



**Haweswater Aqueduct Resilience Programme - Proposed Marl Hill
Section**

Volume 6

Proposed Ribble Crossing

Chapter 18: Air Quality and Climate Change

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Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

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18. Air Quality and Climate Change

18.1 Introduction

- 1) This chapter presents an assessment of the likely significant effects of the Proposed Ribble Crossing on air quality.
- 2) The assessment area for the air quality assessment of the Proposed Ribble Crossing is outlined below. The nature, value and sensitivity of the existing baseline environment are then identified before an assessment is made of the potential air quality effects of the Proposed Ribble Crossing. Mitigation measures have been proposed to avoid, reduce or offset any potential effects and these embedded and good practice mitigation measures have been taken into account in the assessment (see Section 18.4.4 and Chapter 3: Design Evolution and Development Description).
- 3) Two assessment areas have been adopted for the purposes of this assessment, as follows:
 - Fugitive dust emissions: up to 350 m from the construction areas for the assessment of construction dust, noting that a site-specific assessment of the impacts of dust during construction has not been undertaken. Instead, a reasonable worst-case approach has been adopted (i.e. it has been assumed that all proposed construction activities would be categorised as high risk) to define the level of good practice dust mitigation required to avoid likely significant effects. An assessment area of up to 50 m from the construction area was adopted for the consideration of dust impacts on ecological locations (designated sites)
 - Construction vehicle exhaust emissions: up to 200 m from the assessed road links (i.e. local roads requiring assessment due to changes in road traffic volumes or highways layouts associated with the Proposed Ribble Crossing). This assessment area relates to air pollutants with the potential to affect human health and the status of ecosystems at a local level during all phases of the Proposed Ribble Crossing.
- 4) In the context of the Proposed Ribble Crossing and the wider Programme of Works, the term 'climate' is considered in relation to Schedule 4 of the EIA Regulations which requires that an EIA should examine, among other things, likely significant effects on climate (for example, greenhouse gas emissions, and impacts relevant to climate change adaptation). To support this element of the EIA, therefore, estimates of construction-related carbon emissions are provided. However, for reasons explained in the methodology (Section 18.4) carbon emissions are considered in Volume 2 Chapter 18 of the Environmental Statement. Moreover, the topic of climate change adaptation and resilient infrastructure is considered in Volume 2 Chapter 15: Major Accidents and Disasters.

18.2 Scoping and Consultations

18.2.1 Scoping

- 5) An air quality chapter was included within the EIA Scoping Report¹ for the Proposed Marl Hill Section which was submitted to the relevant planning authorities for comment in October 2019, followed by a Scoping Report Addendum in February 2021 which included details of the Proposed Ribble Crossing². Scoping comments and responses are outlined in Volume 4 Appendix 4.1.

18.2.2 Consultation

- 6) During the course of this assessment, consultation has taken place with Ribble Valley Borough Council through email correspondence. This has been summarised in Volume 4 Appendix 4.1.

¹ United Utilities (2019) Haweswater Aqueduct Resilience Programme, Proposed Marl Hill Section - EIA Scoping Report, October 2019

² United Utilities (2020) Haweswater Aqueduct Resilience Programme, Proposed Marl Hill Section - EIA Scoping Report Addendum. February 2021

18.3 Key Legislation and Guidance

- 7) The legislation and guidance relevant to air quality are considered in Volume 2 Section 18.3. National and Local Planning Policies are covered in Chapter 5: Planning Policy and Guidance of Volume 2.
- 8) The relevant EU Limit Values and Air Quality Objectives (AQOs) for nitrogen dioxide (NO₂), oxides of nitrogen (NO_x) and particulate matter (PM₁₀ and PM_{2.5}) reported in Volume 2 Section 18.3.1 are applicable to the assessment of road traffic emissions and construction dust associated with the Proposed Ribble Crossing.

18.4 Assessment Methodology and Assessment Criteria

- 9) The air quality assessment included consideration of the following aspects:
 - Dust emissions generated by earthworks and construction-related activities during the construction phase and decommissioning phase
 - Exhaust emissions of pollutants to air from road vehicles (e.g. cars, vans, buses and lorries) on the local road network during construction, operation and decommissioning of the Proposed Ribble Crossing.

18.4.1 Assessment Methodology

- 10) The methodology for the assessment is consistent with the methodology reported in Volume 2 Section 18.4.1 for the above two aspects.
- 11) Consistent with Volume 2, a reasonable worst-case approach was adopted. This assumed that all construction activities gave rise to a high risk of dust impacts prior to the application of any mitigation measures. Therefore, a site-specific dust assessment was not been undertaken. Instead, Institute of Air Quality Management (IAQM) guidance³ on the control of fugitive dust emissions has been incorporated into the Construction Code of Practice (CCoP). Construction dust impacts are therefore not examined further in this chapter other than in terms of the consideration of nearby sensitive locations, the proposed appropriate good practice mitigation measures (see Section 18.4.4), and the conclusion on residual effects (see Section 18.7).
- 12) The assessment considered emissions of NO_x/NO₂ and PM₁₀/PM_{2.5} from vehicles associated with building the Proposed Ribble Crossing and the construction vehicles serving the Proposed Marl Hill Section which would use the Proposed Ribble Crossing on a day-to-day basis. The assessment was based on traffic data presented in Volume 6: Chapter 16. As described in Volume 2 Section 18.4.1, the traffic flow data and design information were compared to the DMRB LA 105⁴ screening criteria to determine the affected road network (ARN) and need for quantitative assessment.
- 13) Based on this comparison, the ARN encompasses the road links associated with the Proposed Ribble Crossing (due to the creation of a new road) and is shown on Figure 18.1. It should be noted that the Do Something scenario (i.e. construction of the Proposed Ribble Crossing) was based on 'do nothing' (DN) traffic flows for the Proposed Programme of Works. This is the scenario without the Proposed Programme of Works and also without any committed development. This is consistent with the approach for Volume 2, and presents a conservative approach in relation to ecological locations (designated sites). As a result of this, the traffic flow changes discussed in Section 18.6 include vehicle movements not associated with the Proposed Programme of Works.
- 14) Carbon emissions associated with construction vehicle movements have already been estimated for the Proposed Marl Hill Section. Further estimates of carbon emissions have not been undertaken for the construction of the Proposed Ribble Crossing itself, as this would represent a minor and most likely insignificant element in comparison with shaft and tunnel construction, electrical energy production for the TBMs using generating sets, vehicle movements bringing materials to the compounds, and the transport of surplus tunnel arisings to Waddington Fell Quarry over a period of years. Carbon emissions

³ Institute of Air Quality Management (2016) Guidance on the assessment of dust from demolition and construction [online] Available from: http://iaqm.co.uk/wp-content/uploads/guidance/iaqm_guidance_report_draft1.4.pdf

⁴ Highways England (2020) *op. cit.*

were therefore not addressed in Volume 6 although the reader is directed to Volume 2 Chapter 18 for estimates of carbon emissions for the Proposed Marl Hill Section, and to Chapter 19 for cumulative releases of carbon for the Proposed Programme of Works.

18.4.2 Sensitive Locations

Human Locations

- 15) Similar to the assessment for the Proposed Marl Hill Section (see Section 18.4.2 of Volume 2), key human locations within 200 m of the ARN were identified. These included residential properties, schools, hospitals and care homes. All human locations were considered to be of equal value and sensitivity. Human locations close to the planning application boundary of the Proposed Ribble Crossing were also identified in relation to the potential for construction dust impacts to ensure any potential site-specific issues were adequately addressed *via* the proposed mitigation.
- 16) Figure 18.1 shows a selection of the nearest and most relevant human locations to the Proposed Ribble Crossing. Further details of the human locations are provided in Section 18.5.4.

Ecological Locations (Designated Sites)

- 17) The same site designations were considered as those described in Section 18.4.2 of Volume 2 . Figure 18.1 shows the nearest ecological locations to the Proposed Ribble Crossing. Further details of the ecological locations are provided in Section 18.5.4.

18.4.3 Background Concentrations and Deposition

- 18) Where applicable, the same approach to determining the background concentrations and deposition as used for Volume 2 were also used for the Proposed Ribble Crossing.

18.4.4 Embedded Mitigation and Good Practice

- 19) Embedded mitigation is inherent to the design, and good practice measures are standard industry methods and approaches used to manage commonly occurring environmental effects. The assessments presented in Section 18.6 of this chapter are made taking into account embedded mitigation (see Chapter 3: Design Evolution and Development Description) and the implementation of good practice measures (as specified within Volume 4 Appendix 3.2: Construction Code of Practice (CCoP).

18.4.5 Assessment Criteria

- 20) The assessment criteria are the same as those used for the Proposed Marl Hill Section (see Section 18.4.5 of the Proposed Marl Hill Section ES).

18.4.6 Assumptions and Limitations

- 21) Sensitive locations have been determined using online mapping e.g. Google Earth/Maps and also Ordnance Survey mapping data. There may in some cases be properties, such as those recently built, which are not yet present within these data sources.

18.5 Baseline Conditions

- 22) This section details the air quality baseline for the assessment area and identifies locations included within the assessment. The Proposed Ribble Crossing and surrounding area is located within the Ribble Valley Borough Council area.
- 23) Baseline data were collated from a variety of sources in compiling this assessment, including:
 - Local Air Quality Management (LAQM) reviews undertaken by Ribble Valley Borough Council, including monitoring data
 - Pollution Climate Mapping model outputs (PCM)

- Designated Sites information from Natural England and local authorities
- Background concentration maps produced by Defra.

18.5.1 Local Air Quality Management (LAQM)

- 24) Ribble Valley Borough Council has declared one Air Quality Management Area (AQMA) (Whalley Road, Clitheroe AQMA 1) for annual mean NO₂ concentrations. The AQMA is located at the junction of Whalley Road and Greenacre Street, approximately 2.8 km south of the Proposed Ribble Crossing.
- 25) There is currently no continuous monitoring undertaken within the borough. The council is responsible for a network of seven passive diffusion tube monitoring locations. The NO₂ monitoring concentrations within the AQMA (Site IDs 2, 3 and 4) are provided in Table 18.1. The measured concentrations recorded in the AQMA have been below the AQO of 40 µg/m³ for the last five years of monitoring data. The other four diffusion tube locations are in Clitheroe, with one location in Mellor Brook. These are predominantly roadside and urban locations and, similar to the measurements within the AQMA, are not directly representative of the air quality within the rural setting of the Proposed Ribble Crossing. The urban background diffusion tube in Clitheroe (Site ID 1) recorded a concentration of 9.9 µg/m³ in 2019.

Table 18.1: Annual mean NO₂ concentration at Ribble Valley Borough Council diffusion tube sites, 2019

Site ID	Name	Site Type	OS grid co-ordinate		NO ₂ Concentration
			X (m)	Y (m)	(µg/m ³)
1	31 Bolland Prospect	Urban background	374789	441514	9.9
2	Royal British Legion *	Roadside	374234	441291	34.1
3	49 Whalley Road	Roadside	374225	441256	32.8
4	Greenacre Street	Roadside	374222	441315	23.9
5	85 Whalley Road	Roadside	374175	441153	26.6
6	Fieldens Arms, Mellor Brook	Roadside	364027	431179	16.6
7	John Wall Court	Roadside	373911	441498	16.0

Notes
* Average of Royal British Legion 1 and 2. Triplicate site 3 was excluded due to low data capture in 2019.

18.5.2 Pollution Climate Mapping (PCM)

- 26) The Pollution Climate Mapping (PCM) model is run by Ricardo-AEA on behalf of Defra, and is designed to fulfil part of the UK's EU Directive (2008/50/EC) requirements to report on the concentrations of pollutants in the atmosphere. Modelled PCM NO₂ concentrations are provided for a 2018 base year and projected to future years at representative roads throughout the UK.
- 27) Based on the assessment area for the Proposed Ribble Crossing, the closest PCM links in the Defra PCM model are the A671 (Census ID 802077794). The A671 PCM link is within the Whalley Road, Clitheroe AQMA1 and has a modelled annual mean NO₂ concentration of 17.6 µg/m³ in 2019 and 14.3 µg/m³ in 2023. These concentrations are below the EU Limit Value of 40 µg/m³. A671 PCM links, or road links close to the PCM links, were not classed as part of the ARN for the Proposed Ribble Crossing. Therefore, PCM links are not considered further in this assessment as any changes in NO₂ concentrations would be imperceptible and would not affect compliance with the EU Limit Value of 40 µg/m³. The impact on PCM links for the Proposed Programme of Works is considered in Volume 2, which also concluded imperceptible changes in NO₂ concentrations and no risk of non-compliance.

18.5.3 Defra Background Mapping

28) The Defra mapped 1 km x 1 km grid background pollutant concentrations for 2019 and 2023 encompassing the Proposed Ribble Crossing and sensitive human and ecological locations are presented in Table 18.2. All background pollutant concentrations are well within the relevant AQOs. The NO₂ concentrations are similar or lower than the concentrations recorded at the urban background location within Clitheroe as shown in Table 18.1. The higher concentrations shown in Table 18.2 are representative of the northern suburban areas of Clitheroe and cement works which lie within the same 1 km x 1 km grid square.

Table 18.2: Mapped background annual mean pollutant concentrations

Pollutant	2019 Background Concentration range (µg/m ³)	2023 Background Concentration range (µg/m ³)
Nitrogen dioxide (NO ₂)	5.4 to 10.4	4.7 to 9.4
Oxides of nitrogen (NO _x)	6.8 to 13.9	5.9 to 12.4
Particulate matter (PM ₁₀)	8.5 to 12.7	8.0 to 12.0
Particulate matter (PM _{2.5})	5.7 to 6.9	5.4 to 6.5

18.5.4 Key Human Locations

29) Table 18.3 and Figure 18.1 presents a selection of human locations closest to the Planning Application Boundary of the Proposed Ribble Crossing and within 200 m of the ARN (i.e. the specific road carriageway of the Proposed Ribble Crossing). These locations are likely to experience the highest potential dust impacts from the enabling works, construction and decommissioning of the Proposed Ribble Crossing or change in pollutant concentrations from road transport emissions during operation of the Proposed Ribble Crossing.

Table 18.3 Sensitive human locations in proximity to the Proposed Ribble Crossing

Sensitive Location ID	Grid Co-ordinates		Type	Distance to Planning Application Boundary (m) *	Distance to Proposed Ribble Crossing indicative route alignment (m) *
	X(m)	Y(m)			
R1	373249	444034	Residential	21	121
R2	373492	444038	School building	19	114
R3	373491	444029	School boundary	7	106
R4	373531	444038	Residential	0	138
R5	373618	443559	Residential	48	96
R6	374561	443751	Residential	10	92
R7	374548	444234	Residential	154	>200

Notes

* distance to property façade unless otherwise stated

18.5.5 Ecological Locations (Designated Sites)

30) There is one designated site within 50 m of the Planning Application Boundary, which could potentially be affected by the Proposed Ribble Crossing during enabling works, construction, operation or decommissioning (the River Ribble from London Road Bridge Preston, in West, to County Boundary, in East BHS (hereafter referred to as River Ribble BHS)). The Waddington Brickworks Old Working

Biological Heritage Site (BHS) is located approximately 135 m north of the centre of the Proposed Ribble Crossing indicative route alignment and is therefore within 200 m of the ARN. The next nearest designated sites are Cross Hill Quarry Local Nature Reserve (LNR) (approximately 220 m and 300 m south southwest of the Planning Application Boundary and Proposed Ribble Crossing indicative route alignment, respectively); Hospital Wood Ancient Woodland and BHS approximately 420 m from the Planning Application Boundary and 580 m west of the Proposed Ribble Crossing indicative route alignment, respectively. Figure 18.1 shows the closest designated sites to the Proposed Ribble Crossing.

18.5.6 Information Sources

31) The assessment was undertaken with reference to the sources detailed in Table 18.4.

Table 18.4: Key Information Sources

Data Source	Reference
Ribble Valley Borough Council 2019 Air Quality Annual Status Report (ASR) and Monitoring results from ASR 2020 (currently not published). These data sources provided local authority monitoring and AQMA information.	https://www.ribbonvalley.gov.uk/downloads/file/12725/air_quality_annual_status_report_2019
Defra AQMA Maps. This data source provided spatial information regarding existing AQMAs.	https://uk-air.defra.gov.uk/aqma/maps
Defra background map concentration data for NO _x , NO ₂ , PM ₁₀ and PM _{2.5} . This data source provided baseline background air quality pollutant concentration data.	http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html
Defra Pollution Climate Mapping (PCM) data. This data source provides PCM link data.	https://uk-air.defra.gov.uk/library/no2ten/2020-no2-pm-projections-from-2018-data
Designated Sites datasets. This data source provides spatial data for relevant ecological designations (Special Protection Area (SPA), Special Area of Protection (SAC), Site of Special Scientific Interest (SSSI), Ramsar, National Nature Reserve (NNRs), LNRs, BHSs, Ancient Woodland).	SPAs – https://data.gov.uk/dataset/174f4e23-acb6-4305-9365-1e33c8d0e455/special-protection-areas-england SACs – https://data.gov.uk/dataset/a85e64d9-d0f1-4500-9080-b0e29b81fbc8/special-areas-of-conservation-england SSSIs – https://data.gov.uk/dataset/5b632bd7-9838-4ef2-9101-ea9384421b0d/sites-of-special-scientific-interest-england Ramsars – https://data.gov.uk/dataset/67b4ef48-d0b2-4b6f-b659-4efa33469889/ramсар-england LNRs – https://data.gov.uk/dataset/acdf4a9e-a115-41fb-bbe9-603c819aa7f7/local-nature-reserves-england NNRs – https://data.gov.uk/dataset/30348208-fcf4-4419-a092-7de9e5d16e07/national-nature-reserve-nnr-areas-outside-sites-of-special-scientific-interest Ancient Woodland – https://data.gov.uk/dataset/9461f463-c363-4309-ae77-fdcd7e9df7d3/ancient-woodland-england BHSs – Lancashire Environmental Record Network

18.6 Assessment of likely significant effects

- 32) The following section describes the effects of the Proposed Ribble Crossing Section on air quality during the enabling works, construction, operation and decommissioning phases.

18.6.1 Enabling Works and Construction Phase

Construction Dust

- 33) The enabling and construction works could create a high risk of dust impacts (as a worse-case scenario), prior to the application of good practice mitigation measures. A specific assessment of dust emissions for the construction phase has therefore not been undertaken (see Section 18.4.1). Appropriate good practice mitigation measures required to control dust emissions from high risk sites to a level that can be considered to be a not significant effect at nearby sensitive human locations (in accordance with IAQM guidance⁵) have been specified in Section 18.4.4 and included in the CCoP. Figure 18.1 presents the Planning Application Boundary, soil storage areas, welfare locations and construction lay down areas in relation to sensitive locations. The good practice mitigation measures required to control dust emissions for nearby sensitive human locations within 350 m would also control emissions for nearby ecological locations, including the River Ribble BHS which is adjacent to the Planning Application Boundary.

Road Traffic Emissions

- 34) Construction of the Proposed Ribble Crossing could commence in 2023, prior to construction of the Proposed Marl Hill Section. Therefore, only construction traffic associated with the Proposed Ribble Crossing would be travelling on the local road network. The scale of the Proposed Ribble Crossing construction is much smaller than that of the Proposed Marl Hill Section (and Proposed Marl Hill Section). There would be no exceedance of the DMRB screening criteria (i.e. change in vehicle movements of more than 200 HGVs or change of more than 1,000 total vehicles as an AADT) on the road network in the vicinity of the Proposed Ribble Crossing (see Chapter 18 of Volume 2). It is therefore unlikely that the criteria would be exceeded and necessitate the requirement for identifying the ARN and undertaking a quantitative assessment. Given the low background pollutant concentrations in the area surrounding the Proposed Ribble Crossing, and the smaller numbers of construction related vehicles travelling to and from the construction area (compared to the broader Proposed Marl Hill Section), the likely effects would not be significant at sensitive human or ecological locations.

Non-Road Mobile Machinery and Plant Emissions

- 35) As outlined in Section 18.4.1 of the Proposed Marl Hill Section ES, and in accordance with the IAQM guidance⁶, emissions to air from construction plant and machinery would lead to imperceptible increases in pollutant concentrations at human and ecological locations. This is based on the relatively small scale and duration (approximately five – six months) of the development and low numbers of construction plant active on-site at any one time in the same area. The main plant required for the enabling works would include typical earthmoving and construction equipment: excavators, dump trucks, wheeled loader, rollers, bulldozers, pumps, concrete wagon and lighting towers. During the road and bridge construction, other plant types may also be required such as a road grader, road paver, drill rig, mobile crane, mobile work platform and other specialist equipment for the bridge works. Volume 2 Chapter 17 Appendix B provides a list of the plant used as the basis of the noise assessment and indicates the likely number of plant in use at various stages throughout the enabling works and construction activities.
- 36) There may be use of a small diesel generator at the welfare areas within the construction compounds to provide power and lighting; however, these would be relatively small and would lead to imperceptible increases in pollutant concentrations at human and ecological locations.
- 37) The summary of enabling works and construction phase effects are shown in Table 18.5 below.

⁵ Institute of Air Quality Management (2016) *op. cit.*

⁶ Institute of Air Quality Management (2016) *op. cit.*

Table 18.5: Summary of Enabling Works and Construction Phase Effects

Environmental / Community Asset	Value / Sensitivity	Effect	Nature of Effect	Magnitude	Significance of Effect (Pre-Essential Mitigation)
Human locations	N/A	Increase in pollutant concentrations (NO ₂ , PM ₁₀ and PM _{2.5})	Adverse, temporary, short-term	Imperceptible	Not Significant
	N/A	Increase in dust deposition and PM ₁₀ /PM _{2.5} concentrations.	Adverse, temporary, short-term	N/A (assumed high risk)	Not significant (assumed good practice mitigation adopted as standard).
Ecological locations	N/A	Increase in pollutant concentrations (NO _x) and nitrogen and acid deposition.	Adverse, temporary, short-term	Imperceptible	Not Significant
	N/A	Increase in dust deposition.	Adverse, temporary, short-term	N/A (assumed high risk)	Not significant (assumed good practice mitigation adopted as standard).

18.6.2 Operational Phase

- 38) The operational phase assessment considers road traffic using the Proposed Ribble Crossing during the construction phase of the HARP Proposed Programme of Works (i.e. the construction activities at the Proposed Marl Hill Section with a duration of approximately 6 – 7 years).
- 39) There would be no change to vehicle flows associated with the HARP Proposed Programme of Works on the A671 Pimlico Link Road and on the B6478 Slaidburn Road north of the junction with West Bradford Road in Waddington compared to the roads assessed in Chapter 18 of Volume 2 (i.e. 219 total vehicles and 138 HDVs⁷ on the A671 Pimlico Link Road and 275 total vehicles and 136 HDVs on B6478 Slaidburn Road as an AADT). For West Bradford Road, the Proposed Ribble Crossing and West Bradford Road at Waddington, the change in total flows would be between 174 and 226 and the change in HDV flows would be 127 HDVs as an AADT. Some traffic would travel along the A671 Chatburn Road and B6478 Waddington Road/ Clitheroe Road (254 total vehicle and 9 HDVs, 95 total vehicles and 3 HDVs as an AADT, respectively)⁸. So, in terms of changes in traffic flows, the Proposed Ribble Crossing would fall below DMRB criteria (i.e. less than 1000 vehicle movements or 200 HDV movements as an AADT). However, as the Proposed Ribble Crossing itself represents an alignment change of more than 5 m then it is greater than the DMRB criteria and is an affected road. However, DMRB is designed for changes to alignment of major trunk roads within relatively high daily traffic flows. In this case, the actual new road for the Proposed Ribble Crossing would have a total flow of 174 vehicle movements as an AADT, 127 of which would be HDVs. This is less than the DMRB screening criteria used for identifying when an assessment of traffic flow changes on an existing road would be required. Therefore, it is unlikely that these vehicles travelling on the new road link associated with the Proposed Ribble Crossing would lead to any changes in pollutant concentrations that would be above imperceptible at any human or ecological locations within 200 m.

⁷ The term Heavy Duty Vehicle (HDV) relates to large commercial vehicles such as trucks and buses.

⁸ As discussed in Section 18.4.1, the comparison of traffic flows is based on the Do Nothing scenario (i.e. without the Proposed Programme of Works and without any committed development) so the traffic flow changes discussed here also includes vehicle movements for committed developments. The movements associated with the HARP Proposed Programme of Works on these two roads associated with commuters and visitors travelling to and from the park and ride would be a maximum of 27 cars as an AADT.

- 40) The nearest human location is 92 m from the ARN and the nearest ecological locations are the Ribble Crossing BHS, which is adjacent to the road link at the bridge location, and Waddington Brickworks Old Working BHS, which is 135 m from the ARN. As pollutants emitted from road traffic disperse rapidly with distance from the roadside, the operation of the Proposed Ribble Crossing is unlikely to result in predicted changes above imperceptible impacts at 92 m or 135 m from the roadside. As reported in Volume 2 Section 18.6.1, there were some road links to the north where the road traffic for the HARP Proposed Programme of Works would be above the DMRB criteria and were identified as the ARN. The change in traffic flows were 376 total vehicle movements as an AADT, 231 of which were HDVs. The predicted increase in annual mean NO₂, PM₁₀ and PM_{2.5} concentrations at human locations (R11 and R13) approximately 6 m from the roadside of the ARN was 0.1 µg/m³ (an imperceptible impact). Similarly, the largest predicted increases in annual mean NO_x concentrations, nitrogen deposition and acid deposition at an ecological location immediately adjacent to the ARN (H28) was also reported to be imperceptible.
- 41) The background concentrations presented in Table 18.2 also show the Proposed Ribble Crossing and surrounding area has background concentrations of NO_x, NO₂, PM₁₀ and PM_{2.5}, which are well below the AQOs.
- 42) Based on the above analysis, the Proposed Ribble Crossing is therefore unlikely to result in significant effects during the operational phase at all human and ecological locations within 200 m of the ARN. The summary of operational effects is shown in Table 18.6.

Table 18.6: Summary of Operational Phase Effects

Environmental / Community Asset	Value / Sensitivity	Effect	Nature of Effect	Magnitude	Significance of Effect (Pre-Mitigation)
Human locations	N/A	Increase in pollutant concentrations (NO ₂ , PM ₁₀ , PM _{2.5}).	Adverse temporary (Duration of Proposed Marl Hill Section construction).	Imperceptible	Not Significant
Ecological locations	N/A	Increase in pollutant concentrations (NO _x) and nitrogen and acid deposition.	Adverse, temporary, (Duration of Proposed Marl Hill Section construction).	Imperceptible	Not significant

18.6.3 Decommissioning Phase

- 43) The decommissioning phase is anticipated to be similar to the construction phase with regard to the type and scale of activities and likely number of decommissioning related road traffic movements on the local road network. The same good practice mitigation measures required to control dust emissions from high risk sites specified for the construction phase would also be adopted during decommissioning. These would be appropriate to control dust impacts to a level that can be considered as a not significant effect (in accordance with IAQM guidance⁹) and are specified in Section 18.4.4 and included in the CCoP.

⁹ Institute of Air Quality Management (2016) *op. cit.*

Table 18.7: Summary of Decommissioning Phase Effects

Environmental / Community Asset	Value / Sensitivity	Effect	Nature of Effect	Magnitude	Significance of Effect (Pre-Essential Mitigation)
Human locations	N/A	Increase in pollutant concentrations (NO ₂ , PM ₁₀ and PM _{2.5}).	Adverse, temporary, short-term.	Imperceptible	Not Significant
		Increase in dust deposition and PM ₁₀ /PM _{2.5} concentrations.	Adverse, temporary, short-term.	N/A (assumed high risk)	Not significant (assumed good practice mitigation adopted as standard).
Ecological locations	N/A	Increase in pollutant concentrations (NO _x), nitrogen and acid deposition rates.	Adverse, temporary, short-term.	Imperceptible	Not significant
	N/A	Increase in dust deposition.	Adverse, temporary, short-term.	N/A (assumed high risk)	Not significant (no ecological locations within 50 m and assumed good practice mitigation adopted as standard).

18.7 Mitigation and Residual Effects

- 44) Mitigation is most effective if considered as an integral part of the Proposed Ribble Crossing design in order to avoid, reduce or offset any adverse effects on the air quality or wider environment.
- 45) As explained in Section 18.4.4, the assessment of effects in Section 18.6 takes into account the application of both embedded mitigation and good practice measures. Essential mitigation is not required to further control dust or air pollutant emissions during all phases and the residual effects are not significant.

18.8 Cumulative Effects

- 46) The following section considers the potential cumulative effects from different proposed developments and land allocations, in combination with the Proposed Ribble Crossing (i.e. inter-project cumulative assessment). Data on proposed third party developments and land allocations contained in development plan documents were obtained from various sources, including local planning authority websites, online searches, and consultations with planning officers. Proposed development data were then reviewed with a view to identifying schemes or land allocations whose nature, scale and scope could potentially give rise to significant environmental effects when considered in combination with the likely effects arising from the Proposed Ribble Crossing.
- 47) Intra-project cumulative impacts, i.e. two or more types of impact acting in combination on a given environmental receptor, property or community resource, are considered in Chapter 14: Communities and Health.
- 48) It is important to note that future growth on the local road network was taken into account in the traffic modelling described in Chapter 16: Transport Planning. For this reason, the potential cumulative effects

of future traffic growth between the Proposed Ribble Crossing and other proposed developments are embedded into predicted road traffic-related impacts on highways capacity, air quality and noise.

- 49) The over-arching cumulative effects of the Proposed Programme of Works i.e. the five proposed replacement tunnel sections in combination, are considered in Chapter 19: Cumulative Effects. In addition, Chapter 19 examines the cumulative effects associated with the outcomes from Volume 2 (delivery and operation of the main construction compounds, tunnel, and construction traffic routes), Volume 5 (proposed off-site highways works and satellite compounds), and Volume 6 (Proposed Ribble Crossing).
- 50) Based on professional judgement, and recognising that the traffic flow figures used in the air quality assessment already incorporated future traffic growth, it was concluded that there are no proposed third party developments or land allocations in local development plan documents which could potentially give rise to likely significant cumulative effects. This methodology was a conservative approach and did not give rise to significant air quality effects. No specific cumulative assessment was therefore undertaken.

18.9 Conclusion

- 51) This chapter of the ES considered the potential air quality impacts and residual air quality effects of the construction, operation and decommissioning phases of the Proposed Ribble Crossing. The air quality assessment considered both human health and natural habitats. It is noted that the Proposed Ribble Crossing would be used by construction traffic serving both the Bonstone and Braddup (Proposed Marl Hill Section) Compounds.
- 52) Existing air quality was established using a combination of modelled background mapping and existing monitoring data recorded by local authorities. The assessment areas comprised rural and suburban locations with the main contributor to the regional background concentrations being local roads and nearby industrial facilities.
- 53) Appropriate good practice dust mitigation measures would prevent significant effects occurring at off-site locations. Such measures are considered to be normal good practice that would be adopted by the contractor meeting the requirements of the air quality mitigation measures within the CCoP. These would also be agreed with the local authority prior to construction works commencing.
- 54) The chapter has examined the impact of road traffic emissions due to the additional vehicle movements on the local road network associated with the Proposed Ribble Crossing. Given that the additional flows on the surrounding road network, and on the Proposed Ribble Crossing itself, were less than the relevant DMRB screening criteria, a qualitative assessment was undertaken. This concluded that all traffic flow changes are likely to have imperceptible impacts at sensitive human and ecological locations. On this basis, the Proposed Ribble Crossing would not have a significant effect on air quality.

18.10 Glossary and Key Terms

- 55) Key phrases and terms used within this technical chapter relating to Air Quality and Climate Change are defined within Appendix 1.2: Glossary and Key Terms