Not Significant
Ecological Effect	High	Long	Major Adverse	Not Significant	N/A	Not Significant

*For Construction Phases the highest risk category from earthworks, construction or trackout construction activities is presented.

9. Cultural Heritage

Amendments to the original ES have been made in response to comments from Cadw on the July 2017 published ES and do not result in a significant change to the environmental impact assessment conclusions.

The table below summarises the changes in Chapter 9 of this ES Supplement.

Feature	Issue raised by Cadw	Summary
Cultural Heritage Assets	Need to revise the number of assets	Revision to number of assets.
Historic Landscape Character Areas	Need to revise the number of Historic Landscape Character Areas	Revision to number of Historic Landscape Character Areas.
Registered Historic Parks and Gardens	Requested further analysis on the potential effects on these features	Further information and analysis provided; no significant change to the conclusions of the July 2017 assessment.
Historic landscapes	Review of effects on historic landscapes	A sight adverse residual construction effect has been identified for Cyfarthfa Iron Works. This is a change to the conclusion of the July 2017 assessment for this historic landscape.
All	Revised assessment following Cadw comments	No significant change to the overall conclusions of the assessment.

The revised Appendices and Figures issued in this ES Supplement that are associated with this chapter are listed below.

Appendices (ES Supplement Volume 2)

Appendix 9B Cultural Heritage Gazetteer (Sections of text replaced)

Appendix 9D Assessment of the significance of the Impact of Development on the Historic Landscape (ASIDOHL) (Complete replacement)

Figures (ES Supplement Volume 3)

Figure 9.1 Archaeological Remains and Historic Buildings (including Conservation Areas)

Figure 9.2 Historic Landscape Character Areas

Figure 9.3 Registered Historic Landscapes

Insert text below as stated (amendments shown in red text and strikethrough).

Amend text within *Section 9.1 Summary* as follows:

This chapter presents the results of an assessment of potential impacts on cultural heritage assets resulting from the proposed scheme. This assessment was undertaken based on guidance provided by the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 2: Cultural Heritage (HA208/07) (Highways Agency, 2007b).

A study area was defined as the proposed scheme footprint plus a 200 m area extending in all directions from it. Baseline conditions for the study area were established through desk-based assessment, a walkover survey, geophysical survey, test pitting and trial trenching. In addition, statutorily designated assets up to 1 km from the proposed scheme were also considered in relation to potential impacts on the setting of these assets. In total, **159**~~160~~ cultural heritage assets comprising 96 archaeological remains, 34 historic buildings, and **29** ~~30~~ Historic Landscape Character Areas (HLCA) dating from the prehistoric period to the recent past, form the cultural heritage baseline.

During development of the design of the proposed scheme, cultural heritage has been a consideration and has influenced the design to avoid or minimise impacts, where possible, on cultural heritage assets. For example, the proposed widening of the Taf Fechan overbridge has been designed to minimise impact on the Gurnos Tramway and Leat Scheduled Monument (Asset 78). Furthermore, the loss or damage to landscape features such as mature trees, walls, water features or field systems has been avoided where possible.

Before mitigation, the Significance of Impact has been assessed as moderate on **the Grade II Registered Historic Park and Garden**, Cefn Coed Cemetery and Jewish Burial Ground (HLCA 12; ~~Grade II Registered Park and Garden~~) as a result of the proposed scheme.

Before mitigation, the Significance of Impact has been assessed as moderate on the Lofted Cowshed at Coed Meurig Farm (Asset 55) as a result of the proposed scheme.

Before mitigation, the Significance of Impacts has been assessed as either Slight or Neutral Significance on ~~94~~ **91** cultural heritage assets as a result of the proposed scheme. Impacts identified include those predicted on Gurnos Tramway and Leat (Asset 78), a Scheduled Monument. These indirect impacts include a temporary impact on setting as a result of construction activities associated with the widening of the Taf Fechan Viaduct, a reduction in the communal value (Cadw, 2011) of the asset itself as a result of the introduction of a public exclusion area within it where the viaduct crosses above, and the potential for material to fall on to the asset.

Proposed mitigation measures for identified construction impacts include landscape survey, building recording and an archaeological watching brief in advance of, and during, construction. Predicted impacts on the Gurnos Tramway and Leat (Asset 78) would be mitigated through avoidance measures described in the Construction Environmental Management Plan (CEMP).

With mitigation in place, a significant residual impact is predicted on **the Grade II Registered Historic Park and Garden**, Cefn Coed Cemetery and Jewish Burial Ground (HLCA 12; ~~Grade II Registered Park and Garden~~).

In *Section 9.5.1 Study area and sources consulted* the following text should be added at the end of the section:

Please note for the purposes of the ES Chapter all assets (archaeological remains, historic buildings and historic landscapes) have been assigned a reference number. The references in this chapter are identified against the relevant assets within Appendix 9B: Cultural heritage gazetteer (ES Supplement Volume 2). Appendix 9B also includes the reference numbers assigned by Cadw and Glamorgan Gwent Archaeological Trust Historic Environment Record (GGAT HER) to the assets, where relevant.

In order to ensure there were no gaps in the historic landscape data for the study area, four new historic landscape types were created for this assessment (relates to HLCA 3 to HLCA 6) which are detailed in Appendix 9B. Furthermore, some historic landscape types listed in the Historic Landscape Character data provided by GGAT were extended. This concerns HLCA 1, HLCA 7, HLCA 20, HLCA 25 and HLCA 26 and these extensions are shown on Figure 9.2 (ES Supplement Volume 3).

In *Section 9.6 Consultation*, *Table 9.4: Stakeholder consultation in relation to cultural heritage* the following lines should be added:

Table 9.4: Stakeholder consultation in relation to cultural heritage

Date	Stakeholder	Summary of discussion point
October 2017	**Cadw**	**Following consultation responses from Cadw on the content of the ASIDOHL and the assessment of the Grade II Registered Historic Park and Garden, Cefn Coed Cemetery and Jewish Burial within the Cultural Heritage ES chapter, a meeting was held with Cadw where it was agreed revisions would be made to both the ASIDOHL and ES Chapter.**
January 2018	**Cadw**	**Cadw confirmed with Jacobs that the amended ASIDOHL (ES Supplement Volume 2 Appendix 9D) conforms with the guidance and methodology and indicated that the scores and results are appropriate. Cadw also confirmed they have no issues with the proposed mitigation measures.**
January 2018	**Merthyr Tydfil County Borough Council (MTCBC)**	**MTCBC was consulted regarding the scope of the mitigation measures provided in Appendix 9D and within this ES chapter. The Conservation Officer post at MTCBC is currently vacant. MTCBC advised Jacobs to refer any queries to Cadw.**

In *Section 9.7 Evaluation* the following text should be amended:

From sources identified, a total of **159** ~~160~~ cultural heritage assets have been identified comprising 96 archaeological remains, 34 historic buildings and **29** ~~30~~ historic landscape types, including designated and undesignated assets within the study area and those designated assets identified outside the study area within 1 km of the proposed scheme with the potential to experience an impact on their setting.

***Table 9.5: Summary of the value of cultural heritage assets* should be amended as follows**:

Table 9.5: Summary of the value of cultural heritage assets

Subtopic	Value					
	Very high	High	Medium	Low	Negligible	Unknown
Archaeological Remains	0	3 (3 Scheduled Monuments)	2	31	57	3

Subtopic	Value					
	Very high	High	Medium	Low	Negligible	Unknown
Historic Buildings	0	1 (1 Grade II* Listed Building)	7 (including 6 Grade II Listed Buildings, 1 Conservation Area)	18	8	0
Historic Landscape Character Areas	2	5 (including 1 Registered **Historic** Park and Garden, 1 Landscape of Outstanding Historic Interest, 1 Landscape of Special Historic Interest)	1	~~10~~**9**	12	0
TOTAL	**2**	**9**	**10**	~~**59**~~ **58**	**7** ~~**6**~~	~~**4**~~ **3**

Section 9.7.3 Historic character areas should be removed and replaced with the following text:

The overall character of the historic landscape within the study area comprises agricultural land reclaimed from former mineral extraction works, mixed settlement and light industry dating to the 18th, 19th and 20th centuries. The study area includes the existing A465, Cefn Coed Cemetery and Jewish Burial Ground (Grade II Registered **Historic** Park and Garden) and the Merthyr Tydfil Landscape of Outstanding Historic Interest (MTLOHI). The Fforest Ffawr and Mynydd y Glog Landscape of Special Historic Interest (FFMGLSHI) is included in the baseline as a result of consultation (Section 9.5.2) but falls outside the study area. The FFMGLSHI and MTLOHI are registered landscapes on the Register of Landscapes of Historic Interest in Wales (Cadw *et al.,* 2007).

The Grade II Registered Historic Park and Garden, Cefn Coed Cemetery and Jewish Burial Ground (HCLA 12) has been included in this section as it is a historic landscape within the MTLOHI. The value of Cefn Coed Cemetery and Jewish Burial Ground has been assessed in accordance with the guidance provided in Technical Advice Note 24: The Historic Environment (Welsh Government, 2017) and Cadw's Conservation Principles for the sustainable management of the historic environment in Wales: Policies (Cadw, 2011). The assessment of the value of this asset is provided in Table 9.15, whilst further information is provided in ES Supplement Volume 2 Appendix 9B: Cultural heritage gazetteer.

A total of **29** ~~30~~ historic landscape character areas have been identified within or in close proximity to the study area from sources identified in Section 9.5.1. These are shown on Figure 9.2 and Figure 9.3 (ES Supplement Volume 3) and described in full in ES Supplement Volume 2 Appendix 9B: Cultural heritage gazetteer.

***Table 9.14 Historic Landscape Character Areas assessed to be of very high value* should be amended as follows:**

Table 9.14: Historic Landscape Character Areas assessed to be of very high value

Approximate chainage	HLCA number	HLCA name	Location in relation to proposed scheme	Value reasoning
10900 to 12100	9	Cyfarthfa Iron Works ~~and Associated Features~~	Approximately 140 m to the south	Elements of the MTLOHI comprising of ironworks and associated processing facilities founded in the mid-18th century which, by 1806, had become the largest in the world. ~~Landscape has outstanding designation.~~
14100 to 15500	27	Dowlais Iron Works Area	Approximately 400 m to the south	

***Table 9.15 Historic Landscape Character Areas* assessed to be of high value should be updated with a complete replacement of the row shown below:**

Table9.15: Historic Landscape Character Areas assessed to be of high value

Approx. ch.	HLCA number	HLCA name	Location in relation to proposed scheme	Value reasoning
11800 to 13700	12	Cefn Coed Cemetery & Jewish Burial Ground and Essential Setting with Significant Views	Located partly within proposed scheme footprint and to the north	A Grade II Registered Historic Park and Garden, its Essential Setting and three Significant Views. **Historic Value** This assessment has established that the asset's historical value relates to its establishment in the latter part of the 1800s, due to the growth of the Jewish population in the area, which was linked to the expansion of the mining and ironworks industry in the locality. Furthermore, the site is one of the largest Jewish cemeteries in Wales. **Aesthetic Value** The asset's aesthetic value is significantly enhanced by its location along the side of the Taf Fawr River valley, an impressive steep-sided U-shaped valley. Views within the cemetery also enhance the aesthetic value of the cemetery from the combination of plantation and structures within the natural topography of the landscape. Although the A470 road runs alongside it, the asset is largely screened by trees and although there are some filtered views through trees from the Cefn Coed Cemetery of the A465 road viaduct, the cemetery retains a rural a serene and sheltered character which adds to its aesthetic value. **Communal Value** As the site is still in use as a cemetery and burial ground area, which is still visited by the community today, the continuing use as a burial ground, strengthens the communal value of the asset.

Approx. ch.	HLCA number	HLCA name	Location in relation to proposed scheme	Value reasoning
				Furthermore, through their association with the asset, this enables the communities to take a sense of ownership of asset. **Evidential Value** The layout of the cemetery and most of the cemetery features are still extant. Thus, the surviving gravestones provide evidential value of the names, health and occupations of ordinary working men and women throughout the Victorian and modern eras as well as their religious beliefs and denominations. **Setting** The setting of the two parts of the Cefn Coed Cemetery is defined by the Essential Setting, as part of the Cadw's designation of the site as a Grade II Registered Historic Park and Garden. Although the site is defined to the west by A470 and to the south by the existing A465, with the A4054 to the east, the cemetery is largely well-screened by trees and the topography. The Essential Setting is therefore confined to relatively narrow strips of land forming a buffer and link between the two cemetery areas. The Essential Setting also includes an area immediately adjacent to the A470 and A465 roundabout and the A465 viaduct which defines the southern extent of the cemetery's setting.

***Table 9.18: Historic Landscape Character Areas assessed to be of negligible value* should be replaced by the following:**

Table 9.18: Historic Landscape Character Areas assessed to be of negligible value

Approximate chainage	HLCA number	HLCA name	Location in relation to proposed scheme	Value reasoning
0 to 17400	2	A465 Heads of the Valley Road	Within proposed scheme footprint	HLCA 2 comprises a contemporary transport infrastructure of limited historic interest.
14800 to 15300	22	Ivor Iron Works Area	Approximately 110 m to the south	HLCA 23, 24, 25 and 26 comprises reclaimed industrial land, 20th century commercial, retail and light industrial buildings, and the locations of industrial extractive activities, such as quarries and spoil tips.
15000 to 16000	23	Pengarnddu	Within proposed scheme footprint	
15500 to 17400	25	Dowlais Top	Within proposed scheme footprint	
14100 to 17400	25	Dowlais Great Tip, Trecatti, Trehir and Twyn-y-Waun	Within proposed scheme footprint	

In *Section 9.8.3.1 Construction* remove existing text and replace with the following:

No significant impacts on archaeological remains are predicted to result from construction of the proposed scheme.

Non-significant impacts are predicted on ~~49~~ **50** archaeological remains. Impacts comprise partial or total removal and / or the severance of archaeological deposits and upstanding remains as a result of online road widening and the construction of new offline elements of the proposed scheme. No impacts are predicted on the remaining ~~47~~**46** cultural heritage assets.

In *Section 9.8.5.1 Construction* remove the existing text and replace with the following:

Construction of the proposed scheme is predicted to result in a significant impact on ~~one HLCA:~~ **the Grade II Registered Historic Park and Garden,** Cefn Coed Cemetery and Jewish Burial Ground (HLCA 12; ~~Grade II Registered Park and Garden –~~ high value – Figure 9.1 (ES Supplement Volume 3)) because there would be **an impact on its aesthetic value due to the** temporary land take for construction required in the southern area of the Registered **Historic** Park and Garden. This impact would comprise visual intrusion into the Essential Setting of the asset, visual intrusion into a Significant View from the asset, and changes to landscape components. **The construction phase would also have an impact on the evidential value of the Registered Historic Park and Garden (HLCA 1), as there** would be approximately 0.5 ha of land take and the removal of mature trees and vegetation (comprising 0.54 ha) currently acting to screen the existing A465 viaduct. Identified impacts, in combination, have the potential to affect the significance of the asset~~, which has a statutory designation.~~ **The construction of the proposed scheme would not have an impact on the historical value or communal value of the Registered Historic Park and Garden, Cefn Coed Cemetery and Jewish Burial Ground (HLCA 1) as the cemetery area and its current land-use would remain.**

Non-significant impacts are predicted on a further ~~20~~ **19** HLCAs, including one designated historic landscape; the MTLOHI (HLCA **28** ~~29~~), comprising land take as a result of road widening and landscaping. No impacts are predicted on the remaining nine HLCAs. Information on identified impacts during construction is presented in Table 9.22, with the significant impact highlighted in grey.

In *Section 9.8.5.2 Operation* remove the existing text and replace with the following:

Operation of the proposed scheme is predicted to result in a significant impact on ~~one HLCA:~~ **the Grade II Registered Historic Park and Garden,** Cefn Coed Cemetery and Jewish Burial Ground (HLCA 12; ~~Grade II Registered Park and Garden –~~ high value – Figure 9.1 (ES Supplement Volume 3)) comprising visual intrusion into the Essential Setting of the asset, visual intrusion into a Significant View from the asset and changes to landscape components as a result of the introduction of new elements of infrastructure into the landscape. Identified impacts, in combination, have the potential to affect the **aesthetic** significance of the asset~~, which has a statutory designation~~. **The operation of the proposed scheme would not have an impact on the historical value, the communal value or the evidential value of the Registered Historic Park and Garden, Cefn Coed Cemetery and Jewish Burial Ground (HLCA 1), as this phase will not involve any physical alterations to the cemetery area, and its current land-use would remain.**

Non-significant impacts on ~~three~~ **four** HLCAs are predicted as a result of operation of the proposed scheme, comprising permanent land take from these assets and the presence of new elements of infrastructure. No significant impacts are predicted on the remaining **24** ~~26~~ HLCAs. Information on identified impacts during operation is presented in Table 9.23, with the significant impact highlighted in grey.

In *Section 9.8.6.1 Merthyr Tydfil Landscape of Outstanding Historic Interest* remove existing text and replace with the following:

The proposed scheme runs through the northern part of the Merthyr Tydfil Landscape of Outstanding Historic Interest (MTLOHI). The MTLOHI comprises 79 distinct HLCAs, the majority of which have a connection to the extractive and mineral processing industries prevalent in the area from the late 18th to the early 19th centuries. It is this industrial heritage that gives the MTLOHI its distinctive character. The ASIDOHL2 assessment established that of the 79 HLCAs, **20** ~~24~~ are located within the 200 m study area. Of these **20** ~~24~~ HLCAs, **15** ~~16~~ would be affected by the proposed scheme. More information on the ASIDOHL2 assessment, including the assessment results, are provided in ES Supplement Volume 2 Appendix 9D.

In *Section 9.9.3 Historic landscape* remove the existing text and replace with the following:

Landscape survey work would provide a descriptive and interpretative record of the relevant landscape, producing an analysis of its development and use. Level 1 is a basic visual record of the location, date, type and condition of the ~~monument~~ **historic landscape** in question. It comprises a written account and drawing and will be informed by consultation of readily available documentary information. Level 2 is a more detailed investigation than Level 1. It comprises a descriptive and interpretative record of the ~~monument~~ **historic landscape** in question and its wider **historic** landscape, based on photographic, documentary and cartographic research.

The following changes are to be made to *Table 9.22 Predicted construction impacts on historic landscapes*:

1. insert reference to HLCA 10 (Cyfarthfa Iron Works)
2. amend reference to HLCA 12 (Cefn Coed Cemetery and Jewish Burial Ground)
3. remove reference to HLCA 14 (Graig Quarry and Tramroad
4. insert reference to HLCA **19** (Bryniau Quarries)
5. amend reference to HLCA 12 (Cefn Coed Cemetery and Jewish Burial Ground)

Table 9.22: Predicted construction impacts on historic landscapes

Asset number	Asset name	Value	Description of impact	Magnitude of construction impact	Significance of construction effect (pre-mitigation)	Mitigation	Magnitude of residual construction impact	Significance of residual construction effect (post-mitigation)
HLCA 10	**Cyfarthfa Iron Works**	**Very High**	**Land take associated with the addition of a matching viaduct structure built parallel to the existing viaduct, between ch. 11400 and 11500, would result in the removal of landscape elements.**	**Negligible**	**Slight**	**None proposed**	**Negligible**	**Slight**
HLCA 12	**Grade II Registered Historic Park and Garden,** Cefn Coed Cemetery & Jewish Burial Ground and Essential Setting with	High	Direct physical impact of landtake for the new A470 Junction Bridge and the total removal of mature trees. Visual intrusion into the Essential Setting of the asset and one of three Significant Views from the asset. Changes to landscape components (between ch. 10700 and 10950).	Moderate	Moderate	Level 2 landscape survey **(English Heritage, 2007).**	Moderate	Moderate

Asset number	Asset name	Value	Description of impact	Magnitude of construction impact	Significance of construction effect (pre-mitigation)	Mitigation	Magnitude of residual construction impact	Significance of residual construction effect (post-mitigation)
	Significant Views							
~~HLCA 14~~	~~Graig Quarry and Tramroad~~	~~Low~~	~~Land take associated with road / bridge widening between ch. 11400 and 11500, would result in the removal of landscape elements.~~	~~Negligible~~	~~Neutral~~	~~None proposed~~	~~Negligible~~	~~Neutral~~
HLCA 19	**Bryniau Quarries**	**Negligible**	**Land take associated with road widening between ch. 13600 to 13800 would result the removal of landscape elements.**	**Minor**	**Slight**	**None proposed**	**Minor**	**Slight**
HLCA 12	**Grade II Registered Historic Park and Garden,** Cefn Coed Cemetery & Jewish Burial Ground and Essential Setting with Significant Views	High	Visual intrusion into Essential Setting and into one of three Significant Views from the asset. Permanent changes to landscape components as a result of the introduction of new infrastructure into the landscape between ch. 10700 and 109500.	Moderate	Moderate	Sympathetic design and materials, landscaping and tree planting.	Moderate	Moderate

In *Section 9.13 Conclusions* remove the existing text and replace with the following:

This chapter has presented an assessment of the potential effects on cultural heritage assets resulting from the construction and operation of the proposed scheme.

In total, **159** ~~160~~ cultural heritage assets, comprising 96 archaeological remains, 34 historic buildings, and **29** ~~30~~ HLCAs dating from the prehistoric period to the recent past, form the cultural heritage baseline.

During development of the design of the proposed scheme, cultural heritage has been a consideration and has influenced the design to avoid impacts, where possible, on cultural heritage assets.

Before mitigation, the construction of the proposed scheme is predicted to have an impact of Moderate Significance on one Historic Building: Lofted Cowshed at Coed Meurig Farm (Asset 55) and **a Grade II Registered Historic Park and Garden:** ~~one HLC:~~ Cefn Coed Cemetery and Jewish Burial Ground~~, a Grade II Registered Historic Park and Garden~~ (HLCA 12).

Before mitigation, the construction of the proposed scheme is predicted to have an impact of Slight or Neutral Significance on **91** ~~94~~ assets, comprising ~~51~~ **50** archaeological remains, **22** ~~23~~ historic buildings and ~~20~~ **19** historic landscapes. This would include temporary indirect impacts on Gurnos Tramway and Leat (Asset 78); a Scheduled Monument.

Proposed measures to mitigate construction impacts include landscape survey, building recording and an archaeological watching brief in advance of, and during, construction. Predicted impacts on the Gurnos Tramway and Leat (Asset 78) would be mitigated through measures described in the Construction Environmental Management Plan (CEMP).

Following mitigation, residual impacts of Slight or Neutral Significance are still predicted to occur on ~~93~~ **92** heritage assets, these include 50 archaeological remains, 23 historic buildings and ~~20~~ **19** HLCAs. While residual effects of Neutral or Slight Significance are still predicted to occur on cultural heritage assets, even with mitigation in place, these effects are not considered to be significant and are unavoidable.

During operation of the proposed scheme, one residual impact of Moderate Significance is predicted to remain following mitigation on a **Grade II Registered Historic Park and Garden,** ~~one HLCA:~~ Cefn Coed Cemetery and Jewish Burial Ground (HLCA 12; ~~Grade II Registered Historic Park and Garden~~). This impact is considered to be significant. **The existing road infrastructure of the A465 and A470 currently affects the setting of the Registered Historic Park and Garden. The proposed scheme has been designed to be in keeping with the existing highway and bridges / viaducts, to reduce the impact of the scheme on this asset. The proposed scheme infrastructure, located within the Essential Setting, would be up to 12 m higher than the existing infrastructure, although the effects would be confined to the later elements of the Registered Historic Park and Garden (post-1905) and would not directly affect any of the identified Significant Views.** ~~However, it should be noted that the context of asset's setting already includes the highway infrastructure of the existing A465 and A470 roads and the new elements, even though they would be up to 4 m higher than the existing infrastructure, have been designed to be in keeping with the existing highway and bridges / viaducts, in an attempt to reduce the negative impact the scheme would have on this asset.~~ Furthermore, it should be noted that even though the proposed scheme would encroach into asset HLCA 12, this would only result in the partial loss of the southern extent of the asset. This ~~negative~~ impact cannot be avoided due to the proximity of the Registered **Historic** Park and Garden to the existing A465.

~~Where the effects of the proposed scheme cannot be avoided on some cultural heritage assets, mitigation in the form of archaeological recording has been proposed to investigate, record, analyse, interpret and disseminate the results of the investigations. The proposed scheme is therefore considered to be in accordance with the requirements of DMRB (HA208/07), legislation and planning guidance as stipulated in Section 9.3.~~

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10. Landscape and Visual Impact

Amendments to the original ES are required as a result of the modifications to the Croesbychan junction, the revised noise assessment leading to changes in the extent and heights of proposed environmental barriers, and design development regarding the inclusion of variable message boards. The table below summarises the changes in Chapter 10 of this ES Supplement.

Feature	Issue	Summary
Design development and modifications to the Croesbychan Junction	Need to re-assess impacts on landscape and visual impact	No significant change to the overall assessment since July 2017
Revised noise modelling and noise assessment	Revisions to the location and heights of small sections of environmental barrier; need to re-assess impacts on landscape and visual impact	No significant change to the overall assessment since July 2017 but a slight adverse effect has been identified at some locations.
The proposed locations of variable message boards	Need to assess landscape and visual impacts as this element of scheme design was not completed in time for consideration in the July 2017 assessment	No significant change to the overall assessment since July 2017 but slight adverse effects have been identified to some receptors.

The revised Appendices and Figures issued in this ES Supplement that are associated with this chapter are listed below.

Appendices (ES Supplement Volume 2)

Appendix 10E Visual Effects Schedule: People in Residential Properties (Sections of text replaced)

Appendix 10F Visual Effects Schedule: Users of Public Rights of Way and Open Access Land (Sections of text replaced)

Appendix 10H Visual Effects Schedule: People at Work (Sections of text replaced)

Appendix 10I Landscape Assessment (Sections of text replaced)

Appendix 10J Night Skies Assessment (Sections of text replaced)

Figures (ES Supplement Volume 3) (All complete replacements)

Figure 10.5 Landscape Character Areas: National, National Park and County Borough

Figure 10.6.2 Zone of Theoretical Visibility - Existing Road

Figure 10.7 Night Time Light Sources and Exterior Lighting Environmental Zones

Figure 10.8 Visual Effects

Additional Illustrative visualisations have been prepared to illustrate the proposed scheme with mitigation planting at year 1 and year 15 in summer. These visualisations are attached in Volume 3 of the ES Supplement and correspond to the photographs of key views and representative views, as indicated below together with the receptor references.

- Visualisation 1 (RV10.2) - View south-east from National Cycle Route 46 (receptor S6-A6), looking towards Hirwaun junction;
- Visualisation 2 (KV10.8) - View north-west from the Taff Trail on the Cefn Coed viaduct (receptor S5-A1), to the A470 viaduct, A470 junction and the Taf Fawr viaduct;
- Visualisation 3 (RV10.30) - View from Vaynor Public Footpath 34 (receptor S5-A6), looking south along the leat and disused Gurnos Quarry Tramroad to the Taf Fechan viaduct (year 1 and year 15 showed as one image with no proposed planting visible at this point);
- Visualisation 4 (RV10.41) - View south from Pant Hollow open space allocation (receptor S5-A12); and
- Visualisation 5 (RV10.47) - View south from National Cycle Route 46 (receptor S5-A15), to Dowlais junction.

The locations of the visualisation viewpoints are indicated on a revised Figure 10.6.2 (ES Supplement Volume 3).

11. Nature Conservation

Amendments to the original ES are required as a result of the revised air quality assessment and modifications to the Croesbychan junction. The table below summaries the changes in Chapter 11 of this ES Supplement.

Feature	Issue	Summary
Habitats Lost and Gained, including Ancient Woodland	Minor modifications to proposed scheme design at Croesbychan	The changes in habitats lost and gained are minor and do not materially change the assessment and conclusions of the July 2017 ES nor the July 2017 SIAA. The changes, in terms of hectares lost and gained, are reported here for clarity and completeness only.
Botanical sites	Revision of air quality model	The revised air quality model still predicts worsening of air quality impacts on botanical sites with the proposed scheme in place. However, the severity of impacts overall, have decreased compared to those predicted in the July 2017 ES. Therefore, the July 2017 ES is a worst case assessment and its conclusions are not materially changed by the revised air quality model or this document.

The revised Appendices and Figures issued in this ES Supplement that are associated with this chapter are listed below.

Appendices (ES Supplement Volume 2)

Appendix 11A Site of Special Scientific Interest Legislative Compliance report (Sections of text replaced)

Appendix 11Q Marsh fritillary habitat assessment – Lynwood, Croesbychan (New Appendix)

Figures (ES Supplement Volume 3)

Figure 11.6 Marsh Fritillary Site Overview

Figure 11.7 Marsh Fritillary Habitat Loss

Figure 11.15 Nature Conservation Mitigation

Insert text below as stated.

Remove *Table 11.14: Breakdown of marsh fritillary habitat recorded within the study area* and replace with the following:

Habitat condition (Fowles, 2005)	Approximate area (ha) of habitat recorded within the 2 km Blaen Cynon SAC metapopulation area	Approximate area (ha) of habitat recorded outside of the 2 km Blaen Cynon SAC metapopulation area and within a 1 km wide corridor centred on Section 6 of the proposed scheme (Figure 11.7 (ES Supplement Volume 3))
Good Condition	35.0	3.04
Suitable Under grazed	3.2	0.94
Suitable Over grazed	28.0	9.73
Suitable Sparse	43.6	13.02
Potential rank	5.2	1.75
Not suitable	439.2	39.47

Remove the text from *Section 11.8.1.1.4.1 Marsh Fritillary* and replace with the following:

Due to the dynamic nature and distribution of marsh fritillary metapopulations, an assumption is made that all suitable and good condition habitat for marsh fritillary could support the species. Therefore, any loss of this habitat (whether marsh fritillary adults or larval webs have been recorded recently or not) could have a likely significant effect on the metapopulation and, subsequently, the Blaen Cynon SAC. Such habitat loss has the potential to reduce population density and distribution of the species.

However, no likely significant effect on marsh fritillary is considered feasible due to suitable habitat loss in the short term. Bulman (2001) and Bulman *et al*. (2007) state that approximately 100 ha of suitable habitat is necessary to achieve a 95% probably persistence for marsh fritillary for 100 years (within a 4 km x 4 km area). As over 100 ha of suitable habitat for marsh fritillary has been confirmed within the 2 km SAC core metapopulation area (with the potential for much more – see Appendix 11G) and the proposed habitat loss (detailed below) would not reduce the remaining suitable habitat to less than the 100 ha minimum threshold, no likely significant effect is anticipated in the immediate timeframe around site clearance for the proposed scheme.

Nevertheless, in the long term, due to the very dynamic and cyclical boom and bust nature of marsh fritillary populations, the general habitat quality decline and habitat loss in some locations in the wider area and uncertainty of the continued management of marsh fritillary habitat (on land holdings outside of the control of Welsh Government or conservation agencies) could have implications for species population density and dispersal.

Although no loss of marsh fritillary habitat would occur within the boundary of the Blaen Cynon SAC, the proposed scheme would result in the loss of approximately 8.05 ha of habitat suitable for marsh fritillary butterfly. Of the 8.05 ha, 3.45 ha is considered in 'good condition' (Fowles, 2005).

Location of the 8.05 ha of marsh fritillary habitat loss:

- **5.44 ha is within the 2 km of the SAC (the Blaen Cynon SAC metapopulation area) between ch. 1950 and 3300 north and south and ch. 3550 - 3950 south; and**
- **2.61 ha is within the wider Upper Cynon Valley landscape functional area between ch. 5000 and 5100 north, ch. 5500 and 6500 south, ch. 7850 and 8300 south and ch. 9500 and 9800 south**.

Included in these predicted habitat loss figures is approximately 2.19 ha of suitable marsh fritillary habitat located within a severed parcel caused by the proposed offline section at Hirwaun (see Figure 11.7 in ES Supplement Volume 3. Although retained, this area of habitat could lose its functionality over time due to isolation and subsequent change in management. Applying the precautionary principle, this area of habitat is considered to be lost.

This moderate magnitude impact on an internationally valued resource would result in a large adverse effect.

Remove text from *Section 11.8.2.1.2 Non-statutorily designated sites* and replace with the following:

Thirteen environmental transects in SINCs predicted a change of 0.4 µg/m³ in NOx with the proposed scheme in operation, which has the potential for significant effects to occur in the form of habitat degradation at these locations. Four of these were modelled to have a more than 0.4 µg/m³ reduction resulting in potential ecological benefits: Hirwaun Common SINC (two transects – partial reduction along transects); Cwm Ffwrdd SINC and Cwm Taf Fields and Cefn Coed SINC.

Nine transects in SINCs predicted an increase of over 0.4 µg/m³ in NOx with the proposed scheme in operation: Hirwaun Industrial Estate SINC; Upper Cynon Floodplain SINC; East Llwydcoed SINC; Nant Hir Gwyddel SINC; Bryn Defaid Heath SINC; Coed Meurig Pastures SINC; Afon Taf SINC; Bryniau SINC; and Pan march & Traed y Milwyr Llechryd SINC. Further study regarding modelled nitrogen and acid deposition was then undertaken for these transects (see ES Supplement Volume 2 Appendix 8E for detail).

A greater than 1% increase in nitrogen deposition was modelled in all of the listed sites above. A greater than 1% increase in acid deposition was modelled in all of the sites except for Hirwaun Industrial Estate SINC and Afon Taf SINC. As such, a secondary assessment is triggered. If the proposed scheme deposition contribution plus the background concentration is less than 70% of the Air Quality Objective (AQO), significant effects are unlikely. However, these threshold guidelines are generally applicable to inter- and nationally designated sites only and it is appropriate to use a 100% threshold for SINCs. This is irrespective of the existing concentration or deposition rates.

None of the SINCs in the study area were modelled to undergo acid or nitrogen deposition of over 100% of their component habitat type AQO threshold. Therefore, no significant effect on the SINCs as a result on nutrient nitrogen and acid deposition is considered likely.

Remove text from *Section 11.8.2.1.4 Supporting habitats – Marsh fritillary* and replace with the following:

Habitat suitable (including good condition habitat) to support marsh fritillary (within the Upper Cynon Valley Functional Landscape Area) that falls within the 200 m of affected roads has the potential to be significantly adversely impacted by increased nitrogen deposition generated by the operational proposed scheme (ES Supplement Chapter 8: Air Quality, specifically Volume 2 Appendix 8E). This was determined in line with Environment Agency (Environment Agency, 2016) guidance: “Where the process contribution (PC) is less than 1% of the relevant critical level or critical load, the emission is not likely to have a significant effect alone or in combination irrespective of the existing concentrations or deposition rates.”

Ten of the environmental transects were concurrent with marsh fritillary habitat **(see Table 11.27a).** The existing (do nothing) deposition rates showed that seven of the transects were in exceedance of the Critical Load for nitrogen and four were in exceedance of Critical Level for acid deposition (see ES Supplement Volume 2 Appendix 8E).

Table 11.27a: Modelled air quality for marsh fritillary habitats

Transect name	Existing deposition exceedance (Y/N)		Modelled deposition more than 1% (Y/N)	
	Nitrogen	Acid	Nitrogen	Acid
Blaen Cynon SAC / Cors Bryn-y-gaer SSSI_A	Y	Y	N	N
Blaen Cynon SAC / Cors Bryn-y-gaer SSSI_B	Y	N	N	N
Bryncarnau Grasslands SSSI	Y	Y	N	N
Tir Mawr a Dderi Hir SSSI	N	N	N	N
Hirwaun Common_A	Y	Y	N	N
Hirwaun Common_B	Y	N	Y	Y
Coed Meurig Pastures	Y	Y	Y	Y
Llwycoed Slopes	N	N	N	N
Marsh Fritillary (Court Farm)	N	N	N	N
Marsh Fritillary_FD_10 (Trewaun Roundabout)	Y	N	Y	N

A greater than 1% increase in nitrogen deposition was modelled at three areas with suitable habitat for marsh fritillary: Hirwaun Common SINC, 'Marsh Fritillary_FD_10' immediately south east of Trewaun junction and Coed Meurig SINC. Minor increases in acid deposition were also modelled within the first two locations. None of these locations were located within the Blaen Cynon SAC or any SSSIs.

The approximate locations and areas of marsh fritillary habitat that could be adversely affected are listed in Table 11.28 below. However, the modelled increase of atmospheric deposition and potential habitat degradation at Hirwaun Common SINC is located within an area that has already been identified as being lost due to potential isolation. The 'Marsh Fritillary_FD_10' transect also modelled an increase of over 1% in nitrogen deposition for approximately 10 m beyond the boundary of the proposed soft estate, potentially resulting in habitat degradation. This marsh fritillary habitat area has also already been considered lost due to the proposed construction works area (7.5 m around the proposed scheme, extending to 10 m around all junctions / roundabouts). Both these areas of habitat loss are mitigated for in the habitat loss impact section (see revised Section 11.8.1.1.4.1, above).

Table 11.28: Marsh fritillary habitat within the functional landscape area likely to be affected by changes in air quality

Location of habitat suitable to support marsh fritillary	Existing nitrogen deposition (kgN/ha-year)	Max modelled nitrogen deposition (kgN/ha-year)	Approximate chainage	Within 2km of SAC	Good condition habitat affected (ha)	Suitable habitat affected (ha)	TOTAL (ha)
Hirwaun Common_A and B (Site 5 from Jacobs monitoring)	27.6	28.1	1900 -3000 (south)	yes	Already considered lost due to isolation impact of proposed off-line road at Hirwaun. Loss calculated and mitigation in the habitat loss section (see revised section 11.8.1.1.4.1 above)		
Marsh_Fritillary_FD_10 (Trewaun roundabout)	27.6	27.8	3150-3350 (south)	yes	Already considered lost due to proposed construction works		

Location of habitat suitable to support marsh fritillary	Existing nitrogen deposition (kgN/ha-year)	Max modelled nitrogen deposition (kgN/ha-year)	Approximate chainage	Within 2km of SAC	Good condition habitat affected (ha)	Suitable habitat affected (ha)	TOTAL (ha)
					area extending to 10 m around the roundabout.		
Coed Meurig	27.0	28.0	9500-9800 (south)	no	0	0.6	0.6
TOTAL							**0.6**

The air quality transect modelling suggests the potential degradation of up to 0.6 ha of retained marsh fritillary habitat at the Coed Meurig SINC. However, the modelled increase in nitrogen deposition ranges from between 27.5 and 28.0 kgN/ha-year, only marginally more than the existing 27.6 kgN/ha-year deposition rate recorded at Tir Mawr a Dderi Hir SSSI where some of the best quality habitat for marsh fritillary has been recorded. This suggests that the modelled increase in nitrogen deposition would have negligible measureable ecological impact. However, due to uncertainty in the exact impact, the precautionary principle has been applied and the magnitude of potential impact is considered to be minor (rather than negligible), which would result in a slight adverse impact on an international level value resource.

Remove text from *Section 11.9.1.2.2 Ancient woodland inventory sites* and replace with the following:

The loss of approximately 4.52 ha of ancient woodland inventory sites would be mitigated through the:

- creation of replacement woodland ground flora and tree habitat at Croesbychan (adjacent to retained ancient woodland sites, see Figure 11.15 (ES Supplement Volume 3)) by using top soil salvage and translocated specimens from cleared habitats. Some supplementary woodland planting may also be required;
- long term management of the replacement woodland habitat creation site to encourage woodland development, particularly of ancient woodland indicator species / characteristics;
- management of areas of existing and retained ancient woodland immediately adjacent the replacement habitat creation site (see Figure 11.15 in ES Supplement Volume 3) to enhance their structural and species diversity; and
- propagation of seeds and planting of saplings grown from veteran and mature trees within cleared ancient woodland sites into the habitat creation site at Croesbychan.

This approach would comprise approximately 4.3 ha of habitat creation and 2 ha of retained ancient woodland that would be beneficially managed to benefit nature conservation. The 4.3 ha area of habitat creation would reuse ancient woodland topsoil from lost areas which would mimic ground conditions and aid natural colonisation of ancient woodland species from the seedbank. A summary of all land acquired for mitigation, out with the proposed soft estate, is shown in Table 11.30.

Coppiced trees and scrubs from areas of ancient woodland lost would be translocated to this area. Monitoring on translocated hazel stools on the new soft estate of the M4 Junction 32-29 Widening scheme identified quick establishment and fruiting of hazel after just two seasons (Jacobs, unpublished monitoring report). Saplings and seeds from veteran and mature trees within ancient woodland areas lost would also be collected, temporarily stored and reinstated within the replacement habitat. This would supplement the establishment of trees and maintain local provenance of species.

Nevertheless, the aim of this mitigation would be to recreate the ground flora characteristic of ancient woodland. It is acknowledged that the potential for re-creation of the tree and canopy layer of ancient woodland in receptor sites is limited.

With implementation of this mitigation, including long term management, the magnitude of impact would be reduced to minor and a slight negative effect would remain.

Remove text in *Section 11.9.4.4 Supporting habitats* and replace with the following:

Table 11.30 summarises the overall provision of mitigation habitats outside of the soft estate. The areas of mitigation habitats are in excess of the areas lost to the proposed scheme.

The approximate 2.07 ha of habitat loss in the Tir Mawr a Dderi Hir SSSI would be mitigated by reinstatement and enhancement of the new soft estate within the SSSI boundary (approximately 1.83 ha) and habitat enhancement of an additional approximate 0.34 ha in the proposed soft estate immediately adjacent to the SSSI to the north-east (approximate ch. 6250 – 6350) by planting trees to replace those lost in the SSSI and enhance the proposed grassland area using soil salvage and seed harvest from the SSSI.

The minor habitat loss at Cwm Taf Fechan Woodlands SSSI (approximately 0.44 ha) would be mitigated for within the proposed soft estate by using top soil salvage and coppiced trees and shrubs from cleared habitats within the SSSI at the proposed terrestrial habitat around attenuation ponds access track (ch. 12250 – 12500).

The approximate loss of 62.79 ha of SINC habitat loss would be mitigated by creating a new high quality, species rich, diverse soft estate, representative of the local valued habitats. The proposed soft estate would be approximately 133.93 ha and would support woodland, grassland, heath and scrub habitats.

Table 11.30: Summary of land acquired for mitigation located out with the proposed soft estate (Figure 11.15 in ES Supplement Volume 3)

Likely significant effect	Approximate area (ha)	Mitigation site name	Approximate area (ha) of mitigation site
Loss of marsh fritillary habitat	8.05 (3.45 – good quality; and 4.6 – suitable condition)	Llwydcoed slopes	14.4 *Plus approximately 8.03 ha marshy grassland and devil's-bit scabious seeding located within the new soft estate – totalling 22.43 ha*
Potential degradation of marsh fritillary habitat	0.6 *sub-total: 8.65*		
Loss of Ancient Woodland Inventory site	4.52	Croesbychan	6.3
Loss of breeding habitat for lapwing	5.2	Blaencarno	7

12. Geology and Soils

No changes to Chapter 12 are required.

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13. Materials

No changes to Chapter 13 are required.

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14. Noise and Vibration

The table below summaries the changes in Chapter 14 of this ES Supplement due to the revised traffic and noise models.

Feature	Issue	Summary
Dwellings and other noise sensitive receptors	Increase in noise levels in the short term	There will be an increase in the number of dwellings experiencing a perceptible noise increase level of at least 1 dB from 3364 dwellings to 3577. The number of dwellings experiencing a decrease in noise levels would change from 391 to 333 as well as one additional noise sensitive receptor.
Dwellings and other noise sensitive receptors	Increase in noise levels in the long term	There will be an increase in the number of dwellings and other noise sensitive receptors experiencing a perceptible noise increase level of at least 3 dB during the daytime from 773 dwellings to 798. The number of dwellings experiencing a decrease in noise levels would change from 23 to 40.

The entirety of this chapter has been updated. Remove original Chapter 14 and replace with text provided below.

14.1 Summary

This chapter considers the potential noise and vibration impacts that may arise during the construction and operation of the proposed scheme on sensitive receptors.

The assessment has been undertaken in accordance with DMRB Volume 11 Section 3 Part 7 – Noise and Vibration, HD 213/11 Revision 1 (HD 213/11) (Highways Agency, 2011b). The predicted noise levels for all noise sensitive receptors are presented in Appendix 14F (ES Supplement Volume 2).

Despite the application of best practice mitigation measures, major construction noise impacts could occur at properties in close proximity to the proposed works. However, it should be recognised that any such impacts would be temporary in nature.

Vibration during some piling and ground compaction works is likely to be perceptible to residents in nearby residential dwellings for limited durations. However, expected vibration levels fall below those which could give rise to cosmetic building damage.

The proposed scheme design includes the installation of low noise road surfacing, and the use of environmental barriers to provide noise screening for noise sensitive residential dwellings.

The assessment includes the unmitigated effect of the proposed Cynon Valley Gateway scheme in the long term, as the long term traffic forecasts are based on the assumption that it would be operational by 2037 if the proposed scheme were to be constructed.

In the short term, with the proposed mitigated scheme, there are predicted to be 3577 dwellings and 30 other noise sensitive receptors that would experience a perceptible noise increase in noise level of at least 1 decibel (dB). Conversely there are predicted to be 391 dwellings and four other noise sensitive receptors that would experience a decrease in noise level of at least 1 dB.

In the long term, with the proposed mitigated scheme, there are predicted to be 798 dwellings and nine other noise sensitive receptors that would experience an increase in noise level of at least 3 dB during the daytime. By comparison there are predicted to be 40 dwellings that would experience a decrease in noise level of at least 3 dB. For the long term night-time situation, four dwellings are predicted to experience perceptible noise increases, whilst two dwellings are predicted to experience perceptible noise decreases.

Overall, when considering receptors in the area, the proposed scheme is considered to have an adverse noise impact, both on scheme opening and in the long term.

A single Noise Action Plan Priority Area (NAPPA) number 362 is located within the study area, to the south of the proposed scheme in Dowlais Top. When considering the facades that face the A465, perceptible noise decreases are predicted for 13 properties within the NAPPA, with no perceptible noise increase anticipated. The noise benefits for properties within the NAPPA would fall within the minor to major beneficial magnitude of impact category on proposed scheme opening. In the long term situation, a greater number of properties within the NAPPA are predicted to experience perceptible noise benefits, compared to the number predicted to experience perceptible noise increases. Overall, the proposed scheme would be considered to have a beneficial noise impact on properties within the NAPPA.

14.2 Introduction

This chapter presents an assessment of the predicted construction and operational noise and vibration impacts of the proposed scheme. The chapter is supported by the below appendices and figures, which are cross-referenced in the text where relevant.

Appendices

- Appendix 14A - Acoustic context and definitions;
- Appendix 14B - Assessment approach (Revised and located in ES Supplement Volume 2);
- Appendix 14C - Noise monitoring results (Revised and located in ES Supplement Volume 2);
- Appendix 14D - Calibration certificates;
- Appendix 14E - Assumed construction plant and scenarios; and
- Appendix 14F - Predicted noise levels at receptors (Revised and located in ES Supplement Volume 2).

Figures

- Figure 14.1 Study area;
- Figure 14.2 Monitoring locations;
- Figure 14.3 Construction noise assessment locations;
- Figure 14.4 Noise change contour plan DM (opening year) against DS (opening year) (Revised and located in ES Supplement Volume 3;
- Figure 14.5 Noise change contour plan DM (opening year) against DS (future year) (Revised and located in ES Supplement Volume 3);
- Figure 14.6 Noise change contour plan DM (opening year) against DM (future year) (New figure in ES Supplement Volume 3); and
- Figure 14.7 Operational sample receptors and NAPPA location (New Figure in ES Supplement Volume 3).

The assessment has been carried out according to methodology based on the guidance provided in HD 213/11.

Noise levels in this chapter are expressed in terms of the decibel (dB), which is explained further in Appendix 14A together with some of the other technical concepts and terms used in this chapter.

14.3 Legal and Policy Context

National and local policy and legislation, relevant to this noise and vibration assessment of the proposed scheme is summarised below.

14.3.1 Planning Policy Wales (2016)

The Planning Policy Wales (PPW) (Welsh Government, 2016a) sets out the land use planning policies of the Welsh Government. This document is supplemented by a series of Technical Advice Notes (TANs). It communicates the approach from the Welsh Government to sustainable development.

Chapter 4 'Planning for Sustainability' recognises the strengths of urban communities through integral approach to foster sustainable change, in particular making it possible to live with less noise, congestion and traffic pollution, and improving the quality of life. Chapter 8 'Transport' indicates that great care must be taken to minimise the adverse impacts of new transportation infrastructure, or improvement to existing infrastructure. It mentions that routes should make the best use of existing landforms and other landscapes features to reduce noise and visual effects, subject to safety and other environmental considerations.

Chapter 13 'Minimising and Managing Environmental Risks and Pollution' states that local authorities may use planning conditions to meet planning aims to protect the environment where these are pertinent to the development proposed. Proposed development should be designed wherever possible to prevent adverse effects to the environment but as a minimum to limit or constraint any effects that do occur. Noise Action Plans, written by the Welsh Ministers under the Environmental Noise Directive, aim to prevent and reduce environmental noise where necessary and preserve where it is good.

Chapter 13 also states that policies should be designed to ensure that potentially noisy developments are located in areas where noise will not be such an important consideration or where the impact can be minimised. Noise can be a material planning consideration where a proposed new development is likely to generate noise. Special consideration should be given to noise generating developments which could potentially affect protected species or it is proposed statutorily designated areas, including quiet areas designated in Noise Action Plans.

The PPW refers to Technical Advice Note 11 'Noise' (Welsh Assembly Government, 1997) and The Environmental Noise (Wales) Regulations 2006.

14.3.2 Technical Advice Note (Wales) 11, Noise (1997)

Technical Advice Note 11 (TAN 11) (Welsh Assembly Government, 1997) provides advice on how the planning system can be used to minimise the adverse impact of noise without placing unreasonable restrictions on the development.

The note refers to 'Calculation of Road Traffic Noise' and Design Manual for Roads and Bridges Volume 11, Section 3, Part 7, for guidance on noise & vibration from road traffic.

In relation to vibration from road traffic, TAN 11 states that structural damage to buildings through vibration from road traffic is unlikely, and refers to advice on acceptable levels provided in BS 6472:1992.

14.3.3 Noise Insulation Regulations (NIR) (1975, as amended in 1988)

Under the Noise Insulation Regulations 1975 (as amended in 1988) the relevant highways authority has a duty to offer to insulate the living rooms (which include dining rooms and studies) and bedrooms of dwellings affected by new roads and roads that have their line or level altered, if the dwellings satisfy the following criteria:

- The residential premises would be within 300 m of the new or altered highway;
- the noise level 15 years after opening would be not less than 68 dB;

- the predicted noise level 15 years after opening is calculated to be at least 1 dB above the level before work commences; and,
- the improved highway would contribute at least 1 dB to the final noise level.

The procedure for offering noise insulation work or grants is detailed within Regulation 8 of the NIR, and is summarised below:

- a list (or map) of all properties that are eligible for noise insulation shall be published no later than six months after opening of the proposed scheme;
- an offer to carry out work, or the offer of a grant to cover such work, shall be made within three months of the list (or map) of eligible properties being published; and
- each eligible property would be offered the opportunity of work to be undertaken, or a grant be made available, for each eligible room on the building.

14.3.4 Control of Pollution Act 1974

Local Authorities have powers to impose requirements or restrictions on construction methods under the Control of Pollution Act, including the type of plant to be used and permitted noise levels during specified hours. Restrictions can be imposed even if the noise levels would be below those causing a 'nuisance'. In doing so, the local authority must have regard to:

- the relevant provisions of any code of practice approved under this part of the Act;
- the need to ensure 'best practicable means' are used to minimise noise emissions; and,
- the need to protect people from the effects of noise from the site.

Anyone who intends to carry out construction activities is entitled to apply to the local authority for prior consent to carry out the work. The application needs to describe the works, the construction methods to be used and the steps that are to be taken to minimise noise resulting from the works. The local authority has the power to attach conditions to any consent granted and limit the length of its duration.

14.3.5 Environmental Noise (Wales) Regulations 2006

The Environmental Noise Wales Regulations 2006 implements EU Directive 2002/49/EU. This legislation relates to the assessment and management of environmental noise and its implementation is the responsibility of the Welsh Government. Under the Regulations, a first round of environmental noise maps of large agglomerations and major roads, railways and airports was completed in 2007, with a further round completed in 2012. This mapping included the A465 as part of the requirements to map major roads exceeding certain thresholds.

14.3.6 Noise Action Plan for Wales (2013-2018)

The Noise Action Plan for Wales (Welsh Government, 2013d) details environmental noise action plans required by European Regulations and information on Wales-wide policies on noise not covered by the Regulations.

14.3.7 Land Compensation Act 1973

The Land Compensation Act 1973 (LCA) makes provision for those who suffer as a direct result of public development. Under Part 1 of the LCA, compensation may be claimed for "injurious affection" (depreciation in the value of the property caused by public development) resulting from seven 'physical factors', such as noise, vibration, air pollution and artificial lighting arising from the use of the development.

Under Section 4 of Part 1 of the LCA, direction is provided as to the assessment of compensation, as follows.

1) The compensations payable on any claim shall be assessed by reference to prices current on the first claim day.

2) In assessing depreciation due to the physical factors caused by the use of any public works, account shall be taken of the use of those works as it exists on the first claim day and of any intensification that may then be reasonably expected of the use of those works in the state in which they are on that date.

Part 1 of the LCA provides no direction on the appropriate approach to assess the effects of the 'physical factors'. However, Part 2 of the Act introduces the Noise Insulation Regulations 1975 (NIR) (as amended in 1988), which requires that noise levels in terms of the $L_{A10,18hr}$ index should be calculated in accordance with Calculation of Road Traffic Noise (CRTN) (Department for Transport and the Welsh Office, 1988).

14.3.8 Environmental Protection Act 1990

Under Part III of the Environmental Protection Act (EPA) 1990, local authorities have a duty to investigate noise complaints from premises. If a local authority's Environmental Health Officer (EHO) is satisfied that a complaint amounts to a statutory nuisance, then the authority must serve an abatement notice on the person responsible or, in certain cases, the owner or occupier. The notice could require that the noise or nuisance must be stopped altogether or be limited to certain times of the day.

14.3.9 Policy BW11 of Merthyr Tydfil Local Development Plan 2006-2022 (adopted 2011)

Policy BW11 of Merthyr Tydfil Local Development Plan 2006-2022 (adopted 2011) (Merthyr Tydfil County Borough Council (MTCBC) (2011) states that proposals for new transport, cycling, and pedestrian facilities will be favourably considered where they facilitate noise reduction and improved air quality.

14.3.10 Policy AW 10 of Rhondda Cynon Taf Local Development Plan 2006-2022 (adopted 2011)

Policy AW 10 of Rhondda Cynon Taf Local Development Plan 2006-2022, (adopted 2011) (Rhondda Cynon Taf County Borough Council (RCTCBC), 2011) states that Development proposals will not be permitted where they would cause or result in a risk of unacceptable harm to health and / or local amenity as a result of a number of various environmental factors, including noise pollution.

14.4 Assessment Methodology

The assessment follows the methodologies detailed in the Environmental Impact Assessment: Scoping Report (Jacobs 2016a). Although there have been no changes in the assessment methodologies used, the overall approach to each sub topic is summarised below. Additional details of the assessment and methodology approach are provided in Appendix 14B (ES Supplement Volume 2).

14.4.1 Construction noise

Disruption caused during the construction phase of the proposed scheme has the potential to affect nearby residents and other sensitive receptors. HD 213/11 (Highways Agency, 2011b) advises on the use of BS 5228-1: 2009+A1 2014 (BSI, 2014a) to assess and control noise and vibration from construction activities.

Predicted noise and vibration levels arising from construction activities have been assessed following the criteria contained within BS 5228 Parts 1 and 2 (BSI, 2014a) to determine whether potential construction impacts are likely to occur.

BS 5228-1:2009 + A1:2014 includes example thresholds of 'significant effects'. These thresholds can be based on the 'ABC' method, which takes into account the existing ambient noise levels in the area, along with predicted construction noise levels. It should be noted that the thresholds in BS 5228-1:2009 + A1:2014 are examples and therefore there is scope for them to be adapted, if deemed necessary to local circumstances.

Example thresholds of significant effects (or potential disturbance), using the ABC methodology as set out in Annex E of BS5228-1:2009 + A1:2014, are detailed in Table 14.1.

Table 14.1: Construction noise thresholds

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends *	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

NOTE 1: A potential significant effect is indicated if the l L_{Aeq} noise level, from the site, exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. if the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total L_{Aeq} noise level for the period increases by more than 3dB due to site noise.

NOTE 3: Applies to residential receptors only

Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values

Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values

Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values

* 1900 – 2300 weekdays, 1300 – 2300 Saturdays and 0700 – 2300 Sundays

Construction noise levels have been calculated for a series of work locations, considered to represent the 'worst case' parts of the construction programme, in terms of potential noise and vibration impacts.

The numbers of dwellings and other sensitive receptors (OSRs) where construction noise levels are expected to be close to or exceed the relevant threshold value from BS 5228-1:2009 + A1:2014 (BSI, 2014a) have been estimated. The significance of the impact associated with these exceedances has been classified according to the following categories:

- potential minor impacts are judged to have occurred where the construction noise levels are within a range of 0 - 5 dB below the relevant threshold;
- potential moderate impacts are judged to have occurred where the construction noise levels are between 0 - 5 dB above the relevant threshold; and
- potential major impacts are judged to have occurred where the construction noise levels are greater than 5 dB above the relevant threshold.

In determining whether a significant effect would occur, guidance within BS 5228-1:2009 + A1:2014 (BSI, 2014a) advises that consideration should be given to a number of additional factors including the number of receptors affected, the duration of the works and the character of the noise. At this stage, there is insufficient information available to enable consideration of some of these additional factors and the assessment presented should be considered preliminary in nature.

14.4.2 Construction vibration

Vibration is a low frequency disturbance producing physical movement in buildings or to their occupants. Ground-borne vibration is usually measured in terms of peak particle velocity (ppv), which is measured in terms of movement in mm/s.

Assessment of the likelihood of significant effects, as a result of ground-borne vibrations arising from construction activities, has been carried out using the guidance contained within BS 5228-2:2009 + A1:2014 (BSI, 2014b).

The assessment considered vibration levels against guidance for predicting human response to vibration in buildings, as presented in Table 14.2.

Table 14.2: Guidance on the human response to vibration levels from BS5228-2:2009 + A1:2014

Vibration level (ppv)	Effect
0.14 mm/s	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration
0.3 mm/s	Vibration might just be perceptible in residential environments
1.0 mm/s	It is likely that vibration of this level in residential environments would cause complaint, but can be tolerated if prior warning and explanation has been given to residents
10.0 mm/s	Vibration is likely to be intolerable for any more than very brief exposure to this level

For building structure response, BS 5228-2:2009 + A1:2014 (BSI, 2014) reproduces the advice given in BS 7385-2:1993 (BSI, 1993), which gives guidance on vibration levels which could potentially result in building damage. The response of a building to ground-borne vibration is affected by the type of foundation, underlying ground conditions, the building construction and the state of repair of the building.

Table 14.3 reproduces the guidance detailed in BS 5228-2:2009 + A1:2014 (BSI, 2014a) on building classification and guide values for cosmetic building damage. Minor damage is possible at vibration magnitudes which are greater than twice those given in Table 14.3, with major damage at values greater than four times the values in the table. BS 7385-2:1993 (BSI, 1993) also notes that the probability of cosmetic damage tends towards zero at 12.5 mm/s peak component particle velocity.

Table 14.3: Guidance on the effects of vibration levels on building structures from BS5228-2:2009 + A1:2014

<table>
<tr><th rowspan="2">Type of Building</th><th colspan="2">PPV in frequency range of predominant pulse</th></tr>
<tr><th>4 Hz to 15 Hz</th><th>15 Hz and above</th></tr>
<tr><td>Reinforced or framed structures</td><td rowspan="2">50 mm/s</td><td rowspan="2">50 mm/s</td></tr>
<tr><td>Industrial and heavy commercial buildings</td></tr>
<tr><td>Un-reinforced or light framed structures</td><td rowspan="2">15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz</td><td rowspan="2">20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above</td></tr>
<tr><td>Residential or light commercial buildings</td></tr>
</table>

14.4.3 Operational noise

The assessment of noise levels at noise sensitive receptors has followed the “Detailed Assessment” methodology outlined in HD 213/11 (Highways Agency, 2011b). Noise levels have been calculated at all residential dwellings and other sensitive receptors within the Calculation Area (see Figure 14.1). Noise levels at dwellings have generally been calculated at first floor level; unless the property is known to only have one floor. For single storey dwellings, and for other sensitive receptors, such as churches, schools, medical facilities and outdoor areas, predictions have been undertaken at 1.5 m above ground level.

Consideration has also been given to likely noise impacts on the wider road network, outside the calculation area. The basic noise level (BNL) changes have been predicted for the affected routes outside the calculation area where there is a 1 dB increase or decrease in noise in the baseline year and / or a 3 dB increase or decrease in the future assessment year in comparison with the baseline year.

The future assessment year is defined as the year within the first 15 years of opening of the proposed scheme where traffic flows are greatest. The future assessment year is therefore usually 15 years after opening, which in this assessment is 2037.

This assessment considers noise level changes at dwellings and other sensitive receptors according to their baseline façade noise levels (reception point 1 m in front of the building facade). The following comparisons are made:

- Do Minimum scenario in baseline year (2022) against Do Minimum in the future assessment year (2037);
- Do Minimum scenario in the baseline year (2022) against Do Something scenario in the baseline year (2022); and
- Do Minimum condition in baseline year (2022) against Do Something in the future assessment year (2037).

14.4.4 Sensitive receptors

A review of available mapping has been carried out to identify nearby sensitive receptors. Sensitive receptors include residential dwellings, hospitals, schools, community facilities and designated areas. The main sensitive receptors identified in the area are various residential dwellings located adjacent to the A465 such as in Merthyr Tydfil and Hirwaun, along with isolated properties.

Noise impacts have been considered at other non-residential receptors, such as:

- hospitals (e.g. Prince Charles Hospital);
- schools (e.g. Pen-Y-Dre High School, Hirwaun Primary School, Ysgol-y-Graig Primary School);
- designated areas (e.g. Cwm Taf Fechan Woodlands, Penmoelallt, Bryncarnau Grasslands and Tir Mawr a Dderi Hir SSSIs); and
- public rights of way (e.g. National Cycle Network Routes).

14.4.5 Study area

The study and calculation areas for the noise assessment were defined in accordance with HD 213/11. Firstly, the study area was defined as a 1 km boundary around the start and end points of the physical works associated with the proposed scheme, and any improved or bypassed routes as part of the proposed scheme. The calculation area was then defined as all residential dwellings and other noise sensitive receptors within 600 m of the proposed scheme and for those roads (within 1 km of the proposed scheme) on the existing road network that would be predicted to result in noise changes of 1 dB in the opening year or 3 dB in the design year.

HD 213/11 requires consideration beyond the “calculation area”, to take into account the likely noise impacts on the wider road network (considered in terms of change BNL). This is required for such roads where there is a 1 dB increase or decrease in noise in the baseline year and / or a 3 dB increase or decrease in the future assessment year in comparison with the baseline year.

The study area for the noise assessment is shown in Figure 14.1.

The study area for the vibration assessment was defined as the area within 40 m of all roads where noise level predictions were undertaken, as required by HD 213/11.

14.4.6 Noise level predictions

Noise level predictions have been undertaken using the CadnaA noise modelling package, which incorporates the traffic noise prediction methodology contained in CRTN (Department for Transport and the Welsh Office, 1988). This document is a technical memorandum providing the definitive method of predicting road traffic noise in the United Kingdom. Noise level predictions take account of the following variables:

- typical weekday volumes of traffic during the eighteen hour period from 6 am to midnight (18-hour AAWT flows) – day time assessment;
- percentage of Heavy Vehicles (vehicles of unladen weight > 3.5 tonnes);
- traffic speeds (banded speed based on Interim Advice Note 185/15 (Highways Agency, 2015b));
- road gradient;
- local topography;
- nature of the ground cover between the road and the receptor;
- shielding effects of any intervening structures, including allowances for limited angles of view from the road and any reflection effects from relevant surfaces; and
- road surfacing type.

HD 213/11 provides updated guidance on the use of CRTN (Department for Transport and the Welsh Office, 1988). This includes guidance on predicting noise from dual carriageways; noise reduction corrections to be applied for low noise surfacing systems; and the prediction of road traffic noise levels to 600 m from a road traffic source (CRTN provides for a prediction distance of 300 m).

Interim Advice Note 185/15 (Highways Agency, 2015b), which contains advice on the assessment of link speeds and generation of speed-band vehicle speeds, has not been used for this proposed scheme, as it has not been formally adopted for use by the Welsh Government.

For daytime noise levels at dwellings, community facilities and other noise sensitive properties, façade noise levels are predicted whereas night-time noise levels are free-field (in the open, without any nearby noise-reflecting surfaces).

14.4.7 Operational noise assessment

The general approach to Environmental Impact Assessment (EIA) requires the identification of significance taking into account the value or sensitivity of a receptor and the magnitude of impact. However, as discussed in paragraph 3.36 of HD 213/11, in terms of road traffic noise, a standard methodology has not yet been developed to assign significance according to both value / sensitivity and magnitude. Instead, HD 213/11 advises that the magnitude of traffic noise impact from a road project should be classified into levels of impact, in order to assist with the interpretation of the road project.

This chapter therefore presents the assessment findings for operational noise in terms of impact magnitude only.

Section 3 of HD 213/11 provides guidance on the magnitude of traffic noise impacts. Magnitudes of impact are considered for both the short-term and long-term. A change in road traffic noise of 1 dB(A) in the short-term, for example when a project is opened, is the smallest that is considered perceptible. In the long-term, a 3 dB(A) change is considered perceptible. The classification of noise impact in terms of magnitude, provided by HD 213/11, is detailed in Table 14.4 and Table 14.5 for short and long term impacts respectively.

Table 14.4 : Classification of magnitude of noise impacts in the short term

Noise Change ($L_{A10,18hr}$)	Magnitude of impact
0.0	No change
0.1 – 0.9	Negligible

Noise Change ($L_{A10,18hr}$)	Magnitude of impact
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
5.0 +	Major

Table 14.5 : Classification of magnitude of noise impacts in the long term

Noise Change ($L_{A10,18hr}$)	Magnitude of impact
0.0	No change
0.1 – 2.9	Negligible
3.0 – 4.9	Minor
5.0 – 9.9	Moderate
10.0 +	Major

14.4.8 Night-time noise assessment

For the assessment of night-time noise impacts, HD 213/11 advises that until further research is available, only noise impacts in the long-term should be considered. Therefore, the classification in Table 14.5 is used in this assessment for determining night-time noise impacts. In addition, HD 213/11 advises only those sensitive receptors predicted to be subject to noise levels exceeding 55 dB $L_{night,outside}$ should be considered.

14.4.9 Noise nuisance

HD 213/11 defines the level of noise 'nuisance' by reference to the percentage of people in the affected population that are likely to be 'bothered very much or quite a lot' by traffic noise.

In this assessment, noise nuisance predictions have been based on the highest nuisance levels expected during the first 15 years after opening for the Do Minimum and Do Something scenario and compared to the nuisance levels of the Do Minimum baseline year (2022).

14.4.10 Operational vibration

HD 213/11 provides guidance on ground-borne vibration from highway schemes. This assessment provides a qualitative assessment on the likelihood of perceptible traffic induced ground-borne vibration.

It further advises that should the level of vibration at a receptor be predicted to rise to above a level of 0.3 mm/s, or an existing level above 0.3 mm/s is predicted to increase, then this should be classed as an adverse impact.

Paragraph A5.26 states that "*Significant ground-borne vibrations may be generated by irregularities in the road surface. Such vibrations are unlikely to be important when considering disturbance from new roads and the assessment will only be necessary in exceptional circumstances*."

Further to this, Figure 3 from Transport and Road Research Laboratory (TRRL) Report No RR53 – Ground Vibration Caused by Civil Engineering Works provides a summary of measurements taken by the TRRL which indicates the relative effects of various construction related sources. This figure indicates that, for a heavy lorry on a poor road surface at 8 m, a PPV of 0.1 mm/s is expected.

14.4.11 Vibration nuisance

Where properties are within 40 m of the carriageway, HD 213/11 recommends that, for a given level of noise exposure, the percentage of those 'bothered' by airborne vibration is 10% lower than the corresponding figure for noise nuisance. Where noise levels are below 58 dB $L_{A10,18h}$, it should be assumed that residents would not be 'bothered' by airborne vibration. Consideration has been given to changes in airborne vibration nuisance at all dwellings within 40m of roads where noise level predictions have been undertaken.

14.5 Limitations of the assessment

In relation to significance, HD 213/11 states the following:

In terms of road traffic noise, a methodology has not yet been developed to assign a significance according to both the value of a resources and the magnitude of an impact. However, the magnitude of traffic noise impact from a road project should be classified into levels of impact in order to assist with the interpretation of the road project. Therefore, for the assessment of traffic noise that is covered by this document, a classification is provided for the magnitude of impact.

Therefore, in keeping with HD 213/11, the overall significance of the operational noise effects shall not be described in the noise and vibration chapter, as there is currently no agreed methodology for doing so. Instead, a classification is provided for the magnitude of impact.

HD 213/11 requires the use of CRTN (Department for Transport and the Welsh Office, 1988) for the calculation of traffic noise. In relation to links with low traffic flows, CRTN states that calculation of noise from links with daily traffic flows of below 1000 vehicles is unreliable. Where a link has daily traffic flows below 1000 vehicles in some assessment scenarios but not others, it is still necessary to predict the traffic noise from the link in all scenarios to obtain realistic assessment outcomes. Therefore, in some cases, calculations undertaken to inform the assessment may be based on daily traffic flows below 1000 vehicles.

No other particular limitations have been encountered in the course of this assessment. However, all noise modelling studies are dependent on computer modelling of future conditions. The noise model itself is dependent on input data taken from computer modelled traffic data and on a number of assumptions. All computer modelled information is subject to an inherent degree of uncertainty and depends on a number of assumptions. The data and assumptions used in this assessment are set out in Appendix 14B (ES Supplement Volume 2).

Construction plant information, together with a provisional construction works programme, was estimated by project engineers based on preliminary design information. Construction plant noise levels were taken from the sound level data presented in Annex C of BS 5228-1: 2009 + A1:2014 (BSI, 2014a). Construction works are inherently transient and variable in nature and it is not possible to predict exact plant and vehicle movements in advance of the works with a high degree of accuracy. For the purpose of this assessment, it has been assumed that all plant and equipment listed would be in use at the same time in the same location. Such an approach is considered conservative and the predicted levels should therefore be considered as tending towards the worst case likely to occur for each construction stage, and in reality noise levels would generally be less than those presented in Section 14.8.

Vibration levels due to piling and ground compaction operations have been calculated using the empirical approach set out in BS 5228-2:2009 + A1:2014 (BSI, 2014a), based on estimated distances between residential receptors and typical locations where the activities would take place.

14.6 Current Baseline Knowledge

Long and short term noise monitoring was undertaken during January and February 2016 at eleven locations considered representative of communities along the scheme. The monitoring locations are shown in Figure 14.2 and full details of the noise measurements at each location are included in Appendix 14C (ES Supplement Volume 2).

The baseline noise survey was carried out in accordance with the methodology agreed with MTCBC and RCTCBC prior to commencement, which is commensurate with the methodology detailed in HD 213/11 and CRTN (Department for Transport and the Welsh Office, 1988).

The noise equipment was deployed at the dates and times shown in Table 14.6.

Table 14.6 : Summary of baseline noise monitoring dates and locations

Measurement location		Date and time		BNG coordinates	
		Measurement start	Measurement end	X	Y
LT1	12 Penyfan View	14/01/2016 15:00	20/01/2016 16:00	304446	208550
LT2	12 Eighth Avenue	20/01/2016 17:00	03/02/2016 11:00	305411	208369
LT3	84 The Hafod Pant	20/01/2016 16:00	03/02/2016 11:00	306712	208574
LT4	2 Trewaun	14/01/2016 12:00	20/01/2016 14:00	296273	205132
LT5	1 Oakland Close	14/01/2016 13:00	20/01/2016 13:00	296273	205132
LT6	Tawel Fan	20/01/2016 15:00	03/02/2016 10:00	297944	205916
LT7	Hafan Dawel	14/01/2016 14:00	20/01/2016 10:00	296262	205190
ST1	Pearces Court	03/02/2016 14:00	03/02/2016 16:30	302951	207991
ST2	Vaynor Road	20/01/2016 12:24	20/01/2016 15:24	303172	208164
ST3	Hornbeam Close	14/01/2016 14:00	14/01/2016 17:00	304505	208577
ST4	Houlson Street	03/02/2016 10:01	03/02/2016 13:01	306647	208518

The full measured data, location records, photographs, equipment, personnel, calibration records, meteorological records, and subjective impressions of the noise environment are presented in Appendix 14C (ES Supplement Volume 2).

All equipment was set up on site by two appropriately qualified and experienced professionals, who are members of the Institute of Acoustics.

Ambient noise levels were measured at each location using integrating-averaging sound level meters (SLM) or equivalent systems conforming to Class 1 as defined by BS EN 61672: Part 1 (BSI, 2013). Each SLM was field calibrated before the start of each survey by applying an acoustic calibrator to the microphone to check the sensitivity of the measuring equipment. Calibration checks were performed at the end of the survey. The maximum overall drift over the survey period noted at any location was 0.2 dB(A).

The equipment used for the noise monitoring was subject to more extensive performance tests, traceable to primary standards, at accredited independent laboratories within a period of 1 year prior to use. The calibration certificates detailing serial numbers and date of laboratory calibration of equipment used at each location are presented in Appendix 14D.

The microphone height was between 1.2 and 1.5 m above ground level. To minimise the influence of reflections, the microphone positions were at least 3.5 m from any reflecting surface other than the ground. A suitable foam windshield was fitted to each microphone. At each location, the SLM was set to measure using the logging facility and a sampling time of 100 ms, with the A-weighting filter and 'fast' time weighting selected.

The current noise environment is currently dominated by road traffic noise, caused by the surrounding road network. Noise levels adjacent to the existing A465 carriageway vary from around 50 dB $L_{A10,18h}$ to around 80 dB $L_{A10,18h,}$ according to the distance between the road and the façade of the property and whether or not there are other properties or other screening structures between them and the road. If no changes are made to the existing road infrastructure, these noise levels would gradually increase with time, due to expected growth in the volume of traffic.

14.7 Evaluation

Table 14.7 and Table 14.8 present a summary of the long term (minimum of seven days) and the short term (three hour CRTN shortened measurement procedure) monitoring respectively. The monitoring results provided are the average values of the measurements taken. Within Table 14.8, the $L_{A10,18hour}$ noise levels provided have been estimated from the three hourly L_{A10} noise levels measured, using the equation provided within CRTN for the shortened measurement procedure.

Table 14.7 : Summary of long term baseline noise monitoring

Location number	Location	Average measured noise level (dB)		
		$L_{A10,18hour}$	$L_{Aeq,18hour}$	$L_{A90,18hour}$
LT1	12 Penyfan View	62.8	60.7	50.7
LT2	12 Eighth Avenue	63.0	61.6	55.3
LT3	84 The Hafod Pant	60.9	59.5	53.1
LT4	2 Trewaun	66.8	64.0	51.5
LT5	1 Oakland Close	64.5	62.0	50.9
LT6	Tawel Fan	53.4	53.8	51.3
LT7	Hafan Dawel	57.7	55.8	48.7

Table 14.8 : Summary of shortened CRTN baseline noise monitoring

Location number	Location	Average measured noise level (dB)	Estimated noise level (dB)
		$L_{A10,3hour}$	$L_{A10,18hour}$
ST1	Pearces Court	67.4	66.4
ST2	Vaynor Road	70.8	69.8
ST3	Hornbeam Close	73.7	72.7
ST4	Houlson Street	78.8	77.8

In order to ensure that the data used to characterise the baseline noise environment is representative, the data was filtered using the following criteria;

- noise data during any periods of rain were removed, with a buffer of one hour each side of these periods also removed;
- noise data during any period where the average wind speed was over 5 m/s was excluded, with a buffer of one hour each side of these periods also removed; and
- any data which appeared atypically elevated from a visual review of the data, and based on professional judgement, was excluded.

14.8 Impact Assessment

14.8.1 Construction noise

Using the indicative construction activities and plant detailed in Appendix 14E, construction noise levels have been predicted at representative receptors located in close proximity to the works. The potential for significant effects at nearby receptors has been assessed based on criteria derived from the 'ABC' method detailed in Annex E of BS 5228-1: 2009 + A1 2014 (BSI, 2014a).

Sixteen main works locations have been identified as having potential to cause construction noise impacts, either due to their proximity to receptor groups, or the equipment and processes required for the works.

14.8.1.1 Typical working hours

For each works location, the closest receptors have been characterised and compared to the measurement locations reported in Section 14.7. The most representative measurement location has been selected, and the measured daytime L_{Aeq} value has been used to derive the relevant 'ABC' category, which is presented in Table 14.9 for each works location.

Table 14.9 : Determination of BS5228 Category

Works location	Representative measurement location	Daytime L_{Aeq} rounded to nearest 5dB	BS5228 'ABC' Category	BS5228 Daytime Threshold
Hirwaun Junction	LT4	65	B	70
Trewaun Overbridges	LT4	65	B	70
Pentwyn Cynon (Tramway) Footbridge	LT5	60	A	65
Afon Cynon Bridge	LT5	60	A	65
Vale of Neath Railway Bridge	LT5	60	A	65
Court Lodge Underpass	LT5	60	A	65
Croesbychan Junction	LT5	60	A	65
Nant Melyn Mainline Viaduct	LT6	55	A	65
Nant Hir (North) Viaduct	LT6	55	A	65
Baverstock Junction	LT6	55	A	65
Baverstock Excavation	LT6	55	A	65
A465	ST1	65	B	70
Nant Ffrwd structures	ST1	65	B	70
Taf Fawr Mainland Viaduct	ST1	65	B	70
High Street Bridge	ST1	65	B	70
Taf Fechan Viaduct (Widened)	ST2	65	B	70
Gurnos Farm Underpass	LT1	60	A	65
Prince Charles Hospital Junction Widening	LT1	60	A	65
Prince Charles Hospital Junction	LT2	60	A	65
Pant Road Bridge	LT3	60	A	65
Jones St Bridge	LT3	60	A	65
Dowlais Junction	LT3	60	A	65

The noise predictions take into account plant types, plant numbers, expected daily operating times of each plant, distance of plant to the receptors, and topographical information between the plant and the receptors. The noise model assumes typical locations for activities working simultaneously. For mobile activities, for example earthworks or road surfacing, worst case locations have been used adjacent to receptors along the proposed scheme. The highest predicted noise level for each receptor has been considered as the potential construction noise level for this assessment. This approach is considered to provide an estimate of construction noise levels tending towards the worst case for each receptor.

The activities taken into account in the calculations are representative of those expected during normal work hours, which are expected to be between 08:00 to 18:00 Monday to Friday and 08:00 to 13:00 on Saturdays.

The estimated numbers of properties that could potentially experience minor, moderate and major levels of impact for each identified works location are presented in Table 14.10. In evaluating whether significant impacts would occur, consideration would normally also be given to other factors including the duration of the construction activities. This level of detail is not yet known, so it has not been possible to confirm whether significant effects would occur. Instead, given that construction works are to be restricted to typical daytime working hours as much as possible, it is assumed that potential daytime impacts would occur.

Table 14.10 : Construction noise impact assessment

Works location	0 - 5 dB below BS5228 threshold		0 - 5 dB above BS5228 threshold		>5 dB above BS5228 threshold	
	Minor impact		Moderate impact		Major impact	
	Dwellings	OSRs	Dwellings	OSRs	Dwellings	OSRs
Hirwaun Junction	18	0	8	0	0	0
Trewaun Overbridges	58	0	30	0	18	0
Pentwyn Cynon (Tramway) Footbridge	264	0	76	0	24	0
Afon Cynon Bridge	80	2	56	0	24	0
Vale of Neath Railway Bridge	54	0	22	0	8	0
Court Lodge Underpass	4	0	4	0	0	0
Croesbychan Junction	6	0	0	0	6	0
Nant Melyn Mainline Viaduct	2	0	0	0	0	0
Nant Hir (North) Viaduct	0	0	0	0	0	0
Baverstock Junction	4	0	0	0	0	0
Baverstock Excavation	2	0	4	0	0	0
A465	28	0	14	0	0	0
Nant Ffrwd structures	0	0	2	0	0	0
Taf Fawr Mainland Viaduct	20	0	4	0	4	0
High Street Bridge	114	2	28	2	28	2
Taf Fechan Viaduct (Widened)	18	6	10	0	0	0
Gurnos Farm Underpass	164	0	66	0	38	0
Prince Charles Hospital Junction Widening	90	4	26	0	28	0

Works location	0 - 5 dB below BS5228 threshold		0 - 5 dB above BS5228 threshold		>5 dB above BS5228 threshold	
	Minor impact		Moderate impact		Major impact	
	Dwellings	OSRs	Dwellings	OSRs	Dwellings	OSRs
Prince Charles Hospital Junction	88	2	44	0	26	0
Pant Road Bridge	262	0	52	0	4	0
Jones St Bridge	198	0	144	0	94	0
Dowlais Junction	48	8	44	0	10	0

Table 14.10 indicates that major impacts associated with construction noise could be expected at numerous locations where dwellings are in close proximity to the proposed works, including at Gurnos, Jones St Bridge and Pentwyn Cynon. However, it should be recognised that any such impacts would be temporary in nature.

Given the transient nature of construction activities, the worst case predicted construction noise levels provided are likely to occur for a limited period, when construction activities are located in close proximity to the receptors. At other times it is expected that construction noise levels would be lower, and the impacts may be less than those presented in Table 14.10.

Additional mitigation to that incorporated in the construction design is presented in Section 14.9. Through the measures set out in the Construction Environmental Management Plan (CEMP) and Section 61 applications, including the implementation of best practicable means and standard mitigation measures, noise and vibration during construction would be minimised as far as is reasonably practicable.

14.8.1.2 Evening, night-time and weekend possessions

Whilst the vast majority of construction works would take place during typical daytime hours, it is anticipated that some construction works would need to be undertaken during evening and weekend possessions. These construction activities are likely at locations such as the Vale of Neath Railway and Court Farm Underpass for cranes lifting spanning members into position, plus demolition and rebuilding of the existing structures. The need for night-time working has not been identified at this stage, but there is the potential for limited night-time working to be required, depending upon the construction techniques adopted.

During evening, weekend and night-time periods, BS5228 Threshold Noise Limits would be lower than those presented in Table 14.9, to represent the more noise sensitive nature of these periods.

For the proposed construction works during evening and weekend possessions identified in the Constructability Report (Jacobs 2018), those in the vicinity of the Vale of Neath Railway Bridge, the Cefn Coed High Street Bridge, and Prince Charles Hospital Junction are near to sensitive receptors. There is the potential for major adverse noise impacts at these locations during evening and weekend working, depending on the proximity and duration of the works proposed. Similarly, for any night-time working, major adverse noise impacts would again be likely, depending on the proximity and duration of the works proposed.

Given the potential for major adverse impacts at nearby sensitive receptors for works undertaken during evening, night-time or over weekend periods, the need for such working would be minimised by the construction contractor. Additional mitigation to that incorporated in the construction design is presented in Section 14.9. Through the measures set out in the CEMP and Section 61 applications, including the implementation of best practicable means and standard mitigation measures, noise and vibration during construction would be minimised as far as is reasonably practicable.

14.8.1.3 Construction traffic

The majority of the construction phase would require the movement of heavy vehicles along the A465 to establish the required earthworks balance across the proposed scheme. It is estimated that there would be four crews each achieving up to 40 earthwork movements per day (a total approximately 1500 m^3 of earthwork movements).

Based on the worst case assumption that each of the four crews passes the same section of the A465, and that each movement has an associated return journey, this would give rise to a maximum of 320 heavy good vehicle (HGV) movements along any section of the A465 per day. The worst case additional number of other HGV movements associated with deliveries is estimated at an additional 100 movements per day. Table 14.11 presents the noise increases associated with HGV movements along the A465 during the construction phase.

Table 14.11 : Construction HGV movements

Section	Speed (kph)	Baseline		Additional HGVs	Baseline level + construction traffic		Increase in noise, dB
		Total flow	% HGV		Total flow	% HGV	
A465 west of A470 Junction	91	25616	7%	420	26036	9%	0.4
A465 through Gurnos	78	22123	6%	420	22543	8%	0.5

Based on the estimated worst-case number of additional HGV movements, there would not be any anticipated perceptible noise increases in road traffic nose for nearby sensitive receptors, during construction. As such, construction traffic is not expected to cause a significant adverse noise impact at local receptors.

14.8.2 Construction vibration

Construction activities with the potential to give rise to the highest levels of vibration at receptors are vibratory earthwork compacting works and piling activities. Such works would be associated with the construction of structures and earthworks.

Driven piling has the potential to result in high levels of noise and ground-borne vibration, and it is considered that there is the potential for perceptible vibration due to driven piling for receptors near Trewaun.

BS 5228-2:2009+A1:2014 (BSI, 2014) provides empirical vibration prediction methods for piling and earthworks compaction. These methods have been used to undertake preliminary predictions of construction vibration at nearby representative sensitive receptors. The range of estimated vibration levels associated with driven piling works at these locations is presented in Table 14.12, based on the likely minimum distance between the works and the nearest sensitive receptor. The worst-case input data (from the ranges given for the equation) were used in predicting the levels of vibration in Table 14.12.

Table 14.12 : Predicted ranges of ground vibration due to driven piling

Work site	Receptor	Estimated distance (m)	Peak particle velocity due to piling (mm/s)		
			Soft / loose / organic soils	Stiff / dense / obstructed soils	At refusal
Trewaun Junction	Trewaun	15	8.6	25.9	43.1

Due to the high levels of vibration associated with driven piling at properties close to the Trewaun Junction, it is proposed to use a low vibration technique, for example rotary bored or secant piling. With one of these techniques adopted, vibration levels are likely to be around 1 mm/s or lower at a distance of 15 m, based on the data provided

in Table D.6 of Annex D of BS 5228-2:2009+A1:2014 (BSI, 2014). At these levels, there would be minimal adverse effects associated with piling vibration at Trewaun. Low vibration piling techniques would most likely be needed at other locations where sensitive receptors are in close proximity to proposed piling works.

The CEMP will set out the necessary measures to ensure compliance with the appropriate limits in BS 7385-2: 1993, and this is discussed further in Section 14.9.1.1.

BS 5228-2:2009+A1:2014 (BSI, 2014b) also provides empirical vibration prediction methods for the prediction of vibration levels associated with soil compaction. Results are presented in terms of the 95% confidence level (i.e. where the probability of peak particle velocity levels being lower than this value is 95%), as well as the 67% and 50% confidence levels. The worst-case input data (from the ranges given for the equation) were used in predicting the levels of vibration in Table 14.13.

Table 14.13 : Predicted ranges of ground vibration due to soil compaction

Work site	Receptor	Estimated distance (m)	Peak particle velocity due to rotary compaction (mm/s)		
			95% confidence level	67% confidence level	50% confidence level
Croesbychan	Denbeigh Court	30	5.4	2.8	1.5
Gurnos Farm Underpass	Pen Gurnos	30	5.4	2.8	1.5
A465	Pen Y Dyffryn	50	2.5	1.3	0.7

The vibration levels in Table 14.13 above are likely to be perceptible to residents in residential dwellings and are likely to lead to complaint according to the guidance in BS 5228-2:2009+A1:2014 (BSI, 2014b). Careful consideration will need to be given to earth compaction in close proximity to sensitive receptors. The CEMP will include a requirement for vibration soil compaction plant to be set to a low amplitude setting when operating in close proximity to sensitive receptors, where possible. This is discussed further in Section 14.9.1.1.

In all cases, the predicted vibration levels fall well below the vibration levels defined in BS 7385-2:1993 (BSI, 1993) which could give rise to cosmetic damage to buildings. In addition, given the transient nature of the soil compaction works, this level of vibration would only be experienced for short duration, for example two to three days, when the compaction works occur at the nearest position to the properties.

14.8.3 Operational noise

Predicted noise levels at all noise sensitive receptors within the calculation area are detailed in Appendix 14C (ES Supplement Volume 2) which also includes a comparison of the data gathered during the noise monitoring exercise and the predicted noise levels at the measurement locations.

The approach followed within the HD 213/11 methodology for reporting noise impacts is conservative, with the least beneficial impact at each receptor location being considered. For example, if a dwelling was predicted to experience a 7 dB reduction in noise level for one property façade as a result of the proposed scheme, but a 1 dB increase in noise level for another façade, it would only be the 1 dB noise increase that was reported in the HD 213/11 assessment tables. The larger noise benefit at that dwelling would not be reported in the HD 213/11 assessment tables. This approach to reporting impacts should be noted when considering the assessment findings detailed in the sections that follow.

There is one exception to this approach, in the consideration of noise impacts for those dwellings within the NAPPA. These dwellings have been designated on the basis of the noise levels experienced for the facades facing towards the existing A465. As such, the noise impacts reported for the dwellings within the NAPPA are for the relevant façade that has led to its designation.

The noise changes in the short term (on scheme opening) are illustrated in Figure 14.4 (ES Supplement Volume 3) Do-Minimum 2022 versus Do-Something 2022, whilst the noise changes in the long term are highlighted in Figure 14.5 (ES Supplement Volume 3) Do-Minimum 2022 vs Do-Something 2037. The colour palettes used for these figures reflect the 'magnitude of impacts' scales, and differ for the short term and long term comparisons. It should be noted that there may be some apparent differences between the noise levels reported for an individual property and the noise change illustrated within the noise contour plots. As detailed in the section above, HD 213/11 requires the reporting of the least beneficial impacts, whilst the noise contour plots illustrate the general noise change in that area (which may be affecting other facades, rather than the one reported).

14.8.3.1 Noise levels at sample dwellings

In order to provide a summary of the noise changes associated with the proposed scheme, a number of sample dwellings have been selected. The locations for the sample properties have been selected to enable an understanding of the typical magnitudes of change, and the reasons for these changes, for different communities along the scheme corridor. The properties are not intended to be representative of the absolute 'worst case' noise effects for receptor groups along the proposed scheme corridor.

Table 14.14 presents the 'short term' changes in noise level as a result of the proposed scheme (i.e. the Do Minimum scenario in 2022 compared with the Do Something scenario in 2022) at the selected sample dwellings, and indicates the magnitude of noise change at these dwellings in accordance with the criteria presented in Appendix 14C (ES Supplement Volume 2).

Table 14.14 : Summary of short term noise changes at sample dwellings

Receptor	Do Minimum 2022, $L_{A10,18h}$ (dB)	Do Something 2022, $L_{A10,18h}$ (dB)	Noise level change (dB)	Magnitude of impact
Hawthorns Redhill Close CF44 9PS	55.6	55.5	-0.1	Negligible Beneficial
35 Limeslade Close CF44 9RN	64.4	56.9	-7.5	Major Beneficial
5 Trewaun CF44 9HN	60.3	58.0	-2.3	Minor Beneficial
47 Trenant CF44 9LA	65.6	65.1	-0.5	Negligible Beneficial
17 Denbeigh Court CF44 9QH	54.6	52.8	-1.8	Minor Beneficial
8 Clos Cribyn CF48 1NS	64.8	67.7	2.9	Minor Adverse
35 Pen Y Dyffryn CF48 1PL	59.3	62.9	3.6	Moderate Adverse
1 Grawen Houses Grawen Lane CF48 2NL	63.1	64.6	1.5	Minor Adverse
7 Maesygarreg CF48 2RG	67.3	66.8	-0.5	Negligible Beneficial
5 St Johns Close CF48 2PE	60.3	59.9	-0.4	Negligible Beneficial
2 Vaynor Villas Upper Vaynor Road CF48 2NR	49.2	49.8	0.6	Negligible Adverse
95a Lakeside Gardens CF48 1EW	53.9	56.3	2.4	Minor Adverse
19 Lupin Close CF47 9DP	61.4	61.6	0.2	Negligible Adverse
28 Pen Gurnos CF47 9EA	57.6	58.1	0.5	Negligible Adverse
2 Wellingtonia Close CF47 9BL	71.6	71.8	0.2	Negligible Adverse

Receptor	Do Minimum 2022, $L_{A10,18h}$ (dB)	Do Something 2022, $L_{A10,18h}$ (dB)	Noise level change (dB)	Magnitude of impact
12 Eighth Avenue CF47 9UN	57.2	57.3	0.1	Negligible Adverse
30 Rocky Road CF47 9JL	69.8	69.4	-0.4	Negligible Beneficial
15 Ivor Terrace CF48 3SW	54.8	56.0	1.2	Minor Adverse
9 Beacons View Beacons View CF48 3NJ	55.5	57.0	1.5	Minor Adverse
84 The Hafod CF48 2ED	53.6	55.8	2.2	Minor Adverse
2 Guest Cottages Guest Cottages CF48 3NT	48.0	48.8	0.8	Negligible Adverse
27 Station Terrace CF48 3PU	52.6	53.8	1.2	Minor Adverse

Table 14.14 demonstrates that eight sample receptors are expected to experience perceptible adverse noise impacts in the short term, as a result of the proposed scheme. Seven of these are predicted to fall within the minor adverse magnitude of impact category, whilst one would fall within the moderate adverse magnitude of impact category. The underlying reasons for the perceptible increases in noise level are discussed below.

For properties to the north of Clwydyfagwyr (represented by Pen Y Dyffryn and Clos Cribyn) the increase in noise level is as a result of the increase in traffic speed and flow on the A465, as well as the realignment of the carriageway, which results in a reduction in the screening effect of the local topography. Although a low noise road surfacing (LNRS) is proposed on this section of the A465, it currently benefits from such a surface system; therefore, the newly installed LNRS does not deliver a decrease in road noise at this location. Overall, this results in a moderate / minor increase in noise.

For properties at Grawen Lane, the increase in noise level is principally as a result of the realignment of the main Taf Fawr crossing towards the north, which results in a reduction in the distance to the A465. In addition, increases in traffic speed and flow on the A465 increase the source noise of the highway. A third factor is the new eastbound on-slip from the A470 junction which is in close proximity to this location. A minor noise increase persists despite the application of LNRS and the inclusion of environmental barriers in the proposed scheme design.

At 95a Lakeside Gardens, the increase in noise would be predicted to occur on the south-eastern façade, which does not face towards the A465. This increase is principally associated with the change in the realignment of the A465 to the east of the property in the direction of Gurnos. The south-eastern part of the property façade is currently screened from the existing A465 alignment by the property envelope. However, as the property envelope does not provide screening to all sections of the proposed alignment, a minor increase in noise is predicted to occur. It should be noted that a minor beneficial impact (of up to -1.5 dB) is predicted to occur on the north-western façade of this property, which faces towards the A465, due to the inclusion of a proposed environmental barrier in this area.

At 15 Ivor Terrace, the application of a LNRS is not enough to offset noise increases associated with moving the carriageway alignment closer to the property, a small uplift in traffic and increased traffic speed. A minor adverse noise impact results at this property as a result of the proposed scheme on opening.

At 9 Beacons View, there is a minor noise decrease at the northern property façade which faces the A465. However, the southern property façade is currently screened from the A465 by the property envelope, but with the realignment of the A465 to the west of Pant Road, the southern facade would have line of sight to a part of the A465. In addition, the traffic flow and vehicle speed are predicted to increase on the A465 as a result of the proposed scheme. These changes result in a minor increase in noise for the southern façade of this property.

At 84 The Hafod, the minor increase in noise is predicted to occur on the northern façade, which faces away from the A465. The increase is principally due to a predicted increase in traffic flow and speed using the local road network in this area as a consequence of the Prince Charles Hospital junction, whilst the A465 is also proposed to move closer to the receptor. The southern façade, which faces towards the A465, is predicted to experience a negligible adverse impact, owing to a proposed environmental barrier in this area, which has a greater effect on the façade facing the A465 than it does for the northern façade.

At 27 Station Terrace, the minor increase in noise occurs on the southern façade of the property and is due to a predicted increase in traffic using the local road network in this area to access the A465 at the Dowlais junction. It should be noted that on the northern façade, which faces towards the A465, a negligible benefit (of up to -0.8 dB) is predicted as a result of the proposed inclusion of an environmental barrier in this area.

Three representative receptors are expected to experience perceptible noise benefits in the short term, as a result of the proposed scheme, falling within the minor and major beneficial impact categories. The underlying reasons for the perceptible decreases in noise are discussed below:

At Limeslade Close the decrease in noise level is principally as a result of the realignment of the A465 approximately 250 m to the south and the application of LNRS, which results in a major beneficial impact.

In the vicinity of 5 Trewaun, there would be an increase in speed and flow. However, a minor benefit is expected on the south-western façade at this receptor due to the combination of LNRS, an environmental barrier, and the screening effect provided by walls of the cutting at Brecon Road. The north-eastern façade, which faces the A465, is predicted to experience a major beneficial impact as a result of the above.

At Denbigh Court the minor decrease in noise level is as a result of the realignment of the A465 to the east, and the application of LNRS.

On proposed scheme opening, all other sample receptors are expected to experience negligible noise changes with the proposed scheme in place.

Table 14.15 presents the 'long term' changes in noise level as a result of the proposed scheme (i.e. the Do Minimum scenario in 2022 compared with the Do Something scenario in 2037) at the selected sample dwellings, and indicates the magnitude of noise change in accordance with the magnitude criteria presented in Appendix 14C (ES Supplement Volume 2).

Table 14.15 : Summary of long term noise changes at sample dwellings

Receptor	Do Minimum 2022, $L_{A10,18h}$ (dB)	Do Something 2037, $L_{A10,18h}$ (dB)	Noise level change (dB)	Magnitude of impact
Hawthorns Redhill Close CF44 9PS	55.6	56.1	0.5	Negligible Adverse
35 Limeslade Close CF44 9RN	64.4	57.5	-6.9	Moderate Beneficial
5 Trewaun CF44 9HN	60.3	58.2	-2.1	Negligible Beneficial
47 Trenant CF44 9LA	65.6	66.0	0.4	Negligible Adverse
17 Denbeigh Court CF44 9QH	54.6	53.6	-1.0	Negligible Beneficial
8 Clos Cribyn CF48 1NS	64.8	68.5	3.7	Minor Adverse
35 Pen Y Dyffryn CF48 1PL	59.3	64.1	4.8	Minor Adverse
1 Grawen Houses Grawen Lane CF48 2NL	63.1	66.0	2.9	Negligible Adverse

Receptor	Do Minimum 2022, $L_{A10,18h}$ (dB)	Do Something 2037, $L_{A10,18h}$ (dB)	Noise level change (dB)	Magnitude of impact
7 Maesygarreg CF48 2RG	67.3	68.2	0.9	Negligible Adverse
5 St Johns Close CF48 2PE	60.3	60.8	0.5	Negligible Adverse
2 Vaynor Villas Upper Vaynor Road CF48 2NR	49.2	50.7	1.5	Negligible Adverse
95a Lakeside Gardens CF48 1EW	53.9	57.3	3.4	Minor Adverse
19 Lupin Close CF47 9DP	61.4	62.3	0.9	Negligible Adverse
28 Pen Gurnos CF47 9EA	57.6	59.0	1.4	Negligible Adverse
2 Wellingtonia Close CF47 9BL	71.6	72.4	0.8	Negligible Adverse
12 Eighth Avenue CF47 9UN	57.2	58.3	1.1	Negligible Adverse
30 Rocky Road CF47 9JL	69.8	70.6	0.8	Negligible Adverse
15 Ivor Terrace CF48 3SW	54.8	57.0	2.2	Negligible Adverse
9 Beacons View Beacons View CF48 3NJ	55.5	58.1	2.6	Negligible Adverse
84 The Hafod CF48 2ED	53.6	56.9	3.3	Minor Adverse
2 Guest Cottages Guest Cottages CF48 3NT	48.0	49.8	1.8	Negligible Adverse
27 Station Terrace CF48 3PU	52.6	54.6	2.0	Negligible Adverse

Table 14.15 demonstrates that four sample receptors would be expected to experience perceptible adverse noise impacts in the long term, as a result of the proposed scheme, all falling within the minor adverse magnitude of impact category. Conversely, a single sample receptor is expected to experience a perceptible beneficial noise impact, in the long term as a result of the proposed scheme, falling within the moderate beneficial magnitude of impact category. The underlying reasons for the changes in long term noise level are the same as described for the short term impacts.

All other sample receptors are expected to experience negligible noise changes with the proposed scheme in place, in the long term.

14.8.3.2 Noise levels at health, educational and community receptors

Table 14.16 presents the ‘short term’ changes in noise level as a result of the proposed scheme (i.e. the Do Minimum scenario in 2022 compared with the Do Something scenario in 2022) at selected health, educational and community receptors.

Table 14.16 : Summary of short term noise changes at health, education and community receptors

Receptor	Do Minimum 2022, $L_{A10,18h}$ (dB)	Do Something 2022, $L_{A10,18h}$ (dB)	Noise level change (dB)	Magnitude of impact
Cylch Meithrin St Lleurwgs Hall Station Road Hirwaun	49.2	48.7	-0.5	Negligible Beneficial
Dowlais Primary School - Junior Department High Street Caeharris Dowlais Merthyr Tydfil CF48 3HB	47.3	48.4	1.1	Minor Adverse
Dowlais Primary School Nursery and Infants Department Market Street Dowlais Merthyr Tydfil CF48 3HW	47.1	47.9	0.8	Negligible Adverse
Hirwaun County Primary School Glanant Street Hirwaun, Hirwaun CF44 9NF	51.0	48.9	-2.1	Minor Beneficial
Hirwaun Infants and Nursery School Glanant Street Hirwaun, Hirwaun CF44 9NF	50.9	49.6	-1.3	Minor Beneficial
Morlais Medical Centre Berry Square Dowlais Merthyr Tydfil CF48 3AL	68.2	69.7	1.5	Minor Adverse
Pant Primary School Heol-Y-Bryniau Pant Merthyr Tydfil CF48 2AD	50.1	51.8	1.7	Minor Adverse
Pen-Y-Dre High School Goitre Lane Gurnos Merthyr Tydfil CF47 9BY	53.8	53.6	-0.2	Negligible Beneficial
Penywaun Primary School Coed Glas Penywaun Aberdare CF44 9DR	49.7	50.5	0.8	Negligible Adverse
Prince Charles Hospital Gurnos Road Gurnos Merthyr Tydfil CF47 9DQ	53.5	53.7	0.2	Negligible Adverse
Roseville Nurseries Hirwaun Road Hirwaun	47.8	48.6	0.8	Negligible Adverse
The Co Operative Pharmacy Hirwaun Health Centre High Street Hirwaun	50.2	50.8	0.6	Negligible Adverse
Trefechan Nursery School Rowan Rise Trefechan Merthyr Tydfil CF48 2EW	55.0	55.6	0.6	Negligible Adverse
Ysgol Gynradd Coed Y Dderwen Heol Parc Maen Swansea Road Merthyr Tydfil CF48 1LG	49.4	49.7	0.3	Negligible Adverse
Ysgol Y Graig School Brewery Lane Cefn Coed Merthyr Tydfil CF48 2LR	53.3	54.1	0.8	Negligible Adverse
Ysgol Gyfun Rhydywaun, CF44 9ES	50.6	51.6	1.0	Minor Adverse

Table 14.16 demonstrates that Dowlais Primary School (Junior Department), Morlais Medical Centre, Pant Primary School and Ysgol Gyfun Rhydywaun would be expected to experience a minor adverse noise increase in the short term. This is principally due to a predicted increase in traffic using the local road network in these areas. In the case of Pant Primary School this is also as a consequence of traffic using the Prince Charles Hospital junction, rather than noise from traffic on the A465 itself.

Hirwaun County Primary School and Hirwaun Infants and Nursey School would be expected to experience minor decreases in noise level on proposed scheme opening, principally as a result of the realignment of the A465 to the south, as well as the application of LNRS.

All other identified health, educational and community receptors are expected to experience negligible noise changes with the proposed scheme in place, in the year of opening.

Table 14.17 presents the 'long term' changes in noise level as a result of the proposed scheme (i.e. the Do Minimum scenario in 2022 compared with the Do Something scenario in 2037) at the selected health, educational and community receptors dwellings.

Table 14.17 : Summary of long term noise changes at health, education and community receptors

Receptor	Do Minimum 2022, $L_{A10,18h}$ (dB)	Do Something 2037, $L_{A10,18h}$ (dB)	Noise level change (dB)	Magnitude of impact
Cylch Meithrin St Lleurwgs Hall Station Road Hirwaun	49.2	49.4	0.2	Negligible Adverse
Dowlais Primary School - Junior Department High Street Caeharris Dowlais Merthyr Tydfil CF48 3HB	47.3	49.2	1.9	Negligible Adverse
Dowlais Primary School Nursery and Infants Department Market Street Dowlais Merthyr Tydfil CF48 3HW	47.1	48.5	1.4	Negligible Adverse
Hirwaun County Primary School Glanant Street Hirwaun, Hirwaun CF44 9NF	51.0	49.5	-1.5	Negligible Beneficial
Hirwaun Infants and Nursery School Glanant Street Hirwaun, Hirwaun CF44 9NF	50.9	50.2	-0.7	Negligible Beneficial
Morlais Medical Centre Berry Square Dowlais Merthyr Tydfil CF48 3AL	68.2	69.6	1.4	Negligible Adverse
Pant Primary School Heol-Y-Bryniau Pant Merthyr Tydfil CF48 2AD	50.1	52.8	2.7	Negligible Adverse
Pen-Y-Dre High School Goitre Lane Gurnos Merthyr Tydfil CF47 9BY	53.8	54.6	0.8	Negligible Adverse
Penywaun Primary School Coed Glas Penywaun Aberdare CF44 9DR	49.7	53.6	3.9	Minor Adverse
Prince Charles Hospital Gurnos Road Gurnos Merthyr Tydfil CF47 9DQ	53.5	54.4	0.9	Negligible Adverse
Roseville Nurseries Hirwaun Road Hirwaun	47.8	49.0	1.2	Negligible Adverse
The Co Operative Pharmacy Hirwaun Health Centre High Street Hirwaun	50.2	51.5	1.3	Negligible Adverse
Trefechan Nursery School Rowan Rise Trefechan Merthyr Tydfil CF48 2EW	55.0	56.0	1.0	Negligible Adverse
Ysgol Gynradd Coed Y Dderwen Heol Parc Maen Swansea Road Merthyr Tydfil CF48 1LG	49.4	50.5	1.1	Negligible Adverse

Receptor	Do Minimum 2022, $L_{A10,18h}$ (dB)	Do Something 2037, $L_{A10,18h}$ (dB)	Noise level change (dB)	Magnitude of impact
Ysgol Y Graig School Brewery Lane Cefn Coed Merthyr Tydfil CF48 2LR	53.3	54.7	1.4	Negligible Adverse
Ysgol Gyfun Rhydywaun, CF44 9ES	50.6	52.8	2.2	Negligible Adverse

Table 14.17 demonstrates that only Penywaun Primary School would be expected to experience a minor noise increase in the long term. This is due to the influence of the proposed Cynon Valley Gateway scheme that is included in the Do Something scenario in 2037. This project has been modelled without any mitigation, as the project is not currently at the design stage, and therefore a noise increase of this magnitude would be unlikely to occur in practice even if both the proposed scheme and the proposed Cynon Valley Gateway scheme were to be in operation by 2037. Any increase associated with the proposed A465 scheme itself at Penywaun Primary School would be negligible.

All other sample receptors are expected to experience negligible noise changes with the proposed scheme in place, in the long term.

14.8.3.3 Designated areas and public rights of way

Changes in noise due to the proposed scheme at identified designated areas and public rights of way have been quantified, and the associated magnitudes of impact are presented in Table 14.18.

Table 14.18 : Summary of impacts at designated areas and public rights of way

Receptor	Approximate range of changes in noise, $L_{A10,18h}$ (dB)		Magnitude of impact	
	Short term	Long term	Short term	Long term
Bryncarnau Grasslands SSSI	2 to 3	3 to 5	Minor Adverse	Minor Adverse
Cors Bryn Y Gaer SSSI	0 to 1	0 to 2	No Change to Negligible Adverse	No Change to Negligible Adverse
Penmoelallt SSSI	0 to -1	0 to 1	Negligible Beneficial to No Change	No Change to Negligible Adverse
Tir Mawr a Dderi Hir SSSI	-7 to 7	-4 to 20	Major Benefit to Major Adverse	Minor Beneficial to Major Adverse
Taf Fechan Woodlands SSSI	-16 to 0	-11 to 1	Major Beneficial to No Change	Major Beneficial to Negligible Adverse

Various public rights of way and the National Cycle Network Routes (8, 46 and 478) intersect the DMRB Study area. The distance between the routes and the scheme varies greatly, but it is predicted that there could be some adverse impacts on the public rights of ways and National Cycle Network, where they are closest to the proposed alignment.

14.8.3.4 Detailed Assessment summary tables

Table 14.19, Table 14.20, and Table 14.21 provide the noise level change comparisons in accordance with the reporting requirements for a detailed assessment within HD 213/11.

Table 14.19 : Short-term traffic noise comparison, Do Minimum (2022) against Do Something (2022)

Scenario / comparison: Do Minimum 2022 against Do Something 2022			
Change in noise level		**Daytime**	
		Number of dwellings	**Number of other sensitive receptors**
Increase in noise level $L_{A10,18h}$	0.1 - 0.9	3762	41
	1.0 - 2.9	3347	25
	3 - 4.9	171	3
	5 +	59	2
No Change	0	402	3
Decrease in noise level $L_{A10,18h}$	0.1 - 0.9	3134	21
	1 - 2.9	335	4
	3 - 4.9	48	0
	5 +	8	0

Table 14.19 demonstrates that with the introduction of the scheme, 3577 dwellings are predicted to experience a noise increase of at least 1 dB in the short term. Of these, there are predicted to be 59 dwellings experiencing a major adverse magnitude of impact, 171 dwellings experiencing a moderate adverse magnitude of impact and 3347 dwellings experiencing a minor adverse magnitude of impact. Conversely, 391 dwellings are predicted to experience noise decreases of at least 1 dB on proposed scheme opening. Of these, there are predicted to be 8 dwellings experiencing a major beneficial magnitude of impact, 48 dwellings experiencing a moderate beneficial magnitude of impact and 335 dwellings experiencing a minor beneficial magnitude of impact.

In terms of other sensitive receptors, 30 are expected to experience perceptible noise increases (two in the major adverse magnitude of impact category, three in the moderate adverse magnitude of impact category and 25 in the minor adverse magnitude of impact category) whilst four are expected to experience perceptible noise reductions on proposed scheme opening (all within the minor beneficial magnitude of impact category).

Overall, when comparing the amount of receptors that would experience a perceptible decrease in noise level (391) against those that would experience a perceptible increase in noise level (3577), the overall impact of the proposed scheme could be considered to be adverse in the short term.

Table 14.20 : Long-term traffic noise comparison, Do Minimum (2022) against Do Minimum (2037)

Scenario / Comparison: Do Minimum 2022 against Do Minimum 2037				
Change in noise level		**Daytime**		**Night-time**
		Number of dwellings	**Number of other sensitive receptors**	**Number of dwellings**
Increase in noise level, LA10,18h	0.1 - 2.9	6418	56	300
	3 - 4.9	0	0	0
	5 - 9.9	0	0	0
	10 +	0	0	0

Scenario / Comparison: Do Minimum 2022 against Do Minimum 2037				
Change in noise level		Daytime		Night-time
		Number of dwellings	Number of other sensitive receptors	Number of dwellings
No Change	0	974	9	9
Decrease in noise level, LA10,18h	0.1 - 2.9	3874	34	16
	3 - 4.9	0	0	0
	5 - 9.9	0	0	0
	10 +	0	0	0

Table 14.20 shows that, should the proposed scheme not be constructed, no dwellings are predicted to experience perceptible changes in noise level (at least 3 dB in the long term daytime scenario).

No perceptible noise changes are expected to be experienced at other sensitive receptors in the long term daytime scenario.

For the night-time assessment only those dwellings predicted to experience noise levels of at least 55 $dBL_{night,outside}$ are considered. At night, without the proposed scheme in place, no dwellings are predicted to experience perceptible changes in noise level (at least 3 dB) in the long term.

Overall, when comparing the amount of receptors that would experience a perceptible noise decrease against those that would experience a perceptible noise increase, the overall long term change could be considered to be neutral if the proposed scheme were not to be constructed.

Table 14.21 : Long-term traffic noise comparison, Do Minimum (2022) against Do Something (2037)

Scenario / comparison: Do Minimum 2022 against Do Something 2037				
Change in noise level		Daytime		Night-time
		Number of dwellings	Number of other sensitive receptors	Number of dwellings
Increase in noise level, LA10,18h	0.1 - 2.9	9726	84	231
	3 - 4.9	667	6	4
	5 - 9.9	128	2	0
	10 +	3	1	0
No Change	0	75	2	5
Decrease in noise level, LA10,18h	0.1 - 2.9	627	4	83
	3 - 4.9	34	0	0
	5 - 9.9	6	0	2
	10 +	0	0	0

Table 14.21 shows that by the 2037 Do Something daytime scenario, 798 dwellings are predicted to experience perceptible noise increases of at least 3 dB. Of these, there are predicted to be three dwellings experiencing a major adverse magnitude of impact, 128 dwellings experiencing a moderate adverse magnitude of impact and 667 dwellings experiencing a minor adverse magnitude of impact. Conversely 40 dwellings are predicted to have experienced a perceptible noise decrease of at least 3 dB. Of these, there are predicted to be no dwellings experiencing a major beneficial magnitude of impact, six dwellings experiencing a moderate beneficial magnitude of impact and 34 dwellings experiencing a minor beneficial magnitude of impact.

In terms of other sensitive receptors, 9 are expected to experience perceptible noise increases (one in the major adverse magnitude of impact category, two in the moderate adverse magnitude of impact category and six in the minor adverse magnitude of impact category), whilst none are expected to experience perceptible noise reductions in the long term daytime scenario.

For the night-time assessment only those dwellings predicted to experience noise levels of at least 55 $dBL_{night,outside}$ are considered. During the night-time period, four dwellings are predicted to experience a perceptible noise increase of at least 3 dB (all within the minor adverse magnitude of impact category), and two dwellings are expected to experience a perceptible noise decrease of at least 3 dB (all within the moderate beneficial magnitude of impact category).

Overall, the impact of the proposed scheme can be considered to have an adverse noise effect in the long term.

14.8.3.5 Traffic noise nuisance

Calculations of the change in noise nuisance have been undertaken for all dwellings within the calculation area for the assessment of permanent traffic noise impacts. Table 14.22 provides the results of the noise nuisance assessment.

Table 14.22 : Traffic noise nuisance

Noise nuisance assessment			
Change in nuisance level		Do Minimum	Do Something
		Number of dwellings	Number of dwellings
Increase in nuisance level, LA10,18h	< 10%	5808	3550
	10 < 20%	0	2921
	20 < 30%	0	3780
	30 < 40%	0	229
	> 40%	0	1
No Change	0%	1801	153
Decrease in nuisance level, LA10,18h	< 10%	3657	627
	10 < 20%	0	5
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0

Table 14.22 shows that with the proposed scheme in place 10481 dwellings would experience an increase in noise nuisance, compared to 5808 dwellings in the Do Minimum situation. Although a proportion of the dwellings are predicted to experience increases in nuisance levels greater than 10% with the proposed scheme in place, it should be noted that a small increase in noise level in the short term, results in a relatively large increase in nuisance (for example a 0.9 dB increase in noise level is equivalent to 20% increase in the noise nuisance level).

Table 14.22 shows that more dwellings would experience noise nuisance increases than decreases in both the Do Minimum and Do Something scenarios. However, the proportion experiencing greater nuisance increases is higher in the Do Something scenario.

14.8.3.6 Basic Noise Level (BNL) changes

Consideration has also been given to likely noise impacts at dwellings along the wider road network, outside the calculation area. Table 14.23 provides predicted BNL values for affected routes outside the calculation area. The levels in brackets are the differences between the Do Minimum in the baseline and the Do Something scenarios.

Table 14.23 : Basic Noise Levels (BNL) for affected routes outside the calculation area

Road	Sensitive Receptors within 50 m	Basic Noise Level dB $L_{A10,18h}$		
		DM2022	DS2022	DS2037
Merthyr Road B4276	104	66.9	68.2 (+1.3)	66.1 (-0.8)
Llwydcoed Road B4276.	150	67.5	68.8 (+1.3)	66.3 (-1.2)
Nantygwenith Street	120	61.9	63.0 (+1.1)	63.4 (+1.5)

Table 14.23 shows a total of 374 sensitive receptors outside of the calculation area fall within 50 m of an Affected Route. Noise increases are likely for Nantygwenith Street and Merthyr Road in both Opening and Future Year Do Something, with Llwydcoed Road having increases in the Opening Year Do Something and decreases in the Future Year Do Something.

The changes in noise level on all three roads are only expected to be minor in the Opening Year, by the Future Year all changes are expected to be negligible.

14.8.3.7 Welsh Government noise priority areas

Based on the noise maps created by the Welsh Government in 2007 and 2012 under The Environmental Noise (Wales) Regulations 2006, priority areas for road noise have been identified, which are available on the Welsh Government website. Noise Action Plan Priority Area (NAPPA) number 362 is located within the study area, to the south of the scheme route in Dowlais, and includes properties on Beacons View, Guest Cottages, Cross Houlson Street, and Houlson Street.

According to information held in the existing Pavement Management System, the A465 at this location currently benefits from a LNRS. The proposed design introduces new LNRS, and a new 2 m high environmental barrier (Ref: EB18) to the south, designed to reduce noise at properties in the NAPPA. The height of the environmental barrier in the noise model has been selected to take into account the preservation of views from the properties in the NAPPA to the north, and to avoid excessive overshadowing in gardens adjacent to the environmental barrier.

Table 14.24 and Table 14.25 present the short term and long term noise changes at all properties within the NAPPA.

Table 14.24 : Summary of short term noise changes at properties within NAPPA

Receptor	Do Minimum 2022, $L_{A10,18h}$ (dB)	Do Something 2022, $L_{A10,18h}$ (dB)	Noise level change (dB)	Magnitude of change
1 Beacons View Beacons View CF48 3NJ	72.7	73.0	0.3	Negligible Adverse
2 Beacons View Beacons View CF48 3NJ	64.4	61.8	-2.6	Minor Beneficial
3 Beacons View Beacons View CF48 3NJ	59.5	58.1	-1.4	Minor Beneficial
4 Beacons View Beacons View CF48 3NJ	57.9	58.7	0.8	Negligible Adverse
5 Beacons View Beacons View CF48 3NJ	69.3	65.1	-4.2	Moderate Beneficial
6 Beacons View Beacons View CF48 3NJ	69.4	65.6	-3.8	Moderate Beneficial
7 Beacons View Beacons View CF48 3NJ	70.9	68.5	-2.4	Minor Beneficial
8 Beacons View Beacons View CF48 3NJ	71.1	68.9	-2.2	Minor Beneficial
9 Beacons View Beacons View CF48 3NJ	71.3	69.4	-1.9	Minor Beneficial
31 Guest Cottages Guest Cottages CF48 3NT	71.6	63.9	-7.7	Major Beneficial
32 Guest Cottages Guest Cottages CF48 3NT	70.6	62.9	-7.7	Major Beneficial
33 Guest Cottages Guest Cottages CF48 3NT	69.8	61.2	-8.6	Major Beneficial
34 Guest Cottages Guest Cottages CF48 3NT	68.6	60.3	-8.3	Major Beneficial
1 Cross Houlson Street CF48 3NN	64.4	63.4	-1.0	Minor Beneficial
2 Cross Houlson Street CF48 3NN	63.9	63.0	-0.9	Negligible Beneficial
3 Cross Houlson Street CF48 3NN	63.5	62.8	-0.7	Negligible Beneficial
4 Cross Houlson Street CF48 3NN	63.1	62.6	-0.5	Negligible Beneficial
5 Cross Houlson Street CF48 3NN	63.1	62.7	-0.4	Negligible Beneficial
6 Cross Houlson Street CF48 3NN	63.5	62.8	-0.7	Negligible Beneficial
9 Houlson Street CF48 3NW	67.4	66.4	-1.0	Minor Beneficial

Table 14.24 demonstrates that, when considering the property facades that face towards the A465, perceptible noise benefits are predicted on proposed scheme opening for 13 of the residential properties situated within the NAPPA, due predominantly to the inclusion of a new LNRS and environmental barrier in this area. These noise benefits range from minor to major beneficial magnitudes of change. Noise changes for the remaining seven residential properties situated within the NAPPA are predicted to fall within the negligible magnitudes of change categories.

Overall in the short term, the proposed scheme is considered to have a beneficial noise impact for properties situated within the NAPPA.

Table 14.25 : Summary of long term noise changes at properties within NAPPA

Receptor	Do Minimum 2022, $L_{A10,18h}$ (dB)	Do Something 2037, $L_{A10,18h}$ (dB)	Noise level change (dB)	Magnitude of change
1 Beacons View Beacons View CF48 3NJ	72.7	74.2	1.5	Minor Adverse
2 Beacons View Beacons View CF48 3NJ	64.4	62.9	-1.5	Minor Beneficial
3 Beacons View Beacons View CF48 3NJ	59.5	59.2	-0.3	Negligible Beneficial
4 Beacons View Beacons View CF48 3NJ	57.9	59.8	1.9	Minor Adverse
5 Beacons View Beacons View CF48 3NJ	69.3	66.2	-3.1	Moderate Beneficial
6 Beacons View Beacons View CF48 3NJ	69.4	66.7	-2.7	Minor Beneficial
7 Beacons View Beacons View CF48 3NJ	70.9	69.7	-1.2	Minor Beneficial
8 Beacons View Beacons View CF48 3NJ	71.1	70.1	-1.0	Minor Beneficial
9 Beacons View Beacons View CF48 3NJ	71.3	70.5	-0.8	Negligible Beneficial
31 Guest Cottages Guest Cottages CF48 3NT	71.6	65.1	-6.5	Major Beneficial
32 Guest Cottages Guest Cottages CF48 3NT	70.6	64.0	-6.6	Major Beneficial
33 Guest Cottages Guest Cottages CF48 3NT	69.8	62.4	-7.4	Major Beneficial
34 Guest Cottages Guest Cottages CF48 3NT	68.6	61.5	-7.1	Major Beneficial
1 Cross Houlson Street CF48 3NN	64.4	64.5	0.1	Negligible Adverse
2 Cross Houlson Street CF48 3NN	63.9	64.2	0.3	Negligible Adverse
3 Cross Houlson Street CF48 3NN	63.5	63.9	0.4	Negligible Adverse

Receptor	Do Minimum 2022, $L_{A10,18h}$ (dB)	Do Something 2037, $L_{A10,18h}$ (dB)	Noise level change (dB)	Magnitude of change
4 Cross Houlson Street CF48 3NN	63.1	63.8	0.7	Negligible Adverse
5 Cross Houlson Street CF48 3NN	63.1	63.8	0.7	Negligible Adverse
6 Cross Houlson Street CF48 3NN	63.5	63.9	0.4	Negligible Adverse
9 Houlson Street CF48 3NW	67.4	67.6	0.2	Negligible Adverse

In the long term, Table 14.25 demonstrates that when considering the property facades that face towards the A465, perceptible noise benefits are predicted for eight of the residential properties situated within the NAPPA. These noise benefits range from minor to major beneficial magnitudes of change. Perceptible noise increases are predicted for two of the residential properties within the NAPPA in the long term, falling within the minor adverse magnitude of change category. Noise changes for the remaining nine residential properties situated within the NAPPA are predicted to fall within the negligible magnitudes of change categories.

Overall in the long term, the proposed scheme is considered to have a beneficial noise impact for properties situated within the NAPPA.

14.8.4 Operational vibration

14.8.4.1 Airborne vibration nuisance

Changes in vibration nuisance have been calculated for all dwellings within the calculation area. Table 14.26 presents the results of the vibration nuisance assessment.

Table 14.26 : Traffic airborne vibration nuisance reporting table

Vibration nuisance assessment			
Change in nuisance level		Do Minimum	Do Something
		Number of dwellings	Number of dwellings
Increase in nuisance level, LA10,18h	< 10%	1079	1698
	10 < 20%	0	0
	20 < 30%	0	0
	30 < 40%	0	0
	> 40%	0	0
No Change	0%	9901	9364
Decrease in nuisance level, LA10,18h	< 10%	286	199
	10 < 20%	0	5
	20 < 30%	0	0
	30 < 40%	0	0

Vibration nuisance assessment			
Change in nuisance level		Do Minimum	Do Something
		Number of dwellings	Number of dwellings
	> 40%	0	0

Table 14.26 shows that 1698 properties would experience an increase in airborne vibration nuisance with the proposed scheme in place, compared to 1079 in the Do Minimum. In addition, 204 properties would be predicted to experience a reduction in airborne vibration nuisance with the proposed scheme in place, compared to 286 in the Do Minimum scenario.

14.8.4.2 Ground-borne vibration

HD 213/11 paragraph A5.26 states, "Significant ground-borne vibrations may be generated by irregularities in the road surface. Such vibrations are unlikely to be important when considering disturbance from new roads and the assessment will only be necessary in exceptional circumstances." Further to this, Figure 3 from Report No RR53 - Ground Vibration Caused by Civil Engineering Works (Transport and Road Research Laboratory, 1986) provides a summary of measurements taken by the TRRL which indicates the relative effects of various construction related sources. This figure indicates that, for a heavy lorry on a poor road surface at 8 m, a PPV of 0.1 mm/s is expected.

The shortest horizontal distance between a sensitive receptor and the running surface of the proposed scheme is around 10 m. Therefore, given the distances between the nearest sensitive receptors and the proposed road running surface, and providing that the surface does not contain any defects, ground-borne vibration is not considered to be a significant issue.

14.9 Mitigation

14.9.1 Construction

The construction design incorporates measures that represent ‘best practice’ with respect to noise and vibration control, examples of which are as follows:

- In order to undertake rock breaking in the Cefn Coed cutting, it is proposed to used drill and burst techniques which would reduce the noise levels compared to traditional hydraulic methods of rock breaking;
- It is proposed to use either rotary bored or secant piling to construct the retaining walls adjacent to the Trewaun junction, which would significantly reduce noise levels compared to standard driven piling techniques; and
- The vast majority of works are not proposed during the sensitive evening and / or night-time periods or during Sundays or Bank Holidays.

Despite the application of these measures, the construction noise and vibration impact assessment has identified that there is the potential for a number of significant noise and vibration effects. Consideration has therefore been given to additional mitigation measures which may reduce the effects experienced by receptors.

It is acknowledged that the programme and plant list would not become finalised until after the commercial contracts for the construction works have been awarded. In order to ensure that the appointed contractor does not propose a programme, plant list or working method that would result in greater noise or vibration effects than those assessed, the appointed contractor would be required to develop the following documents:

- Construction Environmental Management Plan (CEMP);
- Applications for prior consent under the Control of Pollution Act 1974; and
- Noise Insulation and Temporary Rehousing Plan.

These would be developed in conjunction with the Welsh Government, and agreed with MTCBC and RCTCBC, prior to commencement of works, after submission of the planning application for the scheme.

14.9.1.1 Construction Environmental Management Plan

The CEMP sets out the following information in relation to the control of noise and vibration:

- the good practice noise and vibration control measures (based on the measures set out in Section 14.9.1.2) that the contractor would adopt;
- noise monitoring procedures, including equipment specification, locations, duration and reporting requirements;
- vibration monitoring procedures designed to demonstrate that the relevant thresholds within BS 7385-2:1993 (BSI, 1993) and BS 5228-2:2009 + A1:2014 (BSI, 2014b) are not exceeded;
- duties and responsibilities for a Public Liaison Officer who would be responsible for the day-to-day communication on noise and vibration issues with the EHO and the general public;
- contact details (24 hours, seven days a week) for on-site personnel responsible for noise and vibration management; and
- complaint response protocols.

Compliance with this CEMP would be a requirement of the contract between the Welsh Government and the key contractors appointed to undertake the works.

14.9.1.2 Best Practicable Means

In the CEMP, the selected Contractor will be required to apply Best Practicable Means (BPMs) to minimise any residual noise and vibration impact during construction. It is expected that as a minimum these would include the following measures:

- the appropriate selection of plant, construction methods and programming: Only plant conforming with or better than relevant national or international standards, directives or recommendations on noise or vibration emissions would be used. Construction plant would be maintained in good condition with regards to minimising noise output and workers exposed to harmful noise and vibration;
- construction plant would be operated and maintained appropriately, following manufacturer's written recommendations or using other appropriate operation and maintenance programmes that reduce noise and vibration emissions;
- avoid unnecessary revving of engines and ensure that plant and equipment is switched off when it is not in use for longer periods of time;
- use of low noise emission plant where possible;
- use of audible reversing warning systems on mobile plant and vehicles should be of a type which, whilst ensuring that they give proper warning, have a minimum noise impact on persons outside sites;
- choice of routes and timings for the transport of construction materials, waste materials and personnel to reduce the risk of increased noise and vibration impacts due to the construction of the project. Haul roads to be well maintained and avoid use of steep gradients, where possible;
- where practicable, rotary drills actuated by hydraulic or electrical power should be used for excavating hard materials;
- the use of mufflers on pneumatic tools;
- the physical positioning of construction plant and activities to minimise noise at sensitive locations;
- use of site hoardings and screens, where necessary, to provide acoustic screening at the earliest opportunity. Where practicable, gates and discontinuities in barriers would not be located near to noise sensitive receptors;

- programming works so that the requirement for working outside normal working hours is minimised (taking into account the highway authority's statutory duties under the Traffic Management Act 2004);
- the use of low-vibratory piling techniques (such as rotary bored piling) where piling works are proposed in close proximity to residential properties and other sensitive receptors;
- where possible, vibration soil compaction plant shall be set to a low amplitude setting when operating in close proximity to sensitive receptors;
- the use of non-reciprocating construction plant where practicable; and
- the use, where necessary, of effective sound reducing enclosures.

14.9.1.3 Section 61 Applications

One or a number of applications for prior consent under the Control of Pollution Act 1974 would be made for the proposed construction works, as and when plant lists, programmes and working methods become sufficiently finalised. Each application would contain particulars of the works, working methods and noise control measures and would be submitted to the relevant local authority for approval. The aim of any Section 61 application will be to demonstrate compliance with the relevant noise and vibration thresholds, or to establish that the best practicable means have been employed to control noise emissions. The local authority may attach conditions to each consent, including a limit on duration of the works.

As part of the commitment to seek prior consent for the works under Section 61 of the Control of Pollution Act 1974, the contractor will need to review the proposed works and confirm that Best Practicable Means are being employed. This will include consideration of all reasonably practicable measures to control noise and vibration.

As the construction noise and vibration impact assessment presented in Section 14.8 considers the worst case, it is likely that contractors will be able to further reduce noise and vibration emission levels to below those assumed in this assessment.

14.9.1.4 Noise Insulation and Temporary Rehousing Plan

During the construction, the contractor would be required, through the procedures set out in the CEMP and Section 61 Applications, to control the effects of noise and vibration from the proposed construction works. However, there may be circumstances where noise impacts would arise which will need to be mitigated still further. In certain circumstances, the Welsh Government would either provide and install (free of charge), or provide grant aid for, noise insulation and / or arrange temporary re-housing (or help residents to arrange it for themselves and recoup the costs).

The contractor would be required to agree a set of qualifying criteria with the Welsh Government for temporary rehousing and noise insulation measures for those worst affected by construction noise.

As this would be a voluntary plan for local residents to participate in, it has not been relied upon as an additional mitigation measure for EIA purposes.

14.9.2 Operation

The proposed scheme design incorporates various features that would be effective in reducing potential noise increases, which can be summarised as follows:

- the application of a LNRS to the proposed scheme in close proximity to sensitive receptors. A section of the scheme between just north-east of Croesbychan junction and just west of Baverstock junction has few sensitive receptors in close proximity and a hot rolled asphalt (HRA) surface has been proposed for this section of the scheme, instead of a LNRS;
- the introduction of various cuttings that would screen road traffic noise from certain receptor locations (e.g. west of Gurnos and at Trewaun); and

- the inclusion of various environmental barriers in the design that would provide screening of road traffic noise at local receptors.

A schedule of the environmental barriers included in the proposed scheme design is presented in Table 14.27.

Table 14.27 : Schedule of environmental barriers

Environmental Barrier ID	Location	Chainage		Length (m)	Height (m)
		Start	End		
EB01	Between Trewaun Overbridges (N)	3150	3230	83	2
EB02	Trewaun South East Retaining Wall 1 (S)	3250	3350	92	2
EB03	Trewaun North East Retaining Wall (N)	3250	3530	288	2
EB04	Trewaun South East Retaining Wall 2 (S)	3350	3400	66	2
EB05	Croesbychan Junction (E)	4820	5300	485	1
EB06	Taf Fawr Viaduct (N)	10850	11030	187	2
EB07	Taf Fawr Slip Road 1 (S)	10950	11050	94	3
EB08	Taf Fawr Slip Road 2 (S)	11050	11130	87	2
EB09	Cefn Coed High Street Bridge to Taff Trail Footbridge (N)	11170	11270	100	2
EB10	Cefn Coed High Street Bridge to Taf Fechan Viaduct (S)	11150	11370	207	2
EB11	Taf Fechan Viaduct (S)	11420	11550	131	1
EB12	Taf Fechan (S)	11150	11770	219	1
EB13	Gurnos Farm Underpass to Prince Charles Hospital 1 (S)	12290	12700	405	3
EB14	Gurnos Farm Underpass to Prince Charles Hospital 2 (S)	12700	12780	80	4
EB15	Gurnos Farm Underpass to Prince Charles Hospital 3 (S)	12780	12950	177	3
EB16	Pant Viaduct to Jones St Bridge (N)	14810	15030	271	1
EB17	Beacons View (Dowlais) (S)	14840	14880	44	2
EB18	Cross Houlson Street (Dowlais) (S)	14880	14960	81	2
EB19	Jones St. Bridge (Dowlais) (S)	14960	15450	478	3
EB20	Dowlais Top Slip Road (S)	15650	16050	431	1
EB21	Dowlais Top Mainline (S)	15850	16050	206	1

It should be recognised that these measures are all considered as inherent aspects of the proposed scheme design, and therefore their effects are reflected in the assessment presented in Section 14.8.

14.10 Residual Effects and Conclusion

As the mitigation measures described in Section 14.9 are intrinsic to the proposed scheme assessed in Section 14.8, the residual effects are identical to those described in Section 14.8.

This chapter has considered the potential noise and vibration impacts of the proposed scheme on sensitive receptors. The predicted noise levels for all noise sensitive receptors are presented in Appendix 14F (ES Supplement Volume 2).

Despite the application of best practice mitigation measures, major construction noise impacts could occur at properties in close proximity to the proposed works. However, it should be recognised that any such impacts would be temporary in nature.

Vibration during some ground compaction works is likely to be perceptible to residents in nearby residential dwellings for limited durations. However, expected vibration levels fall below those which could give rise to cosmetic building damage.

The proposed scheme design includes the use of low noise road surfacing (LNRS), and the use of environmental barriers that provide noise screening for noise sensitive residential dwellings.

It should be noted that the assessment includes the unmitigated effect of the proposed Cynon Valley Gateway scheme in the long term, as the long term traffic forecasts assume it would be operational by 2037 if the proposed scheme were to be constructed.

In the short term, with the proposed mitigated scheme, there are predicted to be 3577 dwellings and 30 other noise sensitive receptors that would experience a perceptible increase in noise level on proposed scheme opening. Conversely, there are predicted to be 391 dwellings and four other noise sensitive receptors that would experience a perceptible decrease in noise level on proposed scheme opening. Overall, the proposed scheme is considered to have an adverse noise impact on scheme opening.

In the long term, with the proposed mitigated scheme, there are predicted to be 798 dwellings and nine other noise sensitive receptors that would experience a perceptible increase in noise level, whilst 40 dwellings are predicted to experience a perceptible decrease in noise level. For the long term night-time situation, four dwellings are predicted to experience perceptible noise increases, whilst two dwellings are predicted to experience perceptible noise decreases. Overall, the proposed scheme is considered to have an adverse noise impact in the long term.

A single Noise Action Plan Priority Area (NAPPA) number 362 is located within the study area, to the south of the proposed scheme route in Dowlais. When considering the facades that face the A465, perceptible noise decreases are predicted for 13 properties within the NAPPA, with no perceptible noise increase anticipated. The noise benefits for properties within the NAPPA would fall within the minor to major beneficial magnitude of impact category on scheme opening. In the long term situation, a greater number of properties within the NAPPA are predicted to experience perceptible noise benefits, compared to the number predicted to experience perceptible noise increases. Overall, the proposed scheme is considered to have a beneficial noise impact on properties within the NAPPA.

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15. Effects on All Travellers

No changes to Chapter 15 are required.

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16. Community and Private Assets

No changes to Chapter 16 are required.

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17. Road Drainage and the Water Environment

No changes to Chapter 17 are required. Minor modifications to culverts within the proposed scheme design have not significantly affected the conclusions of the road drainage and water environment assessment published in July 2017.

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18. Cumulative Effects

No changes to Chapter 18 are required.

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19. Summary and Conclusions

Amendments to the July 2017 ES were required as a result of the following key revisions and changes:

- the revised traffic model;
- the revised air quality and noise assessments; and
- design development modifications to the Croesbychan junction.

19.1 Air Quality

There is not considered to be a significant effect on local air quality during the operational phase of the proposed scheme, and there are no receptors in exceedance of the relevant Air Quality Objectives (AQOs) (i.e. annual average nitrogen dioxide (NO_2) and particulate matter (PM_{10})) AQOs) in either the Do Minimum (DM) (existing alignment without any changes) or Do Something (DS) (with the proposed scheme in place) scenarios in 2022.

The Twynyrodyn Road Air Quality Management Area (AQMA), as shown on Figure 8.2, is more than 200 m away from the proposed scheme's affected road network. Therefore, it is not expected that the AQMA would be affected with the proposed scheme in place.

There are 14 identified nature conservation sites that are predicted to exceed the annual mean oxides of nitrogen (NO_x) AQO in the opening year (2022) for either the DM or DS scenario and which are predicted to experience changes in pollutant concentrations greater than imperceptible (> 0.4 µg/m^3 magnitude change). These sites have the potential for nutrient nitrogen and / or acid deposition impacts. These results, and associated proposed mitigation, are discussed in Chapter 11: Nature Conservation.

There are no significant changes to the conclusions in the July 2017 ES.

19.2 Cultural Heritage

There are no material changes to the conclusions in the July 2017 ES.

19.3 Landscape and Visual Impact

The installation of the variable message signs and changes to the environmental barriers, whilst increasing the visual impact on some receptors, do not result in any material changes to the conclusions in the July 2017 ES.

19.4 Nature Conservation

There is no material change to the conclusions in the July 2017 ES. The revised air quality model still predicts worsening of air quality impacts on botanical sites with the proposed scheme in place. However, the severity of impacts overall have decreased compared to those predicted in the July 2017 ES.

19.5 Geology and Soils

There is no material change to the conclusions in the July 2017 ES.

19.6 Materials

There is no material change to the conclusions in the July 2017 ES.

19.7 Noise and Vibration

In the short term, with the proposed mitigated scheme, there are predicted to be 3577 dwellings and 30 other noise sensitive receptors that would experience a perceptible noise increase in noise level of at least 1 decibel

(dB). Conversely there are predicted to be 391 dwellings and four other noise sensitive receptors that would experience a decrease in noise level of at least 1 dB.

In the long term, with the proposed mitigated scheme, there are predicted to be 798 dwellings and nine other noise sensitive receptors that would experience an increase in noise level of at least 3 dB during the daytime. By comparison there are predicted to be 40 dwellings that would experience a decrease in noise level of at least 3 dB. For the long term night-time situation, four dwellings are predicted to experience perceptible noise increases, whilst two dwellings are predicted to experience perceptible noise decreases.

A single Noise Action Plan Priority Area (NAPPA) number 362 is located within the study area, to the south of the proposed scheme in Dowlais Top. When considering the facades that face the A465, perceptible noise decreases are predicted for 13 properties within the NAPPA, with no perceptible noise increase anticipated. The noise benefits for properties within the NAPPA would fall within the minor to major beneficial magnitude of impact category on proposed scheme opening. In the long term situation, a greater number of properties within the NAPPA are predicted to experience perceptible noise benefits, compared to the number predicted to experience perceptible noise increases. Overall, the proposed scheme would be considered to have a beneficial noise impact on properties within the NAPPA.

However, there are no significant changes to the conclusions in the July 2017 ES.

19.8 Effects on All Travellers

There are no material changes to the conclusions in the July 2017 ES.

19.9 Community and Private Assets

There are no material changes to the conclusions in the July 2017 ES.

19.10 Road Drainage and the Water Environment

There are no material changes to the conclusions in the July 2017 ES.

19.11 Overall Summary and Conclusions

There are no material changes to the conclusions in the July 2017 ES.

Additional References

For the full reference list please consult the July 2017 Environmental Statement Volume 1. Additional references used in this ES Supplement, not already included in the July 2017 ES reference list, are listed below.

- Centre for Ecology and Hydrology (2017). Air Pollution Information System Website. Available at: www.apis.ac.uk. (Accessed and confirmed link January 2018).
- The Conservation of Habitats and Species Regulations 2017. No. 1012. Available at: https://www.legislation.gov.uk/uksi/2017/1012/made/data.pdf (Accessed and confirmed link January 2018).
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- DEFRA and Department for Transport (2017a) Air quality plan for nitrogen dioxide (No2) in the UK, 2017. Available at: https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017 (Accessed and confirmed link January 2018).
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