Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

Volume 6

Proposed Ribble Crossing

Chapter 17: Noise and Vibration

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Haweswater Aqueduct Resilience Programme - Proposed Marl Hill Section

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Client Name:	United Utilities Water Ltd

Jacobs U.K. Limited

5 First Street
Manchester M15 4GU
United Kingdom
T +44 (0)161 235 6000
F +44 (0)161 235 6001
www.jacobs.com

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17. Noise and Vibration

17.1 Introduction

1) This chapter presents an assessment of the likely significant effects of the Proposed Ribble Crossing on noise and vibration.

2) The existing baseline environment is presented before an assessment is made of the potential effects on the noise and vibration for the construction and operation of the Proposed Ribble Crossing. Mitigation measures have been proposed to avoid, reduce or offset any potential effects. Embedded mitigation measures have been taken into account in the assessment and are described in Chapter 3: Design Evolution and Development Description. Specific mitigation measures are outlined in Section 17.7.

3) The assessment area includes the closest noise and vibration sensitive receptors to the Proposed Ribble Crossing alignment, with sample assessment locations indicated in Figure 17.1.

17.2 Scoping and consultations

17.2.2 Scoping

4) A Noise and Vibration chapter was included within the EIA Scoping Report which was submitted to the relevant planning authorities for comment *in October 2019.* An Addendum to the EIA Scoping Report was submitted in February 2021 due to design changes, refinements and the need for alternative methodologies, including reference to the latest DMRB LA 111 – noise and vibration[1] guidance and the approach to baseline data gathering during Covid-19 restrictions.

5) No comments regarding the noise and vibration chapter were received from Ribble Valley Borough Council (RVBC) on the EIA Scoping Report. Scoping comments and responses are outlined in Volume 4 Appendix 4.1.

17.2.3 Consultation

- During the course of this assessment, consultation has taken place with the Environmental Health team of Ribble Valley Borough Council.

17.3 Key Legislation and Guidance

6) The legislation and planning policies relevant to Noise and Vibration are considered in Volume 2, Section 17.3 of the Proposed Marl Hill Section ES.

17.4 Assessment Methodology and Criteria

7) The assessment methodology and criteria relevant to noise and vibration are presented in Volume 2, Proposed Section 17.4 of the Proposed Marl Hill Section ES.

8) In order to predict construction noise and vibration arising from the Proposed Ribble Crossing the Ribble Crossing Outline Construction Method Statement was screened to identify the activities to be assessed. Spreadsheet-based construction noise level predictions have been undertaken for the Proposed Ribble Crossing using the methodologies contained within BS 5228-1. The noise assessment considers eight sample assessment locations, with each considered representative of one or more sensitive receptors. The ground cover has been assumed to be 75 % soft ground for all locations, and a +3 dB façade correction has been applied to calculation results for properties. Predicted noise levels for each activity included corrections for operating on-times and mitigation included in the plant and equipment list. Predictions were undertaken for activities potentially resulting in the highest noise emissions and/or impacts.

[1] Highways England, Transport Scotland, Welsh Government, Department for Infrastructure. 2020. Sustainability & Environment Appraisal LA 111 Noise and Vibration. Revision 2.

9) The assessment of road traffic noise from the use of the Proposed Ribble Crossing, and any changes on the surrounding road network is based on the construction traffic assessment of the Proposed Ribble Crossing. Spreadsheet calculations of road traffic noise have been made in accordance with the method set out in the Calculation of Road Traffic Noise (CRTN) and updates detailed in the DMRB LA111 Rev2. The predicted $L_{A10,18h}$ noise levels have been converted to L_{day} levels using Method 3 contained in TRL report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping'. For roads with an AAWT 18-hour flow of less than 1000 vehicles, $L_{Aeq,T}$ predictions of airborne noise from construction road traffic have been made in accordance with the method set out in the Noise Advisory Council measurement and prediction guide.

17.4.2 Assumptions and Limitations

10) Working hours for the construction and decommissioning phases are expected to be weekday and Saturday morning only. Night-time noise from security cabins at each end of the route during the operational phase of the Proposed Ribble Crossing has also been assessed.

11) The following assumptions and limitations apply to construction noise predictions:

- Noise predictions are made using the best available information at the time of assessment. However, the plant list (presented in Volume 4, Appendix 17.2), and the construction strategy developed to support this assessment by the ECI, may not reflect that adopted during construction. The assessment was, however, based on a series of reasonable worst-case assumptions
- Screening in the form of boundary hoardings or noise fences has been assumed around all work sites, with an assumption of 5 dB reduction for partial screening provided to all receptors. In addition, more substantial screening is proposed between the works compound at the north of the Proposed Ribble Crossing and Waddington and West Bradford C of E Primary School in order to completely block the line of sight between operating plant and the school buildings, thus providing a 10 dB noise reduction for full screening. It is anticipated that these would be located either along the site boundary or to the north and eastern edges of the compound.

17.4.3 Good Practice Measures

12) Good practice measures are contained in Volume 4: Appendix 3.2: Construction Code of Practice (CCoP).

13) The CCoP presents a suite of mitigation measures that would be adopted during construction. Where the level of noise reduction can be quantified, these measures have been included in the noise prediction modelling that has been undertaken, while others can be considered examples of adopting Best Practicable Means (BPM) for mitigating noise emissions. BPM would be adopted by the contractor during construction and would further mitigate noise and vibration emissions. Some examples include the use of low vibration or non-vibratory compaction techniques when in close proximity to sensitive properties, fitting silencers to pneumatic tools and exhausts, and the use of sound reducing enclosures and barriers.

17.5 Baseline Conditions

14) This section details the noise and vibration baseline for the assessment area and identifies receptors where there is potential for significant effects to arise.

15) The baseline sound climate for the Proposed Ribble Crossing was determined through sound level monitoring and review of online noise mapping. The baseline sound determination approach and sound levels are detailed in Volume 4, Appendix 17.3, which includes all baseline locations included along all sections of the HARP Proposed Programme of Works. The closest noise measurement locations are B12 and B13, located approximately 1 km to the north and east of the Proposed Ribble Crossing. Noise mapping data from Extrium[2] was also used to determine nearby baseline sound levels. The closest area of the online noise mapping is at the junction of the Waddington Road with A671 Chatburn Road approximately 1.5 km south of the proposed Ribble Crossing. This provides a good indication that

[2] http://www.extrium.co.uk/noiseviewer.html

daytime noise levels are likely to be below 55 dB $L_{Aeq,T}$. A summary of the baseline conditions is provided below.

17.5.2 Sensitive Receptors

16) The proposed Ribble Crossing is located in a rural area, with residential properties located within 300 m of the route at either end of the Proposed Ribble Crossing, a school at the north end, and a cottage near the middle of the indicative route alignment. At the north-eastern end of the Proposed Ribble Crossing the Waddington and West Bradford C of E Primary School is located approximately 100 m east of where the route would tie in with West Bradford Road. There are also residential dwellings located to both the east and west of this tie in. At around the mid-point of the Proposed Ribble Crossing the residential dwelling of Lilands Cottage is located approximately 85 m from the route. Associated with Lilands farm is a historic barn at 4 m from the proposed route, which has the potential to be sensitive to vibration. At the south-eastern end of the route, the Proposed Ribble Crossing ties back in with West Bradford Road, and there are several further noise sensitive receptors located to the north and south of the tie in and within 300 m of the proposed bridge works.

17.5.3 Monitoring Locations

17) Table 17.1 presents the baseline sound level monitoring locations, and the baseline sound levels established in the vicinity of the Proposed Ribble Crossing. Each location is considered representative of the baseline sound climate in the community area in which it is located. Figure 17.1 shows the positions of each baseline location. Appendix 17.1 provides a summary of the additional baseline location B39.

Table 17.1: Baseline Locations and Summary

ID	Monitoring Location Address	Period	Sound Pressure Level (dB $L_{Aeq,1hr}$)			Comments / Observations
			Wk	Sat	Sun	
B12	Braddup House Farm, Cross Lane, Waddington *(Sound level monitoring)*	Day	51	51	56 51*	This is a rural location 1.8 km west of Waddington village. Farm activities, animal sounds and the sound of a stream next to the property were observed during the survey. * baseline sound level adjustments made for assessment: (i) Sunday daytime sound level to match Saturday & weekday = 51 dBA, (ii) weekend night to match weekday = 49 dBA.
		Eve	50	50	-	
		Night	49	55 49*		
B13	Teewood Farm, Slaidburn Road, Waddington *(Sound level monitoring)*	Day	46	43	54 43*	This is a rural location 1.8 km north of Waddington village. Natural sounds (including birdsong), aircraft noise and distant road traffic noise were observed during the survey. * baseline sound level adjustments made for assessment: (i) Sunday daytime sound level to match Saturday = 43 dBA, (ii) weekend night to match weekday = 42 dBA.
		Eve	45	41	-	
		Night	42	47 42*		
B39	Waddington *(Strategic noise mapping – closest mapping)*	Day	50	50	50	This is a rural location outside of Clitheroe. Road traffic noise from local roads is likely to dominate, with additional noise construction from local rural activities. Closest strategic mapping location is approx. 1.5 km south of the Ribble Crossing, beyond which levels of noise from road traffic would be expected to be lower.
		Eve	50	50	-	
		Night	40	40		

Notes:
Weekday (Mon to Fri) Day = 07:00 to 19:00; Eve (evening) = 19:00 to 23:00; Night = 23:00 to 07:00
Saturday Day = 07:00 to 13:00; Eve (evening) = 13:00 to 23:00
Sunday Day = 07:00 to 23:00
Weekend (Sat and Sun) Night = 23:00 to 07:00
Sound level monitoring – Baseline measurements undertaken by Jacobs
Strategic noise mapping – Baseline sourced from DEFRA strategic noise mapping

18) Prevailing baseline groundborne vibration levels at sensitive properties in the vicinity of the proposed Ribble Crossing are anticipated to be low and have not been measured as part of the baseline study.

17.5.4 Information Sources

19) The assessment was undertaken with reference to the sources detailed in Table 17.2.

Table 17.2: Key Information Sources

Data Source	Reference
Ribble Crossing Outline Construction Method Statement	80061155-01-UU-TR4-XX-RP-C-00009
England Noise and Air Quality Viewer, showing road and railway noise level maps.	http://www.extrium.co.uk/noiseviewer.html

17.5.5 Noise and Vibration Sources

20) The list of composite construction activities and indicative plant list presented in Appendix 17.2 was based on the construction programme provided by the ECI contractor, with refinements made to the plant lists by United Utilities in March 2021.

17.5.6 Construction Good Practice

21) Good practice measures are standard industry methods and approaches used to manage commonly occurring environmental effects. The assessments presented in Section 17.6 of this chapter are made taking into account the implementation of good practice measures.

22) Good practice measures are outlined in Volume 4: Appendix 3.2: Construction Code of Practice (CCoP).

23) The need for any additional noise and vibration essential mitigation (generally for effects likely to be significant in the context of the EIA Regulations) identified as a result of the assessment in Section 17.6 is then set out separately in Section 17.7.

17.6 Assessment of likely significant effects

24) The following section describes the effects of the Proposed Ribble Crossing on noise and vibration during the enabling works, construction of the haul route, and bridge and operational phase of the crossing during the Proposed Marl Hill Section construction phase. It is considered that the decommissioning phase would likely use a similar compliment of plant as the construction phase; therefore, decommissioning would result in similar impacts. As such, no specific calculations of decommissioning have been undertaken.

17.6.2 Enabling Works Phase

25) This section presents the potential noise and vibration impacts during the enabling works. The enabling works are preliminary activities that include the following stages:

- Set up compounds and welfare, including site clearance, minor earthworks (to level the site) and compacted stone laydown for parking areas, (two weeks)
- Service diversions and stock-proof fencing (four weeks)
- Access to and construction of bridge working area (seven weeks), southern end of scheme.

Airborne Noise

26) Table 17.3 below presents the calculated reasonable worst case noise levels, assuming a spread of plant items across the closest quarter of the working area. Construction noise levels at a middle distance of works across the full working area are presented in brackets.

Table 17.3: Predicted Construction Noise Levels at Receptors in the vicinity of the Enabling Works

Existing Sound Level (dB $L_{Aeq,T}$) Weekday/Saturday	Construction Noise Limit, SOAEL (dB $L_{Aeq,T}$)	Predicted Construction Noise Level (dB $L_{Aeq,T}$)				
		Set up compounds and laydown areas	Service Diversions	Stock Fencing around laydown areas [3]	Stock Fencing along Route	Bridge Works
R1. Waddington and West Bradford C of E Primary School – building 140 m from route, 130 m from service diversions, 50 m from laydown area, 110 m from compound and >300 m from bridge works.						
46[1]	50	54 (52)	51[4]	65 (57)[4]	54 (49)[4]	-
R1b. Waddington and West Bradford C of E Primary School – school play area at front of buildings						

Existing Sound Level (dB $L_{Aeq,T}$) Weekday/Saturday	Construction Noise Limit, SOAEL (dB $L_{Aeq,T}$)	Predicted Construction Noise Level (dB $L_{Aeq,T}$)				
		Set up compounds and laydown areas	Service Diversions	Stock Fencing around laydown areas [3]	Stock Fencing along Route	Bridge Works
135 m from route, 125 m from service diversions, 45 m from laydown area, 105 m from compound and >300 m from bridge works.						
46[1]	55[2]	51 (50)	48	63 (54)[4]	52 (46)	-
R1c. Waddington and West Bradford C of E Primary School – school field to rear of school buildings 220 m from route, 210 m from service diversions, 130 m from laydown area, 180 m from compound and >300 m from bridge works. Includes screening provided by school buildings						
46[1]	55[2]	45 (42)	42	50 (47)	45 (42)	-
R2. The Healings 145 m from route, 170 m from service diversions, 90 m from laydown area, 145 m from compound and >300 m from bridge works.						
46/43	65	55 (53)	52	59 (54)	54 (49)	-
R3. Meadow Croft 95 m from route, 80 m from service diversions, 80 m from laydown area, 130 m from compound and >300 m from bridge works.						
46/43	65	55 (52)	60	60 (53)	58 (51)	-
R4. Waddow Grove 300 m from laydown areas and >300 m from all other works.						
46/43	65	-	-	47	-	-
R5. Lilands Cottage 85 m from route, 155 m from laydown area, 180 m from welfare compound and >300 m from service diversions and bridge works.						
46/43	65	51 (49)	-	53 (50)	60 (52)	-
R6. Horrocks Farm 100 m from route, 80 m from service diversions, 25 m from laydown area, 130 m from compound and 100 m from closest bridge works.						
46/43	65	60 (57)	60	72 (57)[4]	48 (45)	62
R7. 6 Ribble View 145 m from route, 120 m from service diversions, 95 m from laydown area, 165 m from compound and 145 m from closest bridge works.						
46/43	65	54 (52)	56	58 (52)	54 (49)	58
R8. Ashridge 300 m from laydown area, 220 m from service diversions, 225 m from bridge access and >300 m from all other works.						
46/43	65	-	49	47	-	53
NOTES The predicted construction noise levels for the set up of compounds and laydown areas, shown in brackets represent average noise levels during this works phase (i.e. with plant spread across the main works area). The reasonable worst-case						

Existing Sound Level (dB $L_{Aeq,T}$) Weekday/Saturday	Construction Noise Limit, SOAEL (dB $L_{Aeq,T}$)	Predicted Construction Noise Level (dB $L_{Aeq,T}$)				
		Set up compounds and laydown areas	Service Diversions	Stock Fencing around laydown areas [3)]	Stock Fencing along Route	Bridge Works
assessment scenario, where works are assumed to be undertaken in the vicinity of the property under consideration, are shown as the noise levels outside of brackets. Note 1: Sound level presented is for weekday only as the school is not in use at weekends. Note 2: 55 dB $L_{Aeq,T}$ noise limit, with at least one area suitable for outdoor teaching where noise levels are below 50 dB $L_{Aeq,T}$. Note 3: The predicted construction noise levels for stock-fencing shown in brackets represent noise levels during this works phase as the fencing works moves 100 m along the fence line. The reasonable worst-case assessment scenario, where works are assumed to be undertaken in the closest vicinity of the property under consideration, are shown as the noise level not in brackets. Note 4: Significant effect not predicted during service diversions or fencing due to works duration expected to be <10 days in 15 consecutive days. Amber shading denotes a potential moderate adverse effect. Greyed shading indicates that the assessment location is in excess of 300 m from any works and predicted noise levels are below the SOAEL. Existing sound level data from B13 is presented.						

27) The construction noise levels presented in Table 17.3 at distances of greater than approximately 80 m from any enabling works (school field and The Healings to the north-east, Meadow Croft and Waddow Grove to the west, Lilands Cottage central to the proposed route, Ribble View to the east and Ashridge to the north-east) are predicted to remain below the SOAEL trigger levels. As such, impacts are predicted to be negligible or minor adverse and significant effects are not predicted. However, moderate and major impacts and potential significant effects are predicted at one noise sensitive receptors close to the enabling works.

28) At the northern end of the Proposed Ribble Crossing, where it joins West Bradford Road, moderate noise impacts are predicted at Waddington and West Bradford C of E Primary School during the set-up of the laydown and compound areas, as the SOAEL of 50 dB (for the school buildings) is predicted to be exceeded by up to 4 dB. As the total period of the enabling works are anticipated to exceed 10 or more days in any 15 consecutive days, a potential significant effect is predicted for the school buildings. In order to mitigate the significant impact at the school buildings is it proposed that the noisiest activities are programmed to occur before and after the school day where practicable, as outlined in Section 17.7.

Vibration – Vibratory compaction

29) Vibratory compaction may be undertaken at the compound car park areas, and also compacting layers of fill at the bridge launch platforms. The school (location R1 in Figure 17.1) is located approximately 105 m from the closest compound, with residential receptors at greater distances. The historic barn at Lilands Farm (location R5b in Figure 17.1) is located 110 m from the closest laydown area where compacting may be undertaken during site set up. Volume 4, Appendix 17.4 presents the indicative predicted vibration levels during soil compaction at distances of between 10 and 100 m for both steady state operations and during transient start-up and run-down.

<u>Vibratory compaction (Horrocks Farm and Waddington and West Bradford C of E Primary School)</u>

30) The closest residential receptor to any compaction is Horrocks Farm (location R6 in Figure 17.1) at a distance of 100 m to the bridge launch platforms. The following range in vibration levels may be expected at a distance of 100 m from vibratory compaction:

- With a 50 % chance of exceedance and assuming a low vibration amplitude setting: 0.1 to 0.2 mm/s Peak Particle Velocity (PPV) for steady-state and transient conditions, respectively (0.3 to 0.4 mm/s PPV with a 5 % chance of exceedance)
- With a 5 % chance of exceedance and assuming a high vibration amplitude setting: 0.8 to 1.3 mm/s PPV for steady-state and transient conditions, respectively (0.2 to 0.5 mm/s PPV with a 50 % chance of exceedance).

31) Human impacts (R1 and R6): the vibration levels presented above range from 0.1 mm/s PPV (when considering low vibration amplitude operating setting, steady-state operation and a 50 % chance of exceedance) to 1.3 mm/s PPV (when considering high vibration amplitude operating setting, transient operating modes and a precautionary 5 % chance of exceedance). As such, based on the prediction methods provided in BS 5228-2, moderate adverse impacts during vibratory compaction works are predicted. However, typical methods to control vibration impacts during compaction are included in the CCoP and would be adopted by the construction contractor. With the adoption of these measures, such as running start up and run down modes away from sensitive properties and adopting low vibration amplitude or non-vibratory techniques when working in close proximity to sensitive properties, it is anticipated that vibration impacts can be controlled and would not result in significant adverse effects.

32) Structural impacts (R1 and R6): The predicted levels of vibration during enabling works compaction are below the vibration impact criteria (6 mm/s for continuous vibration). With vibration control measures implemented (as outlined in the CCoP) to mitigate human vibration impacts, including operating vibratory compactors on a low vibration amplitude setting and using non-vibratory techniques when working in close proximity to properties, damage to buildings is considered to be unlikely and significant effects are not predicted.

<u>Vibratory compaction (historic barn at Lilands Farm)</u>

33) Structural impacts (R5b): This receptor is an historic barn, and the condition of its foundations are not known. As such, the more stringent vibration impact criteria for building response (3 mm/s for continuous vibration) are applicable. The predicted levels of vibration during enabling works compaction are below this threshold. Therefore, damage to the building is considered to be unlikely, and significant effects are not predicted.

34) The summary of enabling works effects are shown in Table 17.4 below

Table 17.4: Summary of Enabling Works Effects

Environmental / Community Asset [1) 2)]	Value / Sensitivity	Construction Activity	Effect	Duration	Magnitude	Significance of Effect
Waddington and West Bradford C of E Primary School	High (School)	Set up construction compounds & laydown areas.	Airborne noise	Two weeks	Moderate	Moderate Adverse
		Service diversions and stock fencing	Airborne noise	Four weeks	Major	Not significant (potential *15 dB above 50 dB $L_{Aeq,T}$ SOAEL for <10 days in any 15 consecutive days*)
		Vibration during compaction	Vibration – human response	Six weeks	Negligible/Minor	Slight
			Vibration – structural response	Six weeks	N/A	Not significant
The Healings	High (Residential)	Site clearance, service diversions and fencing at laydown areas.	Airborne noise	Four weeks	Negligible/Minor	Slight
Meadow Croft	High (Residential)	Site clearance, service diversions and fencing at laydown areas and main route area.	Airborne noise	Four weeks	Negligible/Minor	Slight
Lilands Cottage	High (Residential)	Site clearance, service diversions and fencing at main route area.	Airborne noise	Four weeks	Negligible/Minor	Slight
Lilands historic barn	Very High (special case for vibration sensitivity)	Vibratory compaction within laydown area	Vibration – structural response	Two weeks	N/A	Not significant

Environmental / Community Asset [1) 2)]	Value / Sensitivity	Construction Activity	Effect	Duration	Magnitude	Significance of Effect
Horrocks Farm	High (Residential)	Site clearance & set up of compounds and fencing at laydown area.	Airborne noise	Two weeks	Negligible/Minor	Slight
		Bridge enabling works. Service diversions and fencing at main route area.	Airborne noise	Eight weeks	Negligible/Minor	Slight
		Compaction of car park areas and bridge launch platform.	Vibration – human response	Six weeks	Negligible/Minor	Slight
			Vibration – structural response	Six weeks	N/A	Not significant
Ribble View	High (Residential)	Site clearance, service diversions and fencing at laydown areas.	Airborne noise	Four weeks	Negligible/Minor	Slight

NOTES

Note 1) Environmental/Community Assets are noise and vibration assessment sample receptors and represent impacts and effects for one or multiple sensitive properties.

Note 2) All Environmental/Community Assets are considered to be of High sensitivity.

17.6.4 Construction Phase

35) The main construction phase includes road construction and bridge construction. The construction of the bridge includes piling works, for which an assessment of vibration impacts has also been included.

36) The main construction works include the following stages:

- Construction of new temporary road and drainage works. Includes earthworks (EW) within laydown areas, earthworks and drainage along route and paving of route at the end of the programme (production rate 125 m/wk) (12-weeks)
- Bridge piling (3-weeks)
- Concrete abutments & piers structures (followed by 28-day concrete curing period) (5-weeks)
- Install modular bridge sections (4-weeks).

37) Table 17.5 below presents the calculated worst-case noise levels that assume all items of plant are operating at the closest location to each receptor. For the road construction works in brackets a construction noise level for the works occurring at 125 m distance along the route to indicate noise levels a weeks progress along the route.

Table 17.5: Predicted Construction Noise Levels at Receptors in the vicinity of the Main Construction Works

Existing Sound Level (dB $L_{Aeq,T}$) Weekday/Saturday	Const'n Noise Limit, SOAEL (dB $L_{Aeq,T}$)	Predicted Construction Noise Level (dB $L_{Aeq,T}$)						
		EW within laydown area	Route EW	Route Drainage	Route Pavement	Bridge Piling	Bridge Concrete	Bridge Sections
R1. Waddington and West Bradford C of E Primary School – building								
140 m from route, 115 m from laydown central area and >300 m from bridge works.								
46[1)]	50	49	59 (59)	54 (54)	60 (60)[3)]	-	-	-
R1b. Waddington and West Bradford C of E Primary School – school play area at front of buildings								
135 m from route, 105 m from laydown central area and >300 m from bridge works.								
46[1)]	55[2)]	47	56 (56)	51 (51)	57 (57) [3)]	-	-	-
R1c. Waddington and West Bradford C of E Primary School – school field to rear of school buildings								
220 m from route, 200 m from laydown central area and >300 m from bridge works. Includes screening provided by school buildings								
46[1)]	55[2)]	42	50 (50)	45 (45)	51 (51)	-	-	-
R2. The Healings								
145 m from route, 150 m from laydown central area and >300 m from bridge works.								
46/43	65	49	58 (57)	54 (52)	59 (58)	-	-	-
R3. Meadow Croft								
95 m from route, 180 m from laydown central area and >300 m from bridge works.								
46/43	65	47	63 (55)	58 (50)	64 (56)	-	-	-
R4. Waddow Grove								
300 m from laydown areas and >300 m from all other works.								
46/43	65	42	-	-	-	-	-	-
R5. Lilands Cottage								
85 m from route, 210 m from laydown central area and >300 m from bridge works.								

Existing Sound Level (dB $L_{Aeq,T}$) Weekday/Saturday	Const'n Noise Limit, SOAEL (dB $L_{Aeq,T}$)	Predicted Construction Noise Level (dB $L_{Aeq,T}$)						
		EW within laydown area	Route EW	Route Drainage	Route Pavement	Bridge Piling	Bridge Concrete	Bridge Sections
46/43	65	46	64 (58)	59 (53)	65 (59) [4)]	-	-	-
R6. Horrocks Farm 100 m from route, 110 m from laydown central area and 100 m from closest bridge works.								
46/43	65	52	62 (57)	58 (52)	63 (58)	63	53	58
R7. 6 Ribble View 145 m from route, 170 m from laydown central area and 145 m from closest bridge works.								
46/43	65	48	58 (53)	54 (48)	59 (54)	59	49	55
R8. Ashridge 300 m from laydown area and >300 m from all other works.								
46/43	65	42	-	-	-	-	-	-

NOTES

EW - Earthworks

Note 1: Sound level presented is for weekday only as the school is not in use at weekends.

Note 2: 55 dB $L_{Aeq,T}$ noise limit, with at least one area suitable for outdoor teaching where noise levels are below 50 dB $L_{Aeq,T}$.

Note 3: The paving works are programmed for August 2023, when the school will not be in use.

Note 4: Significant effect not predicted during road construction paving due to works duration expected to be <10 days in 15 consecutive days at a fixed location. The predicted construction noise levels for road construction works shown in brackets represents the works moving along the route at a rate of 125 m per week, and indicates the construction noise level at the distance from the receptor to a point 125m along the route form the closest point. The reasonable worst-case assessment scenario, where works are assumed to be undertaken in the closest vicinity of the property under consideration, are shown as the noise level not in brackets.

Red shading denotes potential major adverse effect and amber a potential moderate adverse effect. Greyed shading indicates that the location is in excess of 300 m from any works and predicted noise levels are below SOAEL.

Existing sound level data from B13 is presented.

38) The construction noise levels presented in Table 17.5 from the main road construction works are predicted to remain below the SOAEL trigger levels for all of the residential properties in the vicinity of the Proposed Ribble Crossing. Impacts at these locations are predicted to be negligible or minor adverse and significant effects are not predicted.

39) Waddington and West Bradford C of E Primary School; close to the northern end of the Proposed Ribble Crossing, where it joins West Bradford Road, Major and Moderate noise impacts are predicted at Waddington and West Bradford C of E Primary School during the construction of the route. The SOAEL of 50 dB and 55 dB for the school buildings and outside play area, respectively, are predicted to be exceeded during the following phases:

- Earthworks along the construction route, Major noise impact at the closest school building when 50 dB SOAEL is exceeded by more than 5 dB; Moderate impact at the play area in front of the school when the 55 dB SOAEL is exceeded by less than 5 dB
- Drainage along the construction route, Moderate noise impact at the closest school building when 50 dB SOAEL is exceeded by less than 5 dB.

40) As the construction of the main route moves away from the school (at a rate of 125 m per week) then the construction noise levels would reduce. However, as the total period of exceedance of the SOAEL of

50 dB during the route earthworks and drainage could exceed 10 or more days in any 15 consecutive days, then a significant impact is considered likely without additional noise mitigation.

41) Given an alternative outside teaching area is available at the rear of the buildings, where the SOAEL is not predicted to be exceeded, a significant effect is not considered to occur for outdoor teaching areas.

42) In order to mitigate the significant impact at the school buildings it is proposed that the noisiest activities are programmed to occur before and after the school day where practicable, as outlined in Section 17.7.

43) The paving phase of the road construction works is predicted to meet the 65 dB SOAEL at Lilands Cottage when occurring at the closest area to this receptor. The works are programmed to move along the route at a rate of 125 m per week, and when at this additional distance of 125 m the noise from paving would reduce to below the 65 dB threshold level. As the threshold level would therefore be exceeded for less than two weeks at Lilands Cottage, which is below the criteria of 10 or more days or nights in any 15 consecutive days or nights, then a significant impact from road construction is not likely.

44) The bridge works are not predicted to exceed the SOAEL at any receptor, and impacts at these locations are predicted to be negligible or minor adverse and significant effects are not predicted.

45) As discussed in paragraph 13, the CCoP presents a suite of mitigation measures that would be adopted during construction.

Vibration – Piling and vibratory compaction

46) Piling of the bridge foundations and vibratory compaction of the haul route both have the potential to cause vibration impacts at nearby properties. Volume 4, Appendix 17.4 presents the indicative predicted vibration levels during piling and soil compaction at distances of between 10 and 100 m for both steady state operations and during transient start-up and run-down.

Vibratory compaction (Lilands Cottage)

47) The closest residential receptor to vibratory compaction is Lilands Cottage (location R5 in Figure 17.1) at a distance of 85 m from the route where vibratory rollers may be used to compact fill. The following range in vibration levels may be expected at this distance:

- With a 50 % chance of exceedance and assuming a low vibration amplitude setting: approximately 0.1 to 0.2 mm/s PPV for steady-state and transient conditions, respectively (0.3 to 0.5 mm/s PPV with a 5 % chance of exceedance)
- With a 5 % chance of exceedance and assuming a high vibration amplitude setting: 1.0 to 1.6 mm/s PPV for steady-state and transient conditions, respectively (0.3 to 0.6 mm/s PPV with a 50 % chance of exceedance).

48) Human impacts: the vibration levels presented above range from 0.1 mm/s PPV (when considering low vibration amplitude operating setting, steady-state operation and a 50 % chance of exceedance) to 1.6 mm/s PPV (when considering high vibration amplitude operating setting, transient operating modes and a precautionary 5 % chance of exceedance). As such, based on the prediction methods provided in BS 5228-2, potential moderate adverse impacts at the high sensitivity residential property during vibratory compaction works are predicted. However, practical methods to control vibration impacts during compaction are included in the CCoP and would be adopted by the construction contractor. With the adoption of these measures, such as running start up and run down modes away from sensitive properties and adopting low vibration amplitude or non-vibratory techniques when working in close proximity to sensitive properties, it is anticipated that vibration impacts can be controlled and would not result in significant adverse effects.

49) Structural impacts: with vibration control measures implemented (as outlined in the CCoP) to mitigate human vibration impacts, including operating vibratory compactors on a low vibration amplitude setting and using non-vibratory techniques when working in close proximity to properties, damage to buildings is considered to be unlikely and significant effects are not predicted.

Piling (Horrocks Farm)

50) The residential properties at Horrocks Farm is at a distance of 100 m from the bridge piling at the eastern end of the Proposed Ribble Crossing. The following range in vibration levels may be expected during piling:

- With a 50 % chance of exceedance during vibratory piling: 0.1 to 0.2 mm/s PPV for steady-state and transient conditions, respectively
- With a 5 % chance of exceedance during vibratory piling: 0.4 to 1.1 mm/s PPV for steady-state and transient conditions, respectively.

51) Human impacts: the vibration levels presented above show a prediction below the SOAEL for human response to vibration (1.0 mm/s PPV) are likely. However, a level of 1.1 mm/s PPV is predicted when considering a precautionary 5 % chance of exceedance during transient (start up and run down) modes, which marginally exceeds the SOAEL. As such, based on the prediction methods provided in BS 5228-2, there is the potential for moderate adverse impact magnitudes and moderate significant effects at Horrocks Farm during piling of the bridge foundations.

52) Structural impacts: The PPV at 100 m would be below the vibration impact criteria for buildings for potential vibration damage to (structurally sound) buildings, damage to buildings is considered to be unlikely and significant effects are not predicted.

Vibratory compaction and vibration from construction vehicles (historic barn at Lilands Farm)

53) The historic barn associated with Lilands Farm (location R5b in Figure 17.1) is located about 4 m from the route. The following range in vibration levels may be expected at a 4 m distance from vibratory compaction:

- With a 50 % chance of exceedance and assuming a low vibration amplitude setting: approximately 4.8 to 6.0 mm/s PPV for steady-state and transient conditions (16.2 to 17.6 mm/s PPV with a 5 % chance of exceedance)
- With a 5 % chance of exceedance and assuming a high vibration amplitude setting: 51.0 to 55.3 mm/s PPV for steady-state and transient conditions, respectively (15.0 to 18.7 mm/s PPV with a 50 % chance of exceedance).

54) Structural impacts (R5b): This receptor is an historic barn, and the condition of its foundations are not known. As such, as a precaution, the more stringent vibration impact criteria for building response (3 mm/s for continuous vibration) have been applied. The predicted levels of vibration during enabling works compaction are above this threshold, in all scenarios presented above. Therefore, should vibratory compaction be undertaken in the vicinity of the barn, structural damage is predicted. However, vibration control measures would be implemented (as outlined in the CCoP) to minimise vibration. For works in close proximity to the barn, these would include the potential use of non-vibratory techniques which would be expected to reduce vibration experienced at the barn, resulting in no significant effects. The location specific mitigation measures that include a minimum distance within vibratory compaction would not take place, are presented in Section 17.7.

55) The construction of the proposed Ribble Crossing would entail the use of various heavy vehicles, e.g. excavators, bulldozers, etc, which will create the potential of groundborne vibration at the closest sensitive receptors to the Proposed Ribble Crossing. A British Steel Guidance note[3] provides indicative levels of vibration from heavy vehicle movements, which indicate the following:

- Heavy lorry on a poor road surface, <1 mm/s PPV at ~2 m and ~0.3 mm/s PPV at 4 m
- Bulldozers, ~2.0 to 2.5 mm/s PPV at 4 m and ~0.8 mm/s PPV at 8 m.

56) Structural impacts: the historic barn at Lilands Farm is located at a distance of 4 m from the proposed works. Although the levels of vibration are unlikely to exceed the applicable threshold level for this

[3] British Steel 'Legislation and Practice on Noise and Vibration Control with particular relevance to Piling'

receptor of 3 mm/s for continuous vibration, it is recommended that a structural survey be undertaken prior to works commencing and a risk assessment produced. See Section 17.7 for more detail.

57) The summary of construction effects are shown in Table 17.6 below.

Table 17.6: Summary of Construction Phase Effects

Environmental / Community Asset [1) 2)]	Value / Sensitivity	Construction Activity	Effect	Duration	Magnitude	Significance of Effect
Waddington and West Bradford C of E Primary School	High (School)	Earthworks within laydown area	Airborne noise	Up to twelve weeks	Negligible/Minor	Slight
		Road Construction	Airborne noise	Up to two weeks[3)]	Major	Major Adverse
The Healings	High (Residential)	Earthworks and Road Construction	Airborne noise	Up to twelve weeks[3)]	Minor	Slight Adverse
Meadow Croft	High (Residential)	Earthworks and Road Construction	Airborne noise	Up to twelve weeks[3)]	Negligible/Minor	Slight
Lilands Cottage	High (Residential)	Earthworks and Road earthworks and drainage	Airborne noise	Up to twelve weeks[3)]	Negligible/Minor	Slight
		Road construction paving	Airborne noise	Up to two weeks[3)]	Moderate	Not significant (potential to meet *the 65 dB $L_{Aeq,T}$ SOAEL for <10 days in any 15 consecutive days*)
		Earthworks and Road Construction	Vibration – human response	Up to twelve weeks[3)]	Negligible/Minor	Slight
			Vibration – structural response	Up to twelve weeks[3)]	N/A	Not significant
Lilands Farm historic barn	Very High (special case for vibration sensitivity)	Vibratory compaction	Vibration – structural response	Up to twelve weeks[3)]	N/A	Not significant

Environmental / Community Asset [1) 2)]	Value / Sensitivity	Construction Activity	Effect	Duration	Magnitude	Significance of Effect
Horrocks Farm	High (Residential)	Earthworks within laydown areas	Airborne noise	Up to twelve weeks	Minor	Slight
		Road Construction	Airborne noise	Up to two weeks[3)]	Negligible/Minor	Slight
		Bridge works	Airborne noise	fourteen weeks	Minor	Slight
		Bridge Foundation Piling	Vibration – human response	six weeks	Moderate	Moderate
			Vibration – structural response	six weeks	N/A	Not significant
Ribble View	High (Residential)	Earthworks within laydown areas	Airborne noise	Up to twelve weeks	Minor	Slight
		Road Construction	Airborne noise	Up to two weeks[3)]	Minor	Slight
		Bridge works	Airborne noise	fourteen weeks	Minor	Slight

NOTES

Note 1) Environmental/Community Assets are noise and vibration assessment sample receptors and represent impacts and effects for one or multiple sensitive properties.

Note 2) All Environmental/Community Assets are considered to be of High sensitivity.

Note 3) The route of the bypass will be constructed at a rate of 125 m per week, and so the highest noise levels presented would occur at receptors for a maximum 2-week period, before and after which works would be occurring at 125 m or greater distances where noise impacts would be reduced.

Red shading denotes a potential major adverse effect.

17.6.5 Operational Phase

58) The operational phase assessment considers road traffic using the crossing during the construction phase of the Proposed Marl Hill Section. There would also be a security cabin at either end of the haul route entrance, which may require power on a 24-hour basis. The assessment of the operational phase therefore considers assessment of airborne noise from the following:

- Continuous operation of a generator at each end of the Proposed Ribble Crossing haul route
- The use of the haul route by construction vehicles over the six to seven years' duration of construction activities at the Proposed Marl Hill Section compounds (Bonstone and Braddup Compounds).

Power for Security Cabins

59) The continuous use of a single super-silent generator is assumed at the location of the security cabins throughout the construction programme for the above-mentioned compounds. Table 17.7 presents the calculated noise level from such a generator at each receptor within 300 m of the potential generator location.

Table 17.7: Summary Predicted Noise Level from Security Cabin Generator

Receptor	Period	Existing Sound Level (dB $L_{Aeq,T}$)			Noise Limit, SOAEL (dB $L_{Aeq,T}$)			Predicted Noise Level (dB $L_{Aeq,T}$)
		D	E	N	D	E	N	
R1. Waddington and West Bradford C of E Primary School – building 105 m from generator	Wd[1)]	46	-	-	50	-	-	32
R1b. Waddington and West Bradford C of E Primary School – school play area at front of buildings 105 m from generator	Wd[1)]	46	-	-	55[2)]		-	29
R1c. Waddington and West Bradford C of E Primary School – school field to rear of school buildings 180 m from generator	Wd[1)]	46	-	-	55[2)]		-	24
R2. The Healings 145 m from generator	Wd	46	45	42	65	55	45	29
	Sat	43	41	42	65	55	45	
	Sun	43	-	42	55	-	45	
R3. Meadow Croft 130 m from generator	Wd	46	45	42	65	55	45	30
	Sat	43	41	42	65	55	45	
	Sun	43	-	42	55	-	45	
R5. Lilands Cottage	Wd	46	45	42	65	55	45	27

Receptor	Period	Existing Sound Level (dB $L_{Aeq,T}$)			Noise Limit, SOAEL (dB $L_{Aeq,T}$)			Predicted Noise Level (dB $L_{Aeq,T}$)
		D	E	N	D	E	N	
185 m from generator	Sat	43	41	42	65	55	45	
	Sun	43	-	42	55	-	45	
R6. Horrocks Farm 130 m from generator	Wd	46	45	42	65	55	45	30
	Sat	43	41	42	65	55	45	
	Sun	43	-	42	55	-	45	
R7. 6 Ribble View 165 m from generator	Wd	46	45	42	65	55	45	28
	Sat	43	41	42	65	55	45	
	Sun	43	-	42	55	-	45	

NOTES

Note 1: Sound level presented is for weekday only as the school is not in use at weekends.

Note 2: 55 dB $L_{Aeq,T}$ noise limit, with at least one area suitable for outdoor teaching where noise levels are below 50 dB $L_{Aeq,T}$.

Existing sound level data from B13 is presented.

60) The noise levels presented in Table 17.7 for the continuous operation of a generator through the operation of the proposed Ribble Crossing are predicted to remain below the LOAEL levels for all receptors. Impacts at these locations are predicted to be negligible and significant effects are not predicted.

Construction Traffic

Airborne Noise

61) The construction vehicle access for the Proposed Ribble Crossing would be via West Bradford Road, both west and south of the Proposed Ribble Crossing route, as well as A671 Slaidburn Road to the west and B6478 Pimlico Link Road to the south.

62) An analysis of the traffic data from the spreadsheet traffic model exercise, as reported in Chapter 16: Transport Planning, has not identified any road links on the surrounding road network where the SOAEL would be exceeded and thereby result in a moderate (or greater) magnitude of change. No significant construction traffic impacts are therefore anticipated on the surrounding road network.

63) Road traffic noise levels have also been predicted for the Proposed Ribble Crossing, and the access road to the bridge works , as presented in Table 17.8.

Table 17.8: Summary Predicted Free-field Road Traffic Noise Level Proposed Ribble Crossing

Road Link	Daytime SOAEL (dB $L_{Aeq,T}$)	Predicted Free-field Road Traffic Noise (2024), dB $L_{Aeq,12hr}$
Proposed Ribble Crossing (closest receptor Lilands Cottage, 85 m)	65	46
Access to bridge working area (closest receptor Horrocks Farm, 215 m)	65	30

64) The predicted level of road traffic noise at the closest receptor to these road links are shown to fall well below the SOAEL. Therefore, no significant construction road traffic noise effects are predicted during operation or the proposed Ribble Crossing.

65) The summary of operation effects is shown in Table 17 9 below.

Table 17.9: Summary of Operational Phase Effects

Environmental / Community Asset	Value / Sensitivity	Activity	Effect	Nature of Effect	Magnitude	Significance of Effect
Waddington and West Bradford C of E Primary School	High (School)	Power for Security Cabin	Airborne noise	>six years	Negligible	Slight
		Road traffic using Ribble Crossing	Airborne noise	>six years	Negligible	Slight
Lilands Cottage (All nearby residential receptors) [1)]	High (Residential)	Power for Security Cabin	Airborne noise	>six years	Negligible	Slight
		Road traffic using Ribble Crossing	Airborne noise	>six years	Negligible	Slight

NOTES

Note 1) As the closest residential receptor to the route this is considered representative of all Environmental/Community Assets

17.6.6 **Decommissioning Phase**

66) The decommissioning phase would occur after the completion of construction and commissioning activities at each of the compounds, some six to seven years following construction of the proposed Ribble Crossing. This would entail the reverse of the main construction works, and would include the following:

- Decommissioning of the haulage route and road bridge
- Reinstatement of soils to original levels
- Reinstatement of all areas to their original agricultural use
- Reinstatement of trees and hedgerows, and other boundary features.

67) It is assumed that the impacts of decommissioning would be of a similar magnitude to the main construction phase, and the worst case significant impacts from the construction phase are therefore reproduced here.

68) The summary of decommissioning phase effects are reproduced from the construction phase effects and are shown in Table 17.10 below.

Table 17.10: Summary of Decommissioning Phase Effects

Environmental / Community Asset [1) 2)]	Value / Sensitivity	Construction Activity	Effect	Duration[3)]	Magnitude	Significance of Effect
Waddington and West Bradford C of E Primary School	High (School)	Earthworks and road Reinstatement	Airborne noise	-	Major	Major Adverse

NOTES

Note 1) Environmental/Community Assets are noise and vibration assessment sample receptors and represent impacts and effects for one or multiple sensitive properties.

Note 2) All Environmental/Community Assets are considered to be of High sensitivity.

Note 3) Potential timetable for reinstatement activities is not known at this time.

Red shading denotes a potential major adverse effect.

17.7 Essential Mitigation

69) Mitigation is most effective if delivered as embedded mitigation in the design of the Proposed Ribble Crossing.

70) Construction works would be carried out in accordance with BPM as defined in Section 72 of the Control of Pollution Act 1974[4] and in accordance with the recommendations of BS 5228 parts 1[5] and 2[6].

71) A noise and vibration monitoring and control strategy would be agreed between the construction contractor and Ribble Valley Borough Council before commencement of enabling works. This would comprise engagement and consultation with the primary school's governors and management team, and with affected residential property owners and occupiers.

72) Specific noise control measures that would be used by the contractor would comprise:

- Temporary noise hoardings/barriers installed around work sites prior to works commencing. A resulting conservative 5 dB reduction has been assumed at all locations. More substantial tall noise barriers (providing 10 dB noise reduction) would be installed between the compound and laydown area at the northern end of the route and Waddington and West Bradford C of E Primary School, to interrupt the line of sight from the school buildings to the construction activities (**NV-RC1**)
- Where practicable, works at the areas closest to the school would be programmed around school hours, and to occur during school holidays where this is practicable. It is noted that the construction of the route itself could occur from late June to late August. If practicable, construction could be programmed to occur during the school holidays. If practicable the noisiest items of plant would be programmed for use outside of school hours, particularly the road sweeper and larger excavators (**NV-RC2**)
- During the enabling works, smaller, lower noise emitting (70 dBA @ 10 m), excavators would be used to establish the site compound at the north end of the route, this has been included within the assessment presented (**NV-RC3**)
- Pneumatic hand tools would be fitted with efficient silencers (**NV-RC4**).

73) In respect of vibration impacts, potential adverse impacts have been identified at the historic barn at Lilands Farm during compaction of the route. The CCoP includes the following measure, which is applicable to Lilands Barn.

- Prior to any works commencing, structural surveys would be undertaken at Lilands Barn. A risk assessment would be undertaken by the construction contractor when appointed to the Proposed Programme of Works. The structural surveys would be undertaken by an independent structural engineer. The surveys would be used to determine whether the building is in any way structurally unsound and also inform construction working methods.

74) In order to mitigate vibration at the historic Lilands Farm barn during compaction, an alternative non-vibratory form of compaction would be used in close proximity to the barn. Volume 4 Appendix 17.4 provides graphs indicating vibration levels during compaction and indicate that at distances exceeding 21 m vibration levels would be below the applicable threshold of 3 mm/s (for worst-case transient operating conditions with 5 % change of exceedance and low vibration amplitude). As such, subject to the determination of structural surveys, it is recommended that vibratory compaction should not take place within 21 m of the historic barn.

17.8 Cumulative Effects

75) The following section provides an overview of the potential cumulative effects from different proposed developments and land allocations, in combination with the Proposed Ribble Crossing (i.e. inter-project

[4] Control of Pollution Act *op. cit.*
[5] British Standard 5228-1 *op. cit.*
[6] British Standard 5228-2 *op. cit.*

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

76) 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.

77) The over-arching cumulative effects of the Proposed Programme of Works i.e. the five proposed replacement tunnel sections in combination, are considered in Volume 2 Chapter 19: Cumulative Effects. In addition, Volume 2 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).

78) Based on professional judgement, it was concluded that there are no proposed third party developments or land allocations in local development plan documents which could give rise to likely significant cumulative effects. No cumulative assessment was therefore undertaken for Noise and Vibration in the context of the Ribble Crossing.

17.9 Conclusion

79) This chapter of the ES has assessed the potential noise and vibration impacts associated with construction and operation along the route of the Proposed Ribble Crossing. Noise and vibration impacts on residential properties, a nearby school and a historic barn during construction works at the temporary compounds/and laydown areas, and the construction of the main route and the bridge have been estimated using industry standard techniques. An assessment of the operational phase has examined construction traffic movements during use of the Proposed Ribble Crossing, and the use of generators at security facilities at each end of the route.

80) Existing levels of background noise were established with noise measurement surveys and reference to noise mapping. The assessment area is rural, with noise contributions from local activities, road traffic on local roads and natural sounds.

81) A series of different scenarios has been modelled, covering enabling works, construction of the Proposed Ribble Crossing, the movement of construction vehicles once it becomes operational, and the decommissioning of the haul route prior to returning it to pre-construction conditions. Potential significant noise impacts have been identified at the school. However, these would be mitigated through the deployment of established mitigation techniques and physical noise reduction solutions. Wherever reasonably practicable, the noisiest activities would be undertaken outside normal school hours or during the school holidays. All would be agreed with environmental health officers and the school's governors and management team well in advance of the works commencing. There is the potential for significant vibration effects at Horrocks Farm as a result of bridge foundation piling works.

82) Construction road traffic is not anticipated to result in significant effects during the operation of the Proposed Ribble Crossing.

83) No proposed developments or works have been identified in the vicinity of the Proposed Ribble Crossing, and as such no cumulative effects have been identified.

84) The CCoP includes construction mitigation measures for the management of construction airborne noise and vibration, and specific measures for the school and Lilands barn have also been identified as described above.

17.10 Glossary and Key Terms

85) Key phrases and terms used within this technical chapter relating to Noise and Vibration are defined within Appendix 1.2: Glossary and Key Terms.