

Havant Thicket Reservoir Project

Environmental Statement Volume 2: Main Report Chapter 16 Effect on Climate

Portsmouth Water Ltd.

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16. Effects on Climate

Competent expert evidence

- 16.1. For this chapter of the ES Volume 2, Chapter 16 Effects on Climate, the assessment has been carried out by the following individuals who have used their knowledge and professional judgement to undertake this assessment:
- an Environmental Consultant (BE Environment, ME Environmental Management), with five years' experience in carrying out greenhouse gas assessments for infrastructure projects and other development types.
 - an Environmental Consultant (BSc (Hons) Geography, with a specialism in Climate Science), with six years' experience in carrying out greenhouse gas assessments for infrastructure projects and other development types.
 - a Senior Sustainability Consultant (BEng Civil, MSc Environmental Change and Management, Chartered Environmentalist), with seven years' experience in carrying out greenhouse gas and sustainability performance assessments for infrastructure projects and building services.

Legislative and policy framework

- 16.2. Human activities contribute to the emission of greenhouse gases such as carbon dioxide (CO₂) to the atmosphere, primarily by the combustion of fossil fuels. Greenhouse gases trap heat in the atmosphere, with higher concentrations leading to increased global temperatures. Atmospheric CO₂ concentrations now exceed 400 parts per million for the first time in around 3 million years¹, and increased emissions have led to global average surface temperatures of 1°C higher than pre-industrial levels. There is a global consensus that emissions must be reduced dramatically. Relevant international, national and local policies are cited in Table 16-1.

Table 16-1 - Legislation, regulatory and policy framework for effects on climate

Legislation/Regulation/Policy	Summary of requirements
International	
Kyoto Protocol (1997)	The first international agreement to mandate greenhouse gas emission reductions was the Kyoto Protocol. Under the United Nations Framework Convention on Climate Change (UNFCCC) treaty, industrialised nations pledged to cut their annual emissions by 5% on a 1990 baseline by 2012. Although the target was met successfully, it was insufficient to offset the increase in emissions from industrialising countries. Total global emissions continued to grow over the period, by 40% between 1990 and 2009.
Paris Agreement (2015)	Strengthened negotiations at COP 21 led to the 2015 Paris Agreement, the aim of which is to maintain the increase in global average temperature at 'well below' 2°C and 'pursue efforts' to limit the temperature increase even further to 1.5°C. At COP 21, 160 parties, including the UK, made voluntary pledges to reduce emissions by 2030, however the cumulative effect of these would still lead to an estimated 3°C of warming or greater.
The Special Report on Global Warming of 1.5°C, International Panel on Climate Change (IPCC) (2018)	The IPCC published a special report in response to the Paris Agreement, to present the impacts of the targeted 1.5°C temperature rise. The report highlighted that to achieve this, global emissions must decrease by 45% by 2030 (against a 1990 baseline), and that net zero global emissions (where emissions and removals from the atmosphere are balanced) must be achieved by 2050. This is noted to require rapid and far-reaching transitions of every sector on an unprecedented scale.

¹ [Atmospheric CO₂ concentrations in 2020](#)

Legislation/Regulation/Policy	Summary of requirements
National	
UK Climate Change Act (2008)	To support international efforts, the UK Climate Change Act set a legal reduction target of 80% against 1990 levels by 2050. It also introduced a series of carbon 'budgets' for five-year periods, to act as stepping-stones to the overall reduction. There are budgets currently set up to 2032. In response to the ambitions of the Paris Agreement, in June 2019 the Climate Change Act was amended to set the overall reduction target by 2050 to at least a 100% reduction in net emissions against 1990 levels, i.e. 'net zero carbon'. The UK has so far outperformed its budgets, but progress is slowing, and the country is not on track to meet its future budgets or the overall reduction target, according to the most Recent Progress to Parliament by the Committee on Climate Change².
Local	
Havant Borough Core Strategy (2011)	The Havant Borough Core Strategy provides a 'Vision for Havant Borough in 2026', which includes a reduction in CO₂ emissions. Both Hampshire County Council and East Hampshire District Council declared a Climate Emergency in 2019^{3,4}, agreeing to match the Government's target of net zero carbon by 2050.

Study area

- 16.3. The boundaries of the study have been set to incorporate direct and supply chain emissions for both construction and operational phases of the Scheme. The study area is not limited to the geographic extent of the Scheme itself as shown in the Figure 2.1 Site location⁵, as many emissions will result from upstream and off-site activities such as materials production.
- 16.4. The following elements have been considered:
- the embankments;
 - the wetland retaining structure and islands;
 - the control house and other structures;
 - the access roads; and
 - the pipeline (assessed separately).
- 16.5. The visitor centre and education hide elements of the Scheme have been assessed using industry standard data due to lack of specific design detail at this stage.
- 16.6. For each of the elements above, the assessment considers the following life cycle stages and source categories, selected with reference to PAS 2080:2016 'Carbon Management in Infrastructure':
- construction emissions including from:
 - raw material extraction, manufacturing and intra-manufacturing transport;
 - transport of materials and workforce to the works site;

² [Recent Progress to Parliament by the Committee on Climate Change](#)

³ <https://www.hants.gov.uk/news/June17climatechangecabinetrls>

⁴ <https://www.easthants.gov.uk/news/climate-champion-chosen>

⁵ Figure 2.1 Site location in ES Volume 3: [HTR-ATK-ZZ-ZZ-GS-Z-0143.pdf](#); Figure 1.1 Scheme Setting in ES Volume 3 : [HTR-ATK-ZZ-ZZ-GS-Z-0142.pdf](#)

- construction processes including fuel, energy and water use, and waste transportation and treatment;
 - operational emissions including from:
 - energy and water used to operate pumps and visitor facilities;
 - transport and treatment / disposal of operational wastes; and
 - general maintenance, and periodic replacement / refurbishment of assets during operation.
- 16.7. Use of the access road during operation, by site workers and visitors, has been assessed to not present a likely source of significant effect in Chapter 7 Air Quality in ES Volume 2. It has therefore also been excluded from the effects on climate assessment.
- 16.8. Impacts on land use, land use change and forestry⁶ have also been excluded from the assessment, on the basis that any effects are likely to be negligible in comparison with overall emissions.

Assessment methodology

Approach to the assessment

- 16.9. It is not possible to meaningfully link individual project emissions with indirect effects on global climate (for example temperature increase) in a quantitative manner. The assessment of the effects of the Scheme on climate is therefore limited to quantification of the magnitude of greenhouse gas (GHG) emissions and comparison of these to the baseline. This is best-practice and the approach set out in IEMA's 'Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance'⁷.
- 16.10. The methodology used to calculate emissions has been developed with reference to PAS 2080:2016 'Carbon Management in Infrastructure'. Whilst there are a number of GHGs with a range of different Global Warming Potentials (GWPs), all emissions are presented as their carbon dioxide equivalent (CO₂e).

Data Collection

- 16.11. Data for the assessment has been collected directly from the design and environmental assessment teams. The material quantities have been provided in paragraph 16.49.

Calculations

- 16.12. Emission calculations are carried out by multiplying activity data by an emission factor associated with the activity being measured. 'Activity data' is a quantitative measure of an activity that results in emissions for a defined range of an activity or activities (for example: kilograms of materials produced, kilometres driven, kilowatt hours (kWh) of electricity consumed, or tonnes of waste sent to landfill). An 'emission factor' is a measure of the mass of emissions relative to a unit of activity.
- 16.13. Calculations have been undertaken in the Carbon Knowledgebase (CKB)⁸. The CKB is a web-based tool that allows calculation and assessment of carbon footprints of any infrastructure project using a central database of verified carbon factors. The CKB was developed in-house by Atkins specifically for carbon calculation in infrastructure projects. The CKB has been used successfully on a range of infrastructure and other projects, including Nationally Significant Infrastructure Projects (NSIPs) such as Thames Tideway Tunnel. The tool contains a detailed library of calculation formulae and over 1,000 emissions factors from authoritative sources such as the Inventory of Carbon and Energy (ICE, versions 1.6(a) and 2.0), the DEFRA Greenhouse Gas Reporting Conversion Factors, and the EMEP/ CORINAIR Emission Inventory Guidebook.

Comparison to UK Carbon Budgets

- 16.14. The UK has in place carbon budgets for five-year periods up to 2032⁹. The UK is currently in the third carbon budgetary period (2018-2022), the budget for which is 2,544 MtCO₂e. The UK cannot legally emit more greenhouse gases than this within the budgetary period. The carbon budget for

⁶ LULUCF - land use, land use change and forestry

⁷ [IEMA Assessing Significance Guidance](#)

⁸ <https://carbonknowledgebase.com/>

⁹ <https://www.gov.uk/guidance/carbon-budgets>

the 2023–2027 budgetary period is 1,950 MtCO₂e, and the budget for 2028-2032 is 1,725 MtCO₂e. Whilst budgets are not set beyond this, there is a legal requirement for the UK to reach 0 MtCO₂e by 2050.

- 16.15. The results of emissions calculations are presented in terms of their percentage contribution to the relevant national carbon budget period.

Significance assessment

- 16.16. There is no accepted technical or policy guidance for determining a level of significance of the effect of emissions on climate from a development. There is also no legal limit for emissions for any one development, although there is global consensus that atmospheric warming should be kept to below 1.5 – 2.0°C and the UK Government has set national carbon budgets to 2032 and an overall target for 2050.
- 16.17. The emission of GHGs is certain to lead to a long-term negative impact (global warming) on a highly sensitive and internationally significant receptor (the atmosphere) no matter the location of the emission source. The effect is currently irreversible without significant technological development, and will continue after the lifespan of the Scheme. These considerations apply to all emissions, generated from any source, in any location.
- 16.18. The level of significance of the impact (i.e. whether it is minor or moderate) is therefore based solely upon the magnitude of emissions generated¹⁰.

Assessment assumptions and limitations

Materials Data

- 16.19. Material quantities per component were provided by the design team, based on current design details in paragraph 16.49.
- 16.20. It is not presently known where materials will be sourced from, or how they will be transported. However, to give an idea of the order of magnitude of emissions from the transport of materials, estimations have been made based on the following high-level assumptions:
- materials will be transported by diesel-fuelled heavy goods vehicles (HGV); and
 - materials will be sourced regionally, from a representative transport distance of 50 km.
- 16.21. The 'empty' return journey is also accounted for, by calculating emissions for 100 km at 50% load.

Construction Data

- 16.22. A key limitation of the study is that estimates of diesel, electricity and water consumption to enable onsite construction processes are not available at the current design stage. The main source of construction process emissions will be the excavation, movement and laying of site-won materials such as clay and topsoil. Emissions associated with these activities are captured within the 'production of materials' aspect of the infrastructure lifecycle. No further construction data (for example, diesel to be used for the pouring of concrete for the control house and culvert) are available, which will lead to an underestimation in emissions for the construction phase of the Scheme.
- 16.23. Only wastes reported to be taken offsite have been included in the assessment. The reported average transport distances for different waste types have been doubled to account for a return journey. Where average transport distances have not been provided, 50 km has been assumed, based on advice from waste and material experts assuming the proximity principle. The 'empty' return journey is also accounted for, as described for materials transport.

Carbon factors

- 16.24. The following material carbon factors were used in the assessment.

¹⁰ [IEMA Assessing Significance Guidance](#)

Table 16-2 - Material carbon factors

Material / component	Carbon factor	Carbon factor source
Clay	0.024 kgCO ₂ e/kg	Bath ICE (2.0)
Topsoil	0.024 kgCO ₂ e/kg	Bath ICE (2.0)
Sand	0.00493 kgCO ₂ e/kg	Bath ICE (3.0)
Gravel	0.0052 kgCO ₂ e/kg	Bath ICE (2.0)
Limestone	0.09 kgCO ₂ e/kg	Bath ICE (2.0)
Polypropylene	2 kgCO ₂ e/kg	Plastics Europe EPD 2008
Concrete	0.103 kgCO ₂ e/kg	Bath ICE (3.0)
Asphalt	14.2 kgCO ₂ e/m ²	Bath ICE (3.0)
Ductile iron	2.03 kgCO ₂ e/kg	Bath ICE (2.0)

- 16.25. For transport of materials, the carbon factor for 'Road Freight: Articulated HGV. Unknown size. 50% Load', sourced from the 2018 Defra Carbon Factors, has been used to translate emissions from estimated tonne-kilometres. For waste transport, the factor for 'Freight – HGV – Rigid (>3.5-7.5t) – 40% Laden – Diesel' has been used.

Baseline conditions

- 16.26. There is a single receptor of interest: the atmosphere. It is of high importance, is global in scale, and there is no potential for substitution or replacement, hence it is a receptor of very high sensitivity.
- 16.27. Global greenhouse gas emissions, from all sources, amounted to 33 billion tonnes of CO₂e in 2019¹¹. The UK is one of the world's largest emitters of greenhouse gases, with emissions for 2018 (the latest reported year) being 451 million tonnes of CO₂e¹².
- 16.28. In 2017 (the latest reported year), emissions for Havant Borough were 437.5 ktCO₂¹³, reduced 33% against a 2005 baseline for the Borough¹⁴. Emissions for East Hampshire over the same period reduced from 890.8 ktCO₂ to 647.3 ktCO₂.
- 16.29. The project baseline is defined as the Do-Minimum scenario, which is continued operation of the existing infrastructure, without the Scheme. The only activity currently undertaken onsite is management of Havant Thicket and Bells Copse by Forestry England. This is likely to continue through construction and operation with no impact from the Scheme, therefore this activity is considered to be outside the Scheme boundary. Excluding this, it is assumed that there are no emissions from the current site and that the baseline is therefore 0 tonnes CO₂ emitted per year.
- 16.30. It is noted, however not considered further, that were the Scheme not to occur it is likely that a different scheme would need to be developed, which may have a greater or lesser effect on climate.

Potential impacts

- 16.31. The earth absorbs energy from the sun and re-emits it as thermal infrared radiation. Greenhouse gases such as CO₂ in the atmosphere absorb this radiation, preventing it from escaping into space. The higher the concentration of greenhouse gases, the more heat is retained, and the higher global temperatures become. Due to human activities, the concentration of greenhouse gases in the atmosphere has increased dramatically, leading to global warming.
- 16.32. The Scheme has the potential to affect climate by causing emissions of GHGs into the atmosphere during its construction and throughout its operational life.

¹¹ <https://www.iea.org/articles/global-co2-emissions-in-2019>

¹² <https://www.gov.uk/government/collections/uk-greenhouse-gas-emissions-statistics>

¹³ kt CO₂ = Kilo tonnes of carbon dioxide

¹⁴ <https://www.gov.uk/government/collections/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics>

Design, mitigation and enhancement measures

- 16.33. Reduction of greenhouse gas emissions was a core part of the design, featuring in two of the Design Principles agreed to inform development of the Scheme:
- 1) Optimise opportunities for a sustainable design where practical to include:
 - improving energy efficiency in base design, consider decentralised low carbon energy sources to achieve an overall improvement in operational energy efficiency;
 - improving climate resilience of the reservoir, ensuring management of reservoir flows, considering whole life sustainability impacts; and
 - minimising material quantities as much as possible and select alternative low carbon materials in design wherever possible.
 - 2) Support the UK's Net Zero Carbon target by minimising where practical greenhouse gas emissions at all stages of the infrastructure lifecycle, and maximising opportunities for greenhouse gas removals through sequestration by vegetation and renewable energy generation.
- 16.34. Design enhancement measures which have contributed to a reduced carbon footprint are described in paragraphs 16.35 to 16.47.

Embankments

- 16.35. Materials for the embankment will be sourced onsite as far as possible, and where this is not possible local materials will be used. Offsite disposal of materials found onsite will be avoided as far as possible, except for material exported for sale.
- 16.36. The overall volume of material required has been reduced by achieving the target reservoir storage in a lean manner, with a 'soft engineering' approach which integrates the embankment into the natural landscape as opposed to traditional carbon-intensive hard engineering approaches. The saving on fill material volume achieved with the embankment realignment was in the order of 260,000 m³, with the length of the embankment shortened by 226 m which meant a material carbon saving of the order of 11,987 tCO₂e (~9.12% reduction).
- 16.37. The use of 3D modelling platforms has allowed precise cut/fill balances and material requirements to be established, which will reduce wastage rates in construction.
- 16.38. Several design changes have been made which will reduce material requirements, including cutting the embankment tie-in at the north-east end. Steepening the upstream slope has also brought carbon benefits, reducing the length of the embankment culvert and pipelines, increasing the space for topsoil storage onsite, and decreasing the construction time of the earthworks which has the effect of reducing diesel consumption in construction.

Wetland retaining structure and islands

- 16.39. Materials to be used in construction will be sourced from site as far as practically possible to limit the requirement for material imports. The design and indicative location of seasonally inundated islands (within the retained wetland area) and ephemeral shallows and raised areas have been developed with a target of achieving a neutral cut and fill balance. Existing intermittent stream inflows and high points in topography will be utilised to both inform the alignment and compartmentalisation of the retained wetland – thus reducing required material for construction and improving sustainability in the long-term.
- 16.40. The design of the wetland and associated spillways has been carried out using an interface of several 3D modelling platforms, as described in paragraph 16.37.
- 16.41. Passive control of levels using spillways along the retention structure and within the retained wetland compartments provides a way to maintain and manage the wetland with low operational input.

Control house and ancillary structures

- 16.42. Operational efficiency (minimising the electricity usage) of the reservoir mixing system will be achieved by provision of water temperature and potentially dissolved oxygen concentration monitoring at various depths within the reservoir, to allow the mixing system to be run when signs of stratification are detected (expected to be during the thermal stratification high-risk period from spring to early autumn).

Visitor centre, educational hide and public realm

- 16.43. The design team for the visitor centre building has recommended that the building should aim for a minimum target of BREEAM 'Very Good'.
- 16.44. The Carbon Knowledgebase has been used to undertake an options assessment for the roof material and establish the most sustainable structure. A living roof has been proposed, to reduce net carbon emissions through sequestration.
- 16.45. The whole community will be able to access this new facility and the amenity resources it provides through sustainable, active travel, on foot, by bike, or through existing bus routes. The reservoir offers further opportunities to improve the public right of way (PROW) networks in the wider area. More than 29,500 people live within walking distance of the site (1.5 km) and 120,000 people live within cycling distance of the site (4.5 km).

Bedhampton to Havant pipeline

- 16.46. Considerable improvement in Scheme's carbon footprint has been achieved by optimising the size of pipeline sections to red through challenging the reservoir's peak drawdown flow, and distribution of drawdown flows between the pipeline and emergency discharge point at the reservoir; achieving a reduction of 75m³.
- 16.47. The use of selected as-dug¹⁵ materials will be adopted wherever possible in the construction of the pipeline to minimise the quantities of imported pipeline bedding material.

Assessment of effects

- 16.48. This section presents the results of the carbon assessment of the construction and operation of the design elements described in paragraph 16.4.

Construction

Embankments

- 16.49. Emissions associated with the production of materials for construction of the embankments are shown in Table 16-3. The key material and source of emissions is clay.

Table 16-3 - Production of embankment materials

Material	Quantity (tonnes)	CO ₂ e (tonnes)
Clay	4,466,678	107,202
Topsoil	74,752	1,794
Sand	183,058	902
Gravel	168,937	878
Limestone	87,128	7,841
Polypropylene	416	832
Total		119,449

- 16.50. Some of the material volume will be sourced onsite and have no associated transport emissions. A total of 4,796,521 tonnes of material will be transported onto site, the majority of which will be from local sources, generating emissions of 46,413 tCO₂e.
- 16.51. The main source of construction process emissions is the excavation, movement and laying of site-won materials. Emissions associated with these activities are captured within the production of materials in Table 16-3. There will be no need to remove any excavated materials including topsoil from site. All the surplus topsoil will be used to line the upper slopes of the borrowpits and the disturbed ground between the borrow pits and the wetland retaining structure, and will be seeded to

¹⁵ Selected as-dug material refers to on-site excavated material which is suitable for use without processing.

allow grass to grow to reduce visual impact of the disturbed ground in the interim years before the reservoir is filled.

16.52. **Construction of the embankments will generate a total of 165,861 tCO₂e.**

Wetland retaining structure and islands

16.53. Emissions associated with the production of materials for construction of the wetland retaining structures and islands are presented in Table 16-4. As with the embankments, use of clay is the key source of emissions.

Table 16-4 - Production of wetland materials

Material	Quantity (tonnes)	CO ₂ e (tonnes)
Clay	131,670	3,160
Topsoil	12,266	294
Limestone	4,264	384
Polypropylene	22	45
Total		3,883

16.54. Clay and topsoil will be sourced onsite and therefore generate no emissions in transport. Transport of the limestone and polypropylene geotextile will lead to approximately 42 tCO₂e.

16.55. The main source of construction process emissions is the excavation, movement and laying of site-won materials. Emissions associated with these activities are captured within the production of materials in Table 16-4. There will be no key source of waste from the construction; there is a net import of materials.

16.56. **Construction of the wetland retaining structure and islands will generate a total of 3,925 tCO₂e.**

Control house and structures

16.57. Emissions associated with the production of concrete and ductile iron for the construction of the controls house, culvert and other structures and pipework are presented in Table 16-5.

Table 16-5 - Production of control house materials

Component	Material	Quantity (tonnes)	CO ₂ e (tonnes)
Culvert under embankment (for 1:7 slope)	Concrete	18,878	1,944
Valve access shaft	Concrete	600	62
Control House (Option 3)	Concrete	1,318	136
Spillway	Concrete	126	13
Pipes	Ductile iron	117	238
Total			2,393

16.58. Transport of the total quantity of concrete and iron for the structures and pipes will generate 205 tCO₂e. No information on diesel consumption for construction processes is available at this project stage.

16.59. **Construction of the various structures and pipes within the reservoir boundary will generate a total of 2,598 tCO₂e.**

Access roads

- 16.60. Emissions associated with the production of materials for construction of the two access roads and car park are presented in Table 16-6.

Table 16-6 - Production of access road materials

Component	Material	Quantity (tonnes)	CO ₂ e (tonnes)
North access	Aggregate	7,289	38
	Asphalt	1,157	60
South access	Aggregate	4,817	25
	Asphalt	2,624	88
Car park	Aggregate	3,874	20
	Asphalt	1,210	40
Total			271

- 16.61. Transport of the above materials to site will generate 204 tCO₂e.
- 16.62. **Construction of the two access roads and car park will generate a total of 475 tCO₂e.**

Visitor centre and educational hide

- 16.63. Due to the outline nature of the design, there is insufficient information available to carry out a detailed carbon calculation for the construction of the visitor centre and educational hide. It is known that the maximum building zone will be 35 x 55 metres in the case of the visitor centre, 9 x 17 metres for the hide, and that both will be single storey. This gives a maximum building footprint of 1,653 square metres, although the internal building area is likely to be smaller than this.
- 16.64. There are ambitions to apply the LETI Climate Emergency Design Guide¹⁶ to reduce whole-life emissions. The guide notes that a 'business as usual' non-residential building built to current Building Regulations has embodied emissions of 1 tCO₂e per square metre of floor area. **This gives a theoretical 'worst case' construction emission level of around 1,650 tCO₂e.**

Operation

- 16.65. There is no design data available to calculate the operational and maintenance emissions associated with the Scheme except for the regulated energy use and estimate water consumption in the Visitor Centre. To provide an estimate, published data for other reservoir projects has been reviewed. The Environment Agency's 2008 Science Report SC070010 'Greenhouse gas emissions of water supply and demand management options'¹⁷ examines the difference in greenhouse gas emissions associated with different water supply project types, and provides a summary of the construction and operational carbon emissions for historic projects.
- 16.66. Whole life carbon emissions for reservoir schemes were found to be 80% capital (construction) carbon and 20% operational carbon over a 60-year design life. With estimated capital carbon emissions of 173,436 tCO₂e, whole-life operational emissions can be estimated as 42,984 tCO₂e for the reservoir, the equivalent of around 716 tCO₂e per year.
- 16.67. It is noted in the report that the results for reservoirs are 'so widespread...it is difficult to define a standard scheme'. There cannot be high confidence in the operational emissions estimate, therefore, and it should be taken as an indicative order of magnitude.
- 16.68. The operational energy and water consumption for the visitor centre is calculated for a design life of 60 years. The visitor centre design includes solar panels installed on part of the roof (80 m² area) which reduce the energy required from the grid.

¹⁶ [LETI Climate Emergency Design Guide](#)

¹⁷ [Science Report SC070010](#)

Reservoir site

- 16.69. Total emissions for the construction and operation of the reservoir are shown in Table 16-7. The largest single source of emissions is the construction of the embankment due to the large quantity of material which must be excavated and moved.
- 16.70. It should be noted that emissions are likely to be underestimated due to lack of construction process information during this assessment.

Table 16-7 - Reservoir greenhouse gas emissions

Design element	Greenhouse gas emissions (tCO ₂ e)		
	Construction	Operation	Total
Embankments	165,861	42,984	214,920
Wetland retaining structure and islands	3,925		
Control house and associated ancillaries	2,598		
Access roads	475		
Visitor centre and educational hide	1,500	6,238	7,738
Reservoir total	172,987	49,222	222,209

Pipeline

- 16.71. Emissions associated with the production of materials for construction of the pipeline are presented in Table 16-8. The pipeline itself is assumed to have no operational emissions.

Table 16-8 - Production of pipeline materials

Component	Material	Quantity (tonnes)	CO ₂ e (tonnes)
Backfill	Aggregate	76,667	399
Wearing course and asphalt	Asphalt	1,310	100
Sub-base	Cement bound aggregate	1,843	264
Topsoil	Soil	1,249	30
Pipe	Ductile iron	1,132	2,297
Total			3,089 ¹⁸

- 16.72. Transport of the materials to site will generate 800 tCO₂e. There will be a total of 7,698 tonnes surplus excavated material. Transport and recycling of this material will generate 83 tCO₂e.
- 16.73. Construction of the pipeline will generate a total of 3,972 tCO₂e.

¹⁸ Individual component totals do not sum to the total due to rounding in the carbon model.

Significance assessment

- 16.74. The contribution of the Scheme to the UK's overall carbon budgets are presented in percentage terms in Table 16-9.

Table 16-9 - Contribution of the Scheme to the UK's carbon budgets

Budgetary period	National carbon budget	Scheme stage	Reservoir emissions (% of budget)	Pipeline emissions (% of budget)
2018-2022	2,544 MtCO ₂ e	Construction	0.038 MtCO ₂ e (0.0015%)	0.0007 MtCO ₂ e (0.000026%)
2023-2027	1,950 MtCO ₂ e	Construction	0.096 MtCO ₂ e (0.0049%)	0.0017 MtCO ₂ e (0.000088%)
2028-2032	1,725 MtCO ₂ e	Construction and Operation	0.0042 MtCO ₂ e (0.0024%)	0.0007 MtCO ₂ e (0.00004%)

Reservoir site

- 16.75. The largest source of emissions will be the construction of the Scheme. Construction activities will take place between 2021 and 2029, sitting across the third, fourth and fifth carbon budget periods (2018-2022, 2023-2027 and 2028-2032 respectively). Assuming construction emissions are spread evenly across the construction period, giving annual construction emissions of approximately 19,564 tCO₂e, the construction of the Scheme would contribute 0.0015% of the third, 0.0049% of the fourth and 0.0022% of the fifth carbon budget. The Scheme will be operational for four years during the fifth carbon budgetary period. Operation during this five-year period would contribute 0.0002% of the UK budget.
- 16.76. There are no UK carbon budgets set beyond 2032, however there is a legal requirement for the UK to reach 0 MtCO₂e by 2050, an ambition which is echoed by both Hampshire County Council and East Hampshire District Council. This is within the operational life of the Scheme, and steps should be taken to achieve net zero carbon operation of the reservoir and ancillaries by this deadline. Considering the scale of operational emissions, it is considered that this is achievable by Portsmouth Water.
- 16.77. Whilst the emission of greenhouses gases from the Scheme will lead to a long-term negative effect (global warming) on a highly sensitive international receptor (the atmosphere), the magnitude of emissions is considered to be minor. The Scheme is deemed to be **unlikely to cause significant effects on climate, or significantly affect the UK's ability to meet its emissions reduction targets**.

Pipeline

- 16.78. The largest source of emissions will be the construction of the Scheme. Construction activities are assumed to take place between 2021 and 2029, sitting across the third, fourth and fifth carbon budget periods (2018-2022, 2023-2027 and 2028-2032 respectively). Assuming construction emissions are spread evenly across the construction period, the construction of the Scheme would contribute 0.000026% of the third, 0.000088% of the fourth and 0.00004% of the fifth carbon budget. The Scheme is deemed to be **unlikely to cause significant effects on climate, or significantly affect the UK's ability to meet its emissions reduction targets**.

Monitoring

- 16.79. It is recommended that throughout construction, a carbon model is maintained and updated which calculates actual emissions. As far as possible, decisions should be made to further reduce embodied carbon.
- 16.80. It is recommended that Operational emissions should be recorded by Portsmouth Water on an ongoing basis. This will help to identify further reductions in line with the net zero carbon by 2050 target.

Summary

- 16.81. Greenhouse gas emissions for the construction and operation of the Scheme have been calculated, based on current design and construction information, and have been considered in the context of the UK's national carbon budgets and overall net zero carbon ambition.
- 16.82. The reservoir will contribute 0.0015% of the third, 0.0049% of the fourth and 0.0024% of the fifth carbon budget. It is considered achievable for the reservoir operation to become carbon neutral by 2050. The pipeline will contribute 0.000026% of the third, 0.000088% of the fourth and 0.00004% of the fifth carbon budget.
- 16.83. Due to its small contribution to overall national emissions and the potential for carbon neutral operation by 2050, the Scheme is deemed unlikely to cause significant effects on climate, or significantly affect the UK's ability to meet its emissions reduction targets.

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