

Havant Thicket Reservoir Project

Environmental Statement Volume 2 - Main Report Chapter 12 Noise and Vibration

Portsmouth Water Ltd.

21/08/20

Atkins Doc No.: HTR-ATK-ZZ-ZZ-RP-Z-0112

Atkins Revision No.: C03

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This document has 31 pages including the cover.

Document history

PW Revision	Status	Purpose description	Originated	Checked	Reviewed	Authorised	Date
C03	B1	Final	DB	CB	LJB	LJB	21/08/20
C02	B1	Updated per PW comments - Assessment added	DB	CB	LJB	LJB	10/07/20
C01	B1	First Issue - Working Draft					

Client signoff

Client	Portsmouth Water Ltd.
Project	Havant Thicket Reservoir Project
Job number	5169117
Client signature / date	

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12. Noise and Vibration

Competent expert evidence

- 12.1. This chapter of the ES Volume 2, Chapter 12 Noise and Vibration, has been prepared by the following individuals who have used their knowledge and professional judgement to undertake this assessment:
- an Acoustician (BSc (Hons) in Music Systems Engineering and a Member the Institute of Acoustics (IOA)), with 8 years' experience of environmental acoustic assessment;
 - an Associate (BEng (Hons) in Acoustics, CEng through the IOA, and is a Fellow of the IOA) with over 25 years' experience of environmental acoustic assessment;
 - a Practice Manager (BEng (Hons) in Civil and Structural Engineering, Diploma in Acoustics & Noise Control, PhD in 'Road Traffic Noise Barrier Design: Measurements and Models Concerning Multiple-Walls and Augmented Earth Mounds' and is a Member of the IOA) with over 20 years' experience in environmental acoustic assessment.

Legislative and policy framework

- 12.2. The following legislation and policies govern the assessment of noise and vibration and have been consulted in preparing this chapter, with the relevant sections summarised in Table 12-1 below.

Table 12-1 - Summary of legislation and policy

Legislation/ Regulation/ Policy	Summary of requirements
National	
National Planning Policy Framework (NPPF, 2019)	The National Planning Policy Framework (NPPF) 2019 includes statements relating to noise and the requirement to take it into account in the planning process. Section 170 indicates that the planning system should contribute to and enhance the natural and local environment: <i>'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development;'</i> Section 180 is specifically related to noise, requiring planning policy decisions to: • mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life; • identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.
Noise Policy Statement for England (2010)	Published in March 2010, the Noise Policy Statement for England (NPSE) sets out the Government's guiding principles and noise policy aims. <i>"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:</i>

Legislation/ Regulation/ Policy

Summary of requirements

- *Avoid significant adverse impacts on health and quality of life*
- *Mitigate and minimise adverse impacts on health and quality of life*
- *Where possible, contribute to the improvement of health and quality of life."*

The NPSE uses two established concepts from toxicology currently applied to noise impacts, which are as follows:

- No Observed Effect Level (NOEL) - the level below which there is no detectable effect on health and quality of life due to the noise
- Lowest Observed Adverse Effect Level (LOAEL) - the level above which adverse effects on health and quality of life can be detected

The NPSE extends these to the concept of a Significant Observed Adverse Effect Level (SOAEL):

- SOAEL - The level above which significant adverse effects on health and quality of life occur

The Government's Planning Practice Guidance (Noise PPG) 2019 on noise provides guidance on the effects of noise exposure. The Noise PPG sets out that peoples' sensitivity to noise is proportional to the level of noise they are already exposed to. The PPG sets out the context of NOEL and, as exposure increases, LOAEL and SOAEL. These are described in the PPG as follows:

LOAEL Definition

"Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life."

SOAEL Definition

"Noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area."

The NPSE notes that it is not possible to implement a single noise threshold that defines SOAEL that is applicable to all sources of noise in all situations. The application of the SOAEL threshold should be specific to the noise source being considered, taking account of different sources of exposure, receptor sensitivity and context.

The first aim of the NPSE, which is to avoid significant adverse effects on health and quality of life, states that:

Legislation/ Regulation/ Policy	Summary of requirements
	<i>“...significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development...”</i> The second aim of the NPSE, which is to mitigate and minimise adverse impacts on health and quality of life, refers to the situation where such impacts lie somewhere between LOAEL and SOAEL: <i>“...all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into account the guiding principles of sustainable development...This does not mean that such adverse effects cannot occur.”</i>
The Environmental Noise (England) Regulations 2006 (as amended)	These regulations implement the European Commission Directive 2002/49/EC, which requires strategic noise maps and noise action plans to be produced for all sources of environmental noise every five years, including that from road traffic using major roads. England's Noise Action Plans, published by Defra, have identified 'Important Areas' at which measures to address environmental noise must be investigated, and those 'Important Areas with First Priority Locations' to be investigated as a priority.
The Control of Pollution Act 1974	The Control of Pollution Act 1974 sets out the framework for the legislative control of construction noise and vibration on any given site. It also sets out the principle of 'best practicable means' (as defined in Section 72 of the Act) and how that should be applied to construction activity noise. The Act refers to approved Codes of Practice, which include BS 5228 Part 1 and Part 2, as being relevant for the purposes of determining the 'best practicable means'. Section 61 of the Act states that construction works may require consent from the relevant local authorities prior to the construction works commencing. If this is required, the relevant local authorities will need to be provided with information about the proposed construction works and how construction noise will be managed, including the use of 'best practicable means'.

Study area

Construction

- 12.3. Annex F of BS 5228 Part 1 states that:

“At distances over 300 m noise predictions have to be treated with caution, especially where a soft ground correction factor has been applied, because of the increasing importance of meteorological effects.”

- 12.4. Based on this, the assessment of construction impacts uses a study area of 300 m around construction works. Construction traffic impacts have been assessed using the same study area as for the operational traffic assessment.

Operation

- 12.5. Traffic flows have been provided by the traffic team and the roads included in the traffic model cover a large proportion of Havant. All of the traffic network identified within the traffic model provided has been assessed.
- 12.6. Following the advice in the Design Manual for Roads and Bridges LA 111 (DMRB) for changes in traffic on existing road networks, where a road is identified as having an impact of at least 1 dB $L_{A10,18h}$ in relation to the Scheme, counts of receptors within 50 m are undertaken. The study area for traffic noise assessments is a distance of 50 m from the roads considered in the traffic model.
- 12.7. This is considered appropriate for this assessment as the area is suburban and impacts would be limited to receptors adjacent to the road. Receptors further back from the road would be expected to benefit from a certain degree of screening from existing buildings.
- 12.8. Figure 13.1 Key highway links in ES Volume 3 shows the extents of the traffic model.

Assessment methodology

Standards and guidelines

- 12.9. BS 5228 provides guidance on the prediction and assessment of construction noise and vibration. Calculation of Road Traffic Noise (CRTN) and the DMRB provide guidance on the prediction and assessment of road traffic noise, used for both construction traffic and operational traffic.
- [BS 5228, \(2009\) + A1 \(2014\): Code of practice for noise and vibration control on construction and open sites Part 1: Noise](#)
- 12.10. BS 5228 Part 1 provides guidance on the prediction and assessment of construction noise. Calculation procedures are set out in Annex F of BS 5228 Part 1 for predicting the likely noise levels from specific construction activities at receptors, taking into account distance, ground absorption, screening, reflections and the percentage on-time for an activity. Annexes C and D Annex F of BS 5228 Part 1 provide generic noise data for various items of plant which can be used for undertaking predictions where no specific information is available.
- 12.11. Annex E of BS 5228 Part 1 sets out the need for a pragmatic approach to be taken when assessing the noise effects of a construction project. It goes on to describe example methods for identifying the likely significance of noise levels from construction activity based on a combination of fixed noise thresholds and noise change criteria.
- 12.12. For this assessment the significance of noise changes on human receptors has been assessed using the ABC Method described in Table E.1 of Annex F of BS 5228 Part 1, using the associated levels of significance shown in Table 12-2.
- 12.13. For this assessment it is assumed that non-residential noise sensitive buildings have the same sensitivity to noise and vibration as residential buildings.

Table 12-2 - Threshold of significant effects at dwellings

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

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

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

NOTE 3 Applied to residential receptors only.

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

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

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

D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

12.14. For the appropriate period (night, evening/weekends or day), the ambient noise level is determined and rounded to the nearest 5 dB. Table 12-2 is used to determine a threshold category which signifies the total site noise level in L_{Aeq} which should not be exceeded for the appropriate period. If the site noise level exceeds the appropriate category, then a potential significant effect is indicated, depending on the context, such as duration of works.

12.15. For there to be significant effects, noise levels must exceed, or be predicted to exceed, the relevant threshold for a period of 10 or more days of working in any 15 consecutive days, or for a total number of days exceeding 40 in any 6 consecutive months.

[BS 5228, Part 2 \(2009\) + A1 \(2014\): Code of practice for noise and vibration control on construction and open sites Part 2: Vibration](#)

12.16. BS 5228 Part 2 provides guidance on vibration levels that could be used to assess the likely impacts of construction activities, including compaction and tunnelling, on the environment and people. The main vibration impacts could arise from these activities or heavy construction vehicle movements near sensitive receivers (typically within 20 m). Annex B of BS 5228 Part 2 gives guidance on the significance of vibration effects in terms of human response to vibration (shown in Table 12-3) and structural response to vibration (shown in Table 12-4).

Table 12-3 - Guidance on effects of vibration levels

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

Table 12-4 - Transient vibration guide values for cosmetic damage

Type of building	Peak component particle velocity in frequency range of predominant pules	
	4Hz to 15Hz	15Hz and above
Reinforced or framed structures	50 mm/s at 4Hz and above	50 mm/s at 4Hz and above
Industrial and heavy commercial buildings		
Unreinforced or light framed structures	15 mm/s at 4Hz increasing to 20 mm/s at 15Hz	20 mm/s at 15Hz increasing to 50 mm/s at 40Hz and above
Residential or light commercial buildings		

Calculation of Road Traffic Noise (1988)

- 12.17. The Calculation of Road Traffic Noise (CRTN) is a technical memorandum that describes procedures for road traffic noise measurements and calculations using the $L_{A10,18\text{hour}}$ noise index. CRTN is suitable for environmental assessments of schemes where road traffic noise may have an impact.
- 12.18. Using the prediction methodology detailed in CRTN, the Basic Noise Level (BNL) can be calculated for an 18 hour period (06:00 to 00:00) at 10 m from the kerb of a road link using the following information:
- Annual Average Weekly Traffic flow (18 hour traffic flows);
 - Average traffic speed;
 - Traffic composition, namely the proportion of heavy goods vehicles comprising the traffic flow.
- 12.19. The Basic Noise Level is then corrected for road gradient, road surface, distance to the noise sensitive receptors, angle of view, reflections and the presence of screening, to arrive at a final noise level for each noise sensitive receptor of interest.

Design Manual for Roads and Bridges (DMRB)

- 12.20. Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration Revision 2 provides guidance on the environmental assessment of noise and vibration impacts from road schemes. It contains advice and information on assessing both construction and operational traffic impacts affecting sensitive receptors adjacent to road networks. It also provides guideline significance criteria for assessing noise and vibration impacts.
- 12.21. The assessment of operational noise impacts follows the DMRB approach focussing on changes in noise on the road network within the study area. The level of detail included is proportionate to the information available.
- 12.22. DMRB gives the descriptions for different changes in noise level and provides the following classifications for the magnitude of noise impacts as set out in Table 12-5:

Table 12-5 - Classification of magnitude of noise impacts from road traffic

Change, $L_{A10,18h}$	Magnitude of impact (Short Term)	Magnitude of impact (Long Term)
0	No change	No change
0.1 - 0.9	Negligible	Negligible
1 - 2.9	Minor	Negligible
3 - 4.9	Moderate	Minor
5 - 9.9	Major	Moderate
10 +	Major	Major

- 12.23. From this classification 'minor', 'moderate' and 'major' changes in noise are perceptible, whereas 'negligible' changes are not perceptible.

Significance of change in noise level

- 12.24. Changes in noise level classed as significant are based on the assessment scale from DMRB shown in Table 12-5 and expanded on in Table 12-6, to show the classification of perceptibility and significance. For this assessment, both short-term and long-term changes in noise that are 'moderate' or 'major' are regarded as significant.

Table 12-6 - Perceptibility and significance relation to impact magnitude

Magnitude of impact	Perceptibility and Significance
No change	Not perceptible and not significant
Negligible	Not perceptible and not significant
Minor	Perceptible but likely not significant
Moderate	Perceptible and likely significant
Major	Perceptible and significant

Construction noise

- 12.25. A methodology for construction noise assessment is provided by BS 5228 Part 1. This standard gives recommendations for basic methods of noise control relating to construction and open sites, and gives guidance concerning methods of predicting and measuring noise and assessing its impact. The standard also provides a database of measured noise levels from typical construction plant items - annexes C and D provide generic source noise data for various items of plant used on open sites which can be used in prediction.
- 12.26. A full list of plant and associated noise levels used in the calculations are provided in Appendix A12 in ES Volume 4.

Reservoir site

- 12.27. The construction noise assessment for the reservoir has been undertaken using NoiseMap 5 modelling software which implements the calculations as defined in BS 5228 Part 1.
- 12.28. For the main reservoir site, including the access roads, results have been calculated for sample receptors within the study area. These receptors all face towards the reservoir site and therefore represent a worst case as they do not benefit from any screening from other buildings.
- 12.29. The construction programme is split into quarters for each year, covering the following months:
- Q1 – January, February and March;
 - Q2 – April, May and June;
 - Q3 – July, August and September;
 - Q4 – October, November and December.

- 12.30. Under normal conditions, night time works are not proposed for the reservoir site. However, in some very exceptional circumstances, there is potential for night time working. Where the impacts of noise and vibration cannot be effectively mitigated, night time working will not be carried out on the reservoir site.
- 12.31. The assessment of night time impacts is therefore presented for completeness, although it is noted that these impacts are not expected under normal conditions.

Pipeline corridor

- 12.32. For the assessment of construction noise related to the pipeline corridor, noise levels have been calculated for each activity based on data within Annex C of BS 5228 Part 1 and predicted percentage on times. This noise level has then been used to determine the distance within which noise levels would be above the threshold for potential significant effects in the daytime and, where applicable, night time.
- 12.33. The installation of the pipeline uses two construction methods; trenchless and open trench. These methods have been assessed separately.
- 12.34. The pipeline corridor has been split into segments for assessment as detailed in in Table 12-7. The duration of works is based on working at a rate of 6 m per day on sections of road and 8 m per day on open land.

Table 12-7 - Pipeline assessment sections

Pipeline section	Construction method	British National Grid Co-ordinates		Duration of works (days)
		Start	End	
1	Trenchless	470575, 106407	470551, 106441	7
1	Open trench	470551, 106441	470656, 106576	32
2	Open trench	470656, 106576	470660, 106675	16
3	Open trench	470660, 106675	470745, 106815	30
4	Open trench	470745, 106815	470881, 106853	25
5	Open trench	470881, 106853	470969, 106873	15
6	Open trench	470969, 106873	471064, 106880	17
7	Open trench	471064, 106880	471194, 107096	33
8	Open trench	471194, 107096	471091, 107281	32
9	Open trench	471091, 107281	470988, 107480	32
10	Open trench	470988, 107480	470770, 107806	51
11	Open trench	470770, 107806	471146, 107967	55
12	Open trench	471146, 107967	471281, 107960	30
13	Open trench	471281, 107960	471296, 108017	10
14	Open trench	471296, 108017	471355, 108133	29
15	Open trench	471355, 108133	471443, 108177	15
16	Open trench	471443, 108177	471645, 108245	37
17	Open trench	471645, 108245	471883, 108375	45
18	Open trench	471883, 108375	471915, 108558	34
19	Open trench	471915, 108558	471795, 108655	18
20	Open trench	471795, 108655	471810, 108796	19
21	Open trench	471810, 108796	471432, 109086	61

- 12.35. The pipeline would be constructed by three gangs each working in a different area. Typically works would be undertaken during daytime hours, however there are five areas within four of the pipeline sections where night time works may be required due to the need to cross roads. These sections are listed in Table 12-8.

Table 12-8 - Pipeline night time works

Pipeline section	British National Grid Co-ordinates	
	Start	End
2	470656, 106576	470660, 106675
3	470660, 106675	470745, 106815
10	470868, 107656	470864, 107683
11	470870, 107890	470888, 107895
	470994, 107928	471013, 107934

- 12.36. The assessment of potential impacts of night time works has only been undertaken for the areas in Table 12-8.

Construction vibration

- 12.37. BS 5228 Part 2 provides guidance for assessing the impacts of any types of construction vibration at nearby properties, including methods for measuring vibration and how to assess its effects on people and the environment. The main vibration impacts are likely to arise from piling activities, compaction, or heavy vehicle construction movements near properties. BS 5228 Part 2 Annex E gives empirical formulae for the prediction of the resultant peak particle velocity (PPV) vibration levels in mm/s for various activities. The formulae found in Annex E can be used to estimate the vibration levels when detailed information about the construction method is known.
- 12.38. Based on the information available, the only construction works that have potential to cause perceptible vibration at receptors are:
- Earth Compaction – at the reservoir site;
 - Road Compaction – along the pipeline corridor;
 - Trenchless construction of some sections of the pipeline.
- 12.39. As these works are only proposed to be of short duration within close proximity to sensitive receptors, and from previous project experience, it is considered that vibration levels of up to PPV of 3 mm/s would be acceptable provided advance notice is given to residents.
- 12.40. The assessment calculates the distance within which PPV levels would have a 33.3% probability of exceeding 3.0 mm/s for each section of pipeline. The number of sensitive receptors within this distance is then reported.

Operational noise

- 12.41. As the pipeline would be underground it has been assumed that there would be no operational noise impacts from this. Equally, it has been assumed that, once complete, there would be no noise generated by the reservoir itself. On this basis operational noise from the Scheme has been scoped out from further assessment except from an assessment of changes in road traffic noise from vehicles accessing the reservoir site.
- 12.42. Assessment of noise from traffic movements during the construction and operational phases has been undertaken using flows and percentage of heavy vehicles as provided by the traffic assessment. Speeds have been derived using the road classification according to CRTN.
- 12.43. BNLs have been calculated for each road link and then comparisons between scenarios have been made to determine the noise impact. Impacts are then classified as per Table 12-5.

- 12.44. The scenarios considered are:
- 2023 Base (i.e. traffic without the Scheme);
 - Construction;
 - 2029 Base (i.e. traffic without the Scheme);
 - 2029 Operational.
- 12.45. The following comparisons between these scenarios have been made:
- 2023 Base to 2029 Base – to determine the impact of traffic growth without the Scheme;
 - 2023 Base to Construction – to determine the impact of construction traffic;
 - 2023 Base to 2029 Operational – to determine the combined impact of traffic growth and the operation of the Scheme;
 - 2029 Base to 2029 Operational – to determine the impact of the operation of the Scheme alone.
- 12.46. Impacts would be negligible where changes in noise are predicted to be below 1 dB $L_{A10,18h}$ between scenarios.

Assessment assumptions and limitations

- 12.47. A definitive plant list is not available at this stage. Therefore, a list of assumed plant has been agreed with project engineers and, where possible, appropriate plant noise levels selected from tables in BS 5228 Part 1 Annex C. Where representative plant data is not available in the standard, data from manufacturer's or research papers have been used.
- 12.48. For each period of the construction noise assessment, it is assumed that all plant would be operating simultaneously. The calculations do not include the effects of any site hoardings or acoustic screens that may be erected during the works. Based on these, this assessment can be considered as a worst case.

Baseline conditions including value/sensitivity of resources and receptors

- 12.49. Arup undertook a baseline noise survey in 2008 as part of an initial assessment for the Scheme. In the EIA Scoping Addendum (HTR-ATK-ZZ-ZZ-RP-Z-0001), Atkins had proposed undertaking further noise surveys to update the data obtained by Arup, however, due to the outbreak of COVID-19 in the UK and subsequent lockdown measures implemented, it has not been possible to undertake representative noise measurements. This is because of atypical conditions characterised by decreased traffic movements.
- 12.50. The Institute of Acoustics and Association of Noise Consultants recently published guidance¹ on determining baseline conditions during the current situation. The guidance includes recommendations on using existing noise survey data as well as Strategic Noise Mapping carried out by Defra or the devolved administrations.
- 12.51. Following this guidance, this baseline assessment is based on the existing Arup survey data and the DEFRA Strategic Noise Maps. This approach was agreed with East Hampshire District Council and Havant Borough Council in June 2020.

Existing measurement data

- 12.52. As part of the 2008 baseline noise assessment undertaken by Arup surveys were undertaken at a total of 10 locations which included 8 short term and 2 long term measurements. Short term measurements consist of 3 attended 10 minute measurements taken over contiguous hours between 10:00 and 17:00. All short term measurements were completed on 19th and 20th November 2008. Long term measurements consisted of unattended measurements, taken in continuous 15 minute intervals over a period of 15 days. All long term measurements were taken

¹ Joint Guidance on the Impact of COVID-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound & Noise Impact Assessments

between 19th November and 4th December 2008. Details of the entire survey and the full measurement data are included in the Arup document 'Baseline Noise Survey' AAc/123755/R01.

12.53. Table 12-9 summarises the levels measured during the short term survey.

Table 12-9 - Arup short term baseline noise measurements (2008) – daytime only

Measurement Location	L _{A90}		L _{A10}		L _{Amax}		L _{Aeq}	
	Range	Typical	Range	Typical	Range	Typical	Range	Typical
1	41.0 - 43.2	42.0	44.4 - 49.6	46.7	60.1 - 63.6	63.6	43.2 - 48.1	45.8
2	45.2 - 48.4	46.3	48.0 - 51.4	49.5	58.8 - 66.1	66.1	47.0 - 50.3	48.7
3	47.8 - 50.0	49.0	53.6 - 56.2	55.1	63.7 - 65.9	65.9	52.0 - 53.5	52.9
4	49.8 - 51.0	50.5	53.2 - 53.8	53.5	59.0 - 67.0	67	51.8 - 52.7	52.2
5	38.0 - 49.8	42.2	56.6 - 66.6	60.3	68.0 - 72.6	72.6	52.5 - 62.9	59.0
6	41.8 - 49.8	46.7	51.0 - 59.4	56.5	61.4 - 65.7	65.7	48.3 - 57.0	55.1
7	52.0 - 58.4	54.4	71.4 - 72.6	72.1	77.4 - 80.3	80.3	66.7 - 68.8	68.0
8	41.0 - 43.2	42.0	44.4 - 49.6	46.7	60.1 - 63.6	63.6	43.2 - 48.1	45.8

12.54. Table 12-10 summarises the levels measured during the long term survey.

Table 12-10 - Arup long term baseline noise measurements (2008)

			Location	
			9	10
Day 07:00 - 23:00	L _{Aeq}	Range	38.3 - 78.2	34.5 - 65.5
		Typical	63.6	48.3
	L _{A10}	Range	41.5 - 79.5	35.5 - 63.5
		Typical	51.5	47.4
	L _{A90}	Range	31.0 - 54.0	30.0 - 56.0
		Typical	45.0	43.6
Night 23:00 - 07:00	L _{Aeq}	Range	29.5 - 54.9	25.3 - 55.9
		Typical	43.9	43.9
	L _{A10}	Range	29.5 - 57.0	27.5 - 58.0
		Typical	42.9	41.6
	L _{A90}	Range	23.0 - 52.5	22.0 - 52.5
		Typical	34.7	35.6

DEFRA strategic noise maps for England

12.55. The Strategic Noise Maps for England were produced by DEFRA and published in 2019 as part of the Environmental Noise Directive (Directive 2002/49/EC) and the Environmental Noise (England)

Regulations 2006 (as amended) and provide a snapshot of the estimated noise from major road and rail sources across England in 2017.

- 12.56. Figure 12.2 Baseline daytime noise contours and measurement locations in ES Volume 3 shows the daytime strategic noise map and Figure 12.3 Baseline night time noise contours and measurement locations in ES Volume 3 shows the night time strategic noise map.
- 12.57. A review of these maps for the area around the reservoir site shows that the major transport noise source is the A3(M). The lower threshold for the strategic noise maps is 55 dB L_{Aeq} for daytime (07:00-23:00) and 50 dB L_{night} for night time (23:00-07:00). The maps show that noise levels from A3(M) are below these thresholds for the majority of Havant, however, the data does not include noise generated from local roads or other sources of community noise.

Review of baseline conditions

- 12.58. Reviewing the measurement positions, all locations are outside the extents of the Defra strategic mapping. However, measurements 3 and 4 are the closest to extents of the strategic noise maps. The measured levels at these locations range between 51.8 dB $L_{Aeq,T}$ and 53.5 dB $L_{Aeq,T}$. Comparing these levels to the daytime strategic noise map, and applying professional judgement, it is suggested that the noise climate in the area has not changed significantly between 2008 and 2017, and therefore the survey data can be considered to be broadly representative of current noise levels.
- 12.59. Following this, the baseline noise levels for receptors in Havant are represented by measurements 1, 2 3 and 10. Receptors in Rowland's Castle are represented by measurements 5, 6, 7 and 9. This gives conservative baseline levels for Havant as 50 dB $L_{Aeq,T}$ (daytime) and 45 dB $L_{Aeq,T}$ (night time), and in Rowland's Castle, levels of 60 dB $L_{Aeq,T}$ (daytime) and 45 dB $L_{Aeq,T}$ (night time).
- 12.60. There is a degree of uncertainty in these levels due to the age of measured baseline noise data and sources included in strategic noise mapping.
- 12.61. The main source of noise during the measurements was noted as being road traffic. Where receptors are close to infrastructure sources, the levels are likely to be broadly similar to those determined in paragraph 12.59, however, where receptors are far away from infrastructure sources, the baseline levels are likely to be lower.

Summary of baseline conditions

- 12.62. Atkins have undertaken a review of existing noise measurements and strategic noise mapping to determine the baseline noise levels at receptors near the proposed Havant Thicket Reservoir site.
- 12.63. From the data available, it is determined that the baseline levels are as follows in Table 12-11:

Table 12-11 - Baseline noise levels

Area	Baseline noise level, dB L_{Aeq}	
	Daytime	Night time
Havant	50	45
Rowland's Castle	60	45

- 12.64. For the assessment of construction noise, this means that all receptors are Category A for daytime and Category B for night time.

Potential impacts

Construction noise

Reservoir site

- 12.65. The following receptors in Table 12-12 are considered to be representative of the worst case effects from noise arising from construction activities on the main reservoir site and access roads: Figure 12.1 Sample receptor location map for reservoir site in ES Volume 3 shows the locations of these receptors.

Table 12-12 - Assessment receptors

Receptor ID	Address
A	Mulberry Cottage, 2, Manor Lodge Road, Rowland's Castle, PO9 6BA
B	The Former Rectory, 74, Manor Lodge Road, Rowland's Castle, PO9 6BA
C	1, Durrants Road, Rowland's Castle, PO9 6BE
D	50A, Durrants Road, Rowland's Castle, PO9 6BG
E	93, Winterslow Drive, Havant, PO9 5DZ
F	35, Well Meadow, Havant, PO9 4LW
G	1, Stratfield Gardens, Havant, PO9 4LS
H	2, Abbas Green, Havant, PO9 4EP
I	101, Swanmore Road, Havant, PO9 4EU

12.66. As detailed in the baseline conditions section, all receptors are considered to be in BS 5228 Part 1 Category A for daytime works and Category B for night time works.

12.67. Therefore, the threshold for potential impacts are as follows in Table 12-13, subject to the duration of works:

Table 12-13 - Thresholds of potential impacts

Assessment period	Threshold value (dB) for potential impacts	Duration of works for potential impacts
Night time	50	10 days in a 15 day period or
Daytime	65	40 days in a 6 month period

12.68. Night time works are not proposed, however there is potential for works at night very exceptional circumstances.

12.69. Construction noise levels have been calculated for each quarter year of the construction period. Table 12-14 presents the range of construction noise levels predicted at each receptor in each year of the construction period. A table showing the construction noise levels in each quarter is included in Appendix A12.3 Reservoir noise modelling results in ES Volume 4.

Table 12-14 - Calculated noise levels

Receptor	2021	2022	2023	2024	2025	2026	2027	2028	2029
Mulberry Cottage, 2, Manor Lodge Road, Rowland's Castle, PO9 6BA	46 to 50	51 to 57	53 to 54	53 to 54	53 to 54	53 to 54	-	-	-
The Former Rectory, 74, Manor Lodge Road, Rowland's Castle, PO9 6BA	45 to 47	46 to 56	59 to 60	59 to 60	59 to 60	59 to 60	-	-	-
1, Durrants Road, Rowland's Castle, PO9 6BE	44 to 47	46 to 53	55 to 56	55 to 56	55 to 56	55 to 56	-	-	-
50A, Durrants Road, Rowland's Castle, PO9 6BG	45 to 48	45 to 51	53 to 54	53 to 54	53 to 54	53 to 54	-	-	-
93, Winterslow Drive, Havant, PO9 5DZ	51 to 54	54 to 60	58 to 59	58 to 59	58 to 59	57 to 59	-	-	-
35, Well Meadow, Havant, PO9 4LW	54 to 57	54 to 61	58 to 59	58 to 59	58 to 59	58 to 59	-	-	-
1, Stratfield Gardens, Havant, PO9 4LS	49 to 53	54 to 60	58 to 59	58 to 59	58 to 59	58 to 59	-	-	-
2, Abbas Green, Havant, PO9 4EP	47 to 54	55 to 65	64 to 64	64 to 64	64 to 64	64 to 64	-	43 to 44	43 to 44
101, Swanmore Road, Havant, PO9 4EU	44 to 65	53 to 64	63 to 64	63 to 64	63 to 64	63 to 64	-	45 to 46	45 to 46

- 12.70. The predicted site noise levels for each period show that noise levels do not exceed the daytime threshold for potential significant effects. access road
- 12.71. If night time works are required, most receptors would potentially experience significant effects in at least 10 quarters over the construction period. In most locations night time works have potential to be mitigated through the installation of temporary acoustic screens to completely block line of sight (BS5228 Part 1:2009 + A1:2014) between the noise source and the receptor.

Pipeline corridor

- 12.72. There are two proposed methods of construction for the pipeline:
- Trenchless – from 470575, 106407 to 470551, 106441 (British National Grid Co-ordinates);
 - Open trench – all other areas.
- 12.73. Tables showing the assumed plant and calculations are shown in Appendix A12.4 Pipeline route construction plant list in ES Volume 4.

Trenchless

- 12.74. Calculations have been undertaken to determine the distance within which trenchless construction noise levels are predicted to be above the threshold for potential impacts. This distance is detailed in Table 12-15.

Table 12-15 - Trenchless construction - distance to potential impact threshold

Threshold	Daytime noise level (dB $L_{Aeq,T}$)	Distance (m)
Potential Impacts	65	61

- 12.75. Night time works are not proposed for this section and therefore only distances to daytime threshold have been calculated.

- 12.76. Using the distance in Table 12-15, the number of sensitive receptors within this distance has been calculated and presented in Table 12-16.

Table 12-16 - Trenchless construction – daytime impacted receptor counts

Pipeline section	Duration of works (days)	Potential impacts - residential	Potential impacts – non-residential
1	7	11	0

- 12.77. Table 12-16 shows that there are 11 residential receptors with potential to experience impacts from trenchless construction of the pipeline. Further discussion on the effects of these impacts is provided in the Assessment of effects section (paragraphs 12.133 and 12.159).

Open trench

- 12.78. Calculations have been undertaken to determine the distances within which open trench construction noise levels are predicted to be above the thresholds for potential significant effects. These distances are detailed in the Table 12-17.

Table 12-17 - Open trench construction - distance to thresholds

Threshold	Daytime noise level (dB $L_{Aeq,T}$)	Daytime distance (m)	Night time noise level (dB $L_{Aeq,T}$)	Night time distance (m)
Potential significant effects	65	55	50	220

- 12.79. Using the distances in Table 12-17, the number of sensitive receptors within each section has been calculated and presented in Table 12-18 and Table 12-19.

Table 12-18 - Open trench construction – daytime impacted receptor counts

Pipeline Section	Duration of works (days)	Potential impacts – residential	Potential impacts – non-residential
1	32	48	1
2	16	42	1
3	30	28	2
4	25	36	1
5	15	56	0
6	17	56	0
7	33	47	0
8	32	47	0
9	32	49	0
10	51	63	0
11	55	115	0
12	30	51	0
13	10	42	0
14	29	69	1
15	15	58	1
16	37	113	0
17	45	120	0
18	34	54	1
19	18	7	0
20	19	0	0
21	61	0	0

12.80. Table 12-18 shows that without mitigation there are potentially daytime impacts from the construction of sections 1 to 19 inclusive. Further discussion on the effects of these impacts is provided in the Assessment of effects section (paragraphs 12.135 to 12.139).

Table 12-19 - Open trench construction – night time impacted receptor counts

Pipeline Section	Duration of works (days)	Potential impacts – residential
2	16	236
3	30	275
10	51	344
11	55	464

12.81. Table 12-19 shows that there are also potential night time impacts. Further discussion on the effects of these impacts is provided in the Assessment of effects section (paragraphs 12.135 to 12.139).

Construction traffic

- 12.82. Assessment of the impacts from construction traffic shows that only the access roads would have a perceptible impact and there are 13 noise sensitive receptors within 50 m of these access roads.
- 12.83. Whilst there is potential for a perceptible impact from the access roads, the forecast flows on the access roads are below the threshold where noise calculations are reliable, and it is unlikely that noise from the access roads would be perceptible above traffic noise from other roads that are closer to the sensitive receptors.
- 12.84. Therefore, it is considered that impacts from construction traffic would be negligible.
- 12.85. A full table of results showing impact on all roads included in the assessment is included in Appendix A12.7 Road traffic noise assessment in ES Volume 4.

Construction vibration

- 12.86. Construction related vibration may arise from earth compaction around the main embankment of the reservoir, from road compaction along the pipeline corridor and from trenchless pipeline construction.

Reservoir site and access roads

- 12.87. Earth compaction works are proposed to take place around the main embankment of the reservoir.
- 12.88. As these works are transient and will not be taking place in close proximity to receptors for extended periods of time, it is considered that PPV levels up to 3 mm/s would be acceptable provided residents are given advance notice of the works, and the assessment has used a threshold where there is a 33.3% probability that this level may be exceeded.
- 12.89. Calculations of vibration from earth compaction have been based on manufacturer data for a Cat CB10 Tandem Vibratory Roller, with two drums of 1.7 m wide, and a nominal maximum amplitude of vibration of 1.06 mm and a minimum of 0.34 mm.
- 12.90. Based on this, there would be a 33.3% probability of exceeding 3.0 mm/s PPV at receptors within 20 m of the plant when it's operating at its maximum amplitude of vibration, or 5.5 m when it's operating at its minimum amplitude of vibration.
- 12.91. This means that from the main reservoir site, vibrations would not be significant at sensitive receptors, as no works are proposed within 20 m of these receptors.

Pipeline corridor

- 12.92. Calculations for road compaction along the pipeline corridor have been based on the same plant as used in the reservoir site Earth Compaction calculations, and therefore, potentially significant impacts are predicted within the same distances as reported in paragraphs 12.88 to 12.91.
- 12.93. Table 12-20 shows the number of sensitive receptors that would potentially be affected from road compaction during pipeline construction.

Table 12-20 - Open trench construction – vibration impacted receptor counts

Pipeline section	Duration of works (days)	Maximum amplitude of vibration		Minimum amplitude of vibration	
		Residential	Non-residential	Residential	Non-residential
1	32	8	1	0	0
2	16	22	1	1	0
3	30	7	0	0	0
4	25	12	1	0	1
5	15	29	0	0	0
6	17	25	0	0	0
7	33	12	0	0	0
8	32	1	0	0	0

Pipeline section	Duration of works (days)	Maximum amplitude of vibration		Minimum amplitude of vibration	
		Residential	Non-residential	Residential	Non-residential
9	32	5	0	0	0
10	51	0	0	0	0
11	55	39	0	0	0
12	30	16	0	0	0
13	10	19	0	0	0
14	29	29	0	0	0
15	15	23	0	0	0
16	37	50	0	0	0
17	45	57	0	0	0
18	34	24	1	0	0
19	18	2	0	0	0
20	19	0	0	0	0
21	61	0	0	0	0

- 12.94. Table 12-20 shows that there is potential for vibration impacts from most sections of the pipeline when the plant is operating at its maximum amplitude of vibration.
- 12.95. When operating at its minimum amplitude of vibration, there is only 1 residential receptor with a potential significant effect from section 2, and only 1 non-residential receptor with a potential significant effect from section 4
- 12.96. With the roller operating at its maximum amplitude of vibration, works would need to be taking place within 4.5 m of a building to give rise to a risk of vibration causing cosmetic damage. This would occur at 2 buildings.
- 12.97. With the roller operating at its minimum amplitude of vibration, works would need to be taking place within 0.4 m of a building to give rise to a risk of vibration causing cosmetic damage. There are no locations where this would happen.

Trenchless pipeline construction

- 12.98. It is proposed that a small section of the pipeline, part of section 1, is to be constructed using a trenchless method. This involves the use of horizontal auger boring machinery which may give rise to vibrations.
- 12.99. BS 5228 Part 2 provides an empirical formula for calculating PPV levels related to tunnelling activities.
- 12.100. This formula shows that PPV would not exceed 3.0 mm/s at sensitive receptors within 25 m of tunnelling works. There are no buildings within this distance of the works and therefore there are no impacts predicted.
- 12.101. Tunnelling works would need to be within 7 m of a building to give rise to a risk of causing cosmetic damage. As noted in paragraph 12.100, works from the trenchless construction are not proposed this close to any building.

Operational noise

Reservoir site and access roads

- 12.102. The assessment of operational traffic impacts looks at the following scenario comparisons:
- 2023 Base to 2029 Base – to determine the impact without the Scheme due to traffic growth;

- 2023 Base to 2029 Operational – to determine the combined impact of traffic growth and the Scheme;
- 2029 Base to 2029 Operational – to determine the impact of the Scheme alone.

12.103. A full table of results showing impact on all roads included in the assessment is included Appendix A12.7 Road traffic noise assessment in ES Volume 4.

2023 base to 2029 base

12.104. Assessment of the impact between these scenarios shows there is one road link where an impact greater than 1 dB $L_{A10,18h}$ is predicted. This road is part of the development of Dunsbury Park, north of Fitzwygram Way. There are currently no noise sensitive receptors within 50 m of this road.

2023 base to 2029 combined operational and traffic growth

- 12.105. Assessment of the impact between these scenarios shows there are three roads where an impact greater than 1 dB $L_{A10,18h}$ is predicted;
- 12.106. One road is part of the development of Dunsbury Park, north of Fitzwygram Way. This is the same road with an impact in the 2023 Base to 2029 Base comparison.
- 12.107. The other two roads with perceptible impacts are predicted are the reservoir access roads, and this is because they do not exist in the 2023 Base scenario. There are currently 13 noise sensitive receptors within 50 m of these access roads.

2023 base to 2029 operational – reservoir only

12.108. Assessment of the impact between these scenarios shows only the two access roads have the potential to give rise to a perceptible impact. There are currently 13 noise sensitive receptors within 50 m of the access roads.

Summary of operational noise impacts

- 12.109. It should be noted that the forecast flows on the access roads are 210 vehicles per day for the northern access road and 110 per day for the southern access road. These flows are below the threshold where noise calculations are reliable, and it is unlikely that noise from the access roads would be perceptible above traffic noise from other roads closer to the sensitive receptors.
- 12.110. Therefore, it is considered that noise impacts from operational traffic would be negligible.

Pipeline corridor

12.111. Operational noise impacts from the pipeline section are not expected and this has not been assessed.

Design, mitigation and enhancement measures

Community liaison

12.112. An important element of the proactive approach to limiting the potential significance of effects is to ensure that the public and residents are kept fully informed over the scale and nature of the works, when they are to take place, and who to contact if disturbed by the construction activities. To ensure good community consultation for the project, a letter drop will take place in the locality advising residents of the programmed works and when they will take place.

Best practical means

- 12.113. Throughout any construction programme, the intention should always be to minimise site noise levels whilst having due regard to the practicability and economic implication of any control or mitigation measure. Best Practicable Means will be applied during the construction works to minimise noise at neighbouring residential properties and other sensitive receptors arising from the works.
- 12.114. Best Practicable Means are defined in Section 72 of the Control of Pollution Act 1974 and Section 79 of the Environment Protection Act 1990 as those measures which are 'reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to financial implications'.

- 12.115. The potential noise effects of the construction works can be minimised by use of noise control measures, as suggested by BS 5228 Part 1. General principles for the control of noise and vibration to be employed during the construction works include:
- Only plant which complies with the relevant EU/UK noise limits applicable to that equipment or is in no way noisier than would be expected from the noise levels quoted in BS 5228: 2009+A1:2014 Part 1 will be used. This includes all vehicles and mechanical plant used for the purpose of the works being fitted with effective exhaust silencers and maintained in good and efficient working order;
 - All compressors and generators being 'sound reduced' models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools will be fitted with mufflers or suppressers of the type recommended by the manufacturers and will be kept in a good state of repair;
 - Machines in intermittent use being shut down in the intervening periods between work, or where this is impracticable, throttled down to a minimum;
 - Where practicable, plant with directional noise characteristics will be positioned so as to minimise noise at adjacent properties;
 - The works covered by this application will be planned so as to ensure that as much work as practicable (taking into account the needs to minimise disruption to trains when the pipeline crosses the rail line and ensuring the safety of the public and workforce) takes place during normal daytime working hours;
 - Ensuring that all staff and operatives are briefed on the requirement to minimise nuisance from site activities, via tool box talks etc.;
 - Regular plant maintenance; all plant and equipment being examined daily, for defects prior to the start of works and under no circumstances will defective plant be used;
 - Use of temporary noise screens or partial enclosures around particularly noisy activities, for example pneumatic breakers used in close proximity to dwellings; and
 - Avoiding any reversing on site as far as reasonably practicable – if reversing is required, utilising broadband low impact reversing alarms or banksmen.

Acoustic screening

- 12.116. The Potential impacts section (paragraphs 12.65 to 12.111) highlighted that there is potential for some significant effects if night time works are undertaken due to very exceptional circumstances. If night time works are required due to exceptional circumstances in these areas, then temporary acoustic screens will be erected to block line of sight between the plant and receptors and this will mitigate the potential noise effects in most areas.
- 12.117. Acoustic screens are unlikely to sufficiently reduce noise levels from night time earthworks activities for receptors along Swanmore Road. Therefore, such works will be avoided, as shown in Figure 12.15 Areas that night works should avoid in in ES Volume 3.
- 12.118. BS 5228 Part 1 gives the following advice about acoustic screens:

"B.4 Acoustic screens

Care is needed in the design, siting and construction of a barrier for screening purposes if it is to be effective. It should be noted also that a barrier may, by reflecting sound, simply transfer a problem from one receiving position to another. On level sites, for maximum effectiveness, a barrier should be brought as close as possible to either the noise source or the receiving positions. In addition, there should be no gaps or openings at joints in the barrier material.

In design it may be necessary for sound transmitted both through and around the barrier to be considered. However, in most practical situations the overall attenuation will be limited by transmission over and around the barrier, provided that the barrier material has a mass per unit of surface area in excess of about 7 kg/m² and there are no gaps at the joints. When equipment is to be screened for many months, sand bags can be useful as they are durable, easy to erect and easy to remove. Ordinary building materials normally stored on site (e.g. bricks, aggregate, timber or top

soil) can, if carefully sited, provide noise screening without additional cost. Plywood sheets can be fixed to a scaffold support frame and if constructed in sections provide a portable barrier.

Some sound will pass round the ends of short straight barriers. As a rough guide, the length of a barrier should be at least five times greater than its height. A shorter barrier should be bent round the noise source. The minimum height of barriers should be such that no part of the noise source will be visible from the receiving point."

- 12.119. Any temporary acoustic screens need to be fabricated out of impervious boards which have a surface mass of not less than 7 kg/m² minimum. A 15 mm plywood would meet this requirement.
- 12.120. All screens need to extend to a height such that the 'line of sight' between noise source and receiver is fully obstructed, but in any case, the height will be at least 2 m.
- 12.121. Subject to safety and access considerations, all screens will be positioned as close to the works as possible. The contractor will ensure that the screen obstructs the direct line of sight between the works and the nearest properties.
- 12.122. Subject to safety considerations, temporary screens will be mounted on wheels to facilitate onsite relocation. Any gaps between the ground and the bottom of the panel will be less than 100 mm.

Hours of working

- 12.123. The Potential impacts section (paragraphs 12.65 to 12.111) notes that there are potentially significant impacts where night time works are required. For the reservoir site, if night time working is required, these impacts will be mitigated using acoustic screens in some locations.
- 12.124. The locations where it is unlikely to be able to fully mitigate night time working impacts are at receptors along Swanmore Road, Havant. As impacts from night time works cannot be fully mitigated in this area, night time earthworks will be avoided around the south west side of the site.

Noise insulation or temporary rehousing

- 12.125. Where works are to exceed the noise level thresholds for potential impacts for extended periods of time, it may be relevant to offer noise insulation or temporary rehousing to affected residents. BS 5228 Part 1 gives example noise level thresholds and durations of works where noise insulation and rehousing may be considered, however these are example values only and alternative levels may be used. The thresholds for noise levels and durations will be determined between the appointed contractor and the local authority.
- 12.126. There is no statutory obligation to offer these, and any offer will be considered on a case by case basis.

Building surveys

- 12.127. Where works causing vibrations are to take place in close proximity to sensitive receptors it is prudent to undertake building surveys before and after works to determine if any damage to the structure is caused. A decision on whether building surveys are to be undertaken will be made by the appointed contractor in liaison with the local authority once the plan to be used has been finalised.

Assessment of effects

Construction noise

Reservoir site and access roads - daytime

- 12.128. All daytime site construction noise levels are predicted to be below the threshold for potentially significant effects and are therefore not considered to be significant.

Reservoir site and access roads – night time

- 12.129. Night time works are not routinely expected during the construction of the reservoir, however they may be required in very exceptional circumstances.

- 12.130. If night works are required, then there is potential for site noise levels to be above the threshold for potential impacts at all sample receptors, depending on the activities taking place.
- 12.131. For receptors in Rowland's Castle, these impacts will be mitigated by installing acoustic screens that would block line of sight between the noise source and receptors.
- 12.132. For receptors in Havant, temporary acoustic screens will be used to mitigate potentially significant night time impact in most locations. Impacts from night time earthworks at receptors along Swanmore Road would not be sufficiently mitigated by screens and earthwork activities around the south west of the reservoir will be avoided, as shown in Figure 12.15 Areas that night works should avoid in ES Volume 3.

Pipeline corridor

Trenchless

- 12.133. The assessment of trenchless construction of the pipeline for part of section 1 shows that there is potential for significant daytime impacts at up to 11 residential receptors.
- 12.134. Given the short duration of works, it is likely that impacts can be mitigated through good communication with residents both prior to and during the works and not undertaking works at night unless absolutely necessary. Therefore, it is not considered that noise effects from trenchless pipeline construction are significant.

Open trench

- 12.135. The assessment of open trench construction of the pipeline shows that there is potential for significant daytime impacts from sections 1 to 19 inclusive and from all four sections where night time works are proposed.
- 12.136. The assessment calculations assume all plant is operating simultaneously at the closest point to the receptor. In reality this is unlikely to happen and therefore noise levels would be lower than those predicted.
- 12.137. The assessment also does not account for any screening that may benefit receptors that do not front onto the works. Therefore, the actual numbers of receptors affected is are likely to be lower than those reported in this assessment.
- 12.138. All sections of open trench construction are programmed to last at least 10 days, with 4 sections lasting longer than 40 days. However, the works would not be taking place in close proximity to all receptors for the whole of the durations stated and therefore it is unlikely that noise levels at receptors would exceed the relevant thresholds for extended periods of time.
- 12.139. Through good communication with residents and employment of Best Practicable Means it is likely that impacts can be minimised and therefore noise effects from open trench pipeline construction is not considered to be significant.

Construction Traffic

- 12.140. The Potential impacts section (paragraphs 12.65 to 12.111) highlights that the only roads with perceptible impacts from construction traffic are the two new reservoir access roads.
- 12.141. Whilst there is potential for a perceptible impact from the access roads, the forecast flows on the access roads are below the threshold where noise calculations are reliable, and it is unlikely that noise from the access roads would be perceptible above traffic noise from other roads closer to the sensitive receptors.
- 12.142. Impacts from all other roads due to construction traffic are predicted to be less than 1 dB $L_{A10,18h}$.
- 12.143. Therefore, it is considered that noise effects from construction traffic would be negligible.

Summary

- 12.144. For daytime construction works the conservative assessment shows that there is potential for significant effects from the open trench construction of the pipeline, although these will be minimised through communication and the use of Best Practical Means. Construction activities at the main reservoir site, access roads, trenchless pipeline and construction traffic would not be significant.

- 12.145. Certain activities would be avoided during the night. If night time works are required on the reservoir site due to very exceptional circumstances, then potentially significant impacts will be avoided with temporary acoustic screens. For night time open trench construction works, potentially significant impacts will be minimised through communication and the use of Best Practical Means. Where the impacts of noise and vibration cannot be effectively mitigated, night time working will not be carried out.

Construction vibration

Reservoir site

- 12.146. The Potential impacts section (paragraphs 12.65 to 12.111) shows that during earth compaction activities in the reservoir site there would be a 33.3% probability of exceeding 3.0 mm/s PPV at receptors within 20 m of the earth compaction plant when it's operating at its maximum amplitude of vibration, or at receptors within 6 m when it is operating at its minimum amplitude of vibration.
- 12.147. This means that from the main reservoir site, vibrations would not be significant at sensitive receptors as no works would be within 20 m of them.

Pipeline corridor

Trenchless pipeline construction

- 12.148. The potential impacts section (paragraphs 12.65 to 12.111) shows that there are no predicted impacts from vibration related to the section of pipeline to be constructed using trenchless methods. Therefore, there are no significant vibration effects in this area.

Open trench

- 12.149. For the open trench construction of the pipeline, there is potential for significant vibration effects in most sections when the road compaction plant is operating at its maximum amplitude of vibration. However, when it is operating at its minimum amplitude there are only 2 receptors that may be affected These are:
- 1, North Street, Havant, PO9 3HD (section 2)
 - St Johns Ambulance Headquarters, Fraser Road, Havant, PO9 3EJ (section 4)
- 12.150. It should be noted that impacts at these receptors would be short term and through good communication with residents and employment of Best Practicable Means it is likely that impacts can be minimised and therefore not considered to be significant.
- 12.151. These same receptors have potential for cosmetic damage when the plant is operating at its maximum amplitude of vibration. Therefore, care will be taken around these receptors to ensure levels of vibration are kept to a minimum for the shortest duration possible in order to minimise impacts. If plant operates above its minimum amplitude of vibration, then vibration levels at these receptors would be significant and it is appropriate to consider building condition surveys for these closest buildings prior to the start of works.
- 12.152. It should be noted that the vibrating plant is expected to be used at the end of the construction of each segment of pipeline to compact the resurfaced road. Therefore, it would only be active for short periods of time.
- 12.153. Figure 12.19 Open trench pipeline construction - potential significant vibration effects on buildings in ES Volume 3 shows the area within which significant effects on buildings is predicted.

Summary

- 12.154. Vibration effects are not expected from construction activities on the reservoir site or from trenchless construction. There is potential for vibration effects from road compaction works along the open trench sections of pipeline, potentially significant at two receptors.

Reservoir site

- 12.155. The Potential impacts section (paragraphs 12.65 to 12.111) highlights that the only roads with perceptible impacts from operational traffic are the two new reservoir access roads and one other road which is part of the development of Dunsbury Park, north of Fitzwygram Way.
- 12.156. The Dunsbury Park road has an impact both with and without the reservoir development and therefore the change is not considered to be an effect related to the reservoir Scheme.
- 12.157. Whilst there is potential for a perceptible impact from the access roads, the forecast flows on the access roads are below the threshold where noise calculations reliable and it is unlikely that noise from the access roads would be perceptible above traffic noise from other roads closer to the sensitive receptors. Impacts from all other roads are predicted to be less than 1 dB $L_{A10,18h}$. Therefore, it is considered that effects from operational traffic would be negligible.

Pipeline corridor

- 12.158. Operational noise impacts from the pipeline section are not expected and this has not been assessed.

Summary

- 12.159. Noise effects from the operation of the reservoir and pipeline are expected to be negligible.

Cumulative effects

Construction noise

- 12.160. There are 3 noise sensitive development areas within the Havant Local Plan that have potential to be impacted by construction noise. These consist of two areas potentially affected by the reservoir construction and one by the pipeline construction.

Reservoir site

- 12.161. The development areas potentially impacted are Site Reference 6 and 8 (Appendix A18 Population and Human Health in ES Volume 4).
- 12.162. Site 6 is a residential development and is immediately west of the southern access road, approximately 30 m from the nearest works.
- 12.163. Site 8 is a mixed use development, including some residential, and is along St Clares Avenue, approximately 300 m from the nearest works.
- 12.164. Figures 12.4 to 12.14 inclusive in ES Volume 3 show that noise levels at Site 8 would not exceed the threshold for potentially significant effects. Therefore, there would be no significant effects at this development location.
- 12.165. Figures 12.4 to 12.14 inclusive in ES Volume 3 show that noise levels may exceed the threshold for potentially significant effects during the construction of access roads and embankment works at Site 6. Therefore, there is potential for a significant effect at this development site that may require mitigation measures to be implemented should these areas of the development be occupied before the completion of the reservoir construction.

Pipeline corridor

- 12.166. Site reference 9 (Appendix A18 Population and Human Health in ES Volume 4) is a residential development and is within the area where there is potential for noise impacts during daytime and night time works.
- 12.167. As noted in the Assessment of effects section (paragraphs 12.128 to 12.159), it is likely that impacts can be minimised through good communication with residents and employment of Best Practicable Means (as required in the REAC as part of the OEMP in Appendix A2.1 in ES Volume 4) and therefore, effects are not considered to be significant.

Construction vibration

- 12.168. Cumulative effects would only occur at properties closer than 20m to vibration producing construction activities. Cumulative construction vibration effects would not be expected for the reservoir site and access roads.
- 12.169. For the pipeline corridor, should cumulative effects be expected, they will be mitigated using the same approach as detailed in paragraphs 12.112 to 12.127. With mitigation measures in place, it is unlikely effects would be significant.

Operation

Reservoir site

- 12.170. Traffic associated with committed developments (e.g. new users on the road network due to a housing development) is included within the Base Traffic Model. The Operational Traffic Model includes the Base Model with the operational traffic flows on top of this. Therefore, the assessment of future traffic has incorporated the effects predicted to result from all committed development.
- 12.171. The assessment of operational traffic indicated that the only roads with impacts directly related to the operation of the reservoir are the two new access roads.
- 12.172. Site reference 6 (Appendix A18 Population and Human Health in ES Volume 4) is immediately adjacent to the southern access road and is allocated for 116 residential units. There is potential for an impact from the access road on this development, however, the A3(M) is approximately 600 m to the west of the site and is likely to be the dominant noise source in the area. Therefore, it is unlikely that noise from the access road would be distinguishable above noise from the A3(M) and other roads in the area, and so it is not considered that the access road would cause a significant effect at this development.

Pipeline corridor

- 12.173. Operational noise impacts from the pipeline section are not expected and therefore cumulative effects would not occur.

Monitoring

- 12.174. Although this assessment has shown that impacts from typical construction activities would not cause significant effects, given the duration of the construction period, targeted noise monitoring will be undertaken by the appointed contractor to ensure that noise levels do not regularly exceed the threshold for significant impacts.
- 12.175. Where works causing vibration are proposed in close proximity to sensitive receptors, vibration levels will be monitored by the appointed contractor to ensure they do not exceed acceptable levels. Acceptable levels will be agreed between the appointed contractor and the local authority and it will be determined if building condition surveys for those buildings closest to the works is appropriate.

Summary

Construction noise

Reservoir site

- 12.176. Noise levels from the reservoir including the access road construction are not predicted to exceed the threshold for potential impacts during the majority of the construction period. Where levels exceed the thresholds, they can be mitigated through good communication with residents and employment of Best Practical Means.
- 12.177. Night time works are not routinely expected throughout the construction of the reservoir but may be required in very exceptional circumstances.
- 12.178. If night time works are required, then there is potential impacts at some sensitive receptors. For receptors in Rowland's Castle and most of Havant, night-time impacts will be mitigated through the use of temporary acoustic screens.

- 12.179. For receptors along Swanmore Road, it may not be possible to completely mitigate night time impacts from earthworks activities and such activities will be avoided around the south west of the reservoir.

Pipeline corridor

- 12.180. There is potential for significant effects from open trench construction along the pipeline corridor.
- 12.181. The worst case assessment has been presented. No correction has been made for screening which may benefit receptors that are not adjacent to the works. Therefore, the actual number of receptors with potential impacts is likely to be lower than those shown in this report.
- 12.182. Due to the rate of progression of pipeline construction, receptors are only likely to be impacted for short periods of time. The effects of noise are not expected to be significant from open trench or trenchless methods.

Construction traffic

- 12.183. The majority of roads would experience a negligible change in noise from construction traffic and are therefore impacts are not considered to be significant.
- 12.184. There are impacts predicted from the two the new reservoir access roads. Whilst there are receptors within 50 m of these new roads, given the low forecast flows, it is unlikely that noise from the access roads would be distinguishable above traffic on existing roads. Therefore, the impacts from the access roads are not considered to be significant.

Construction vibration

Reservoir site

- 12.185. With plant operating at its maximum amplitude of vibration there is potential for significant impacts at receptors within 20 m.
- 12.186. As no vibration inducing works on the reservoir site are proposed within 20 m of receptors, there are no significant effects from vibration.

Pipeline corridor

Trenchless construction

No significant vibration impacts from trenchless construction are predicted. Open trench construction

- 12.187. If the vibration inducing plant is operating at its maximum amplitude of vibration, then there is potential for significant effects from most open trench pipeline sections.
- 12.188. If the plant is operating at its minimum amplitude however, then there are 2 receptors where there is potential for significant effects; there would be a risk of cosmetic damage to these 2 receptors.
- 12.189. The plant used in this assessment is indicative only and further assessment will be undertaken once a contractor is on board and a definitive plant list is available. In any event, care will be taken to minimise the use of vibration inducing equipment when working close to receptors.

Operational noise

Reservoir site

- 12.190. The majority of roads would experience a negligible change in noise due to operational traffic and are therefore not considered to be significant.
- 12.191. There are impacts predicted from the two new reservoir access roads. Whilst there are receptors within 50 m of these new roads, given the low forecast flows, it is unlikely that noise from the access roads would be distinguishable above traffic on existing roads. Therefore, the impacts from the access roads are not considered to be significant.

Pipeline corridor

- 12.192. Operational noise impacts from the pipeline section are not expected.

Overall summary

- 12.193. Construction of the reservoir would not result in significant impacts unless works are required at night. If night time works are required potentially significant works would be limited to those which can be mitigated with temporary acoustic screens. There is potential for significant effects from the open trench construction of the pipeline which will be minimised through communication and the use of Best Practical Means.
- 12.194. Noise effects from the operation of the reservoir and pipeline are expected to be negligible.



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