

Havant Thicket Reservoir Project

Environmental Statement Volume 2 - Main Report **Revised** Chapter 16 Effect on Climate

Portsmouth Water Ltd.

14/05/24

Atkins Doc No.: HTR-ATK-ZZ-ZZ-RP-Z-0116

Atkins Revision No.: C05

Notice

This document and its contents have been prepared and are intended as planning information for Portsmouth Water Limited and use in relation to the Havant Thicket Reservoir.

AtkinsRéalis (formerly known as SNC-Lavalin) assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 18 pages including the cover.

Document history

PW Revision	Status	Purpose description	Originated	Checked	Reviewed	Authorised	Date
C05	A1	Revised ES Submission	DG	LR	AR	JF	14/05/24
C04	B1	Final	FC	CB	LJB	LJB	07/09/20
C03	B1	Final	RD	DD	FC	LJB	21/08/20
C02	B1	Updated per Portsmouth Water comments & Assessment	FC	CB	LJB	LJB	25/06/20

Client signoff

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

Contents

Chapter	Page
16. Effects on Climate	4
Introduction	4
Competent expert evidence	4
Legislative and policy framework	4
Study area	6
Assessment methodology	7
Baseline conditions	9
Potential impacts	9
Design, mitigation and enhancement measures	10
Assessment of effects	11
Monitoring	17
Summary	17

Tables

Table 16-1 - Legislation, regulatory and policy framework for effects on climate	5
Table 16-2 - Material carbon factors	9
Table 16-3 - Production of embankment materials	11
Table 16-4 - Production of wetland materials	12
Table 16-5 - Production of control house materials	12
Table 16-6 - Production of access road materials	13
Table 16-7 - Quantity of materials used in construction stage	13
Table 16-8 – Production of pipeline materials	14
Table 16-9 - Reservoir greenhouse gas emissions	15
Table 16-10 - Construction stage emissions for pipeline	15
Table 16-11 - Contribution of the Scheme to the UK's carbon budgets	16

16. Effects on Climate

Introduction

- 16.1. This chapter is a revision to the original Havant Thicket Reservoir Environmental Statement (ES) which accompanied the Havant Thicket Reservoir hybrid planning application and outline planning application for the associated pipeline, between the reservoir and Bedhampton springs and pumping station, approved on 15th October 2021 (Approved Scheme).
- 16.2. A new pipeline route and design have been identified, which needs a new planning approval. A new full planning application has been prepared for this new pipeline scheme supported by this revision to the original ES (2020 ES).
- 16.3. To make it easier for the reader, this chapter still includes the effects on climate assessment of the reservoir but also includes the new or updated baseline, impact assessment and mitigation for the pipeline. The changes from the original ES Chapter are shown in green text.
- 16.4. Chapters 1 to 6 provide more information on the context for this revised ES, the revised scheme description, the need for the scheme (which hasn't changed) and the alternatives, the methodology and the consultation undertaken.

Changes to the Approved Scheme

- 16.5. Following planning permission in 2021, further design work and extensive ground investigations have been undertaken which has resulted in changes to the reservoir scheme including a reduction in the reservoir embankment slope angle and relocation of the valve tower from inside the main embankment into the reservoir. The height of the embankment crest level would not change from the 2020 ES, but the position of the embankment crest would move up to 100m to the north.
- 16.6. An application to amend the reservoir scheme was submitted in April 2024 under Section 73 (S73) of the Planning Act 1990. An ES Addendum was prepared to support the S73 application to present an assessment of any new or different significant effects that could result from these changes. The ES Addendum has been considered within this Revised ES and also forms part of the Revised ES submitted alongside the new pipeline application.
- 16.7. The ES Addendum Effects of Climate relating to these changes has been reviewed and the findings are incorporated within this revised chapter.

Competent expert evidence

- 16.8. 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 (BSc (Hons) Environmental Science, Chartered Environmentalist), with four years' experience in carrying out greenhouse gas assessments for infrastructure projects and other development types;
 - 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; and
 - 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

- 16.9. 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.
National	
UK Climate Change Act (2008), as amended 2019	To support international efforts, the UK Climate Change Act set a legal reduction target of 100% 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 2037. 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. Also, the country now has a solid Net Zero strategy in place but important policy gaps remain, according to the most recent report 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 CO ₂ emissions. Both Hampshire County Council and East Hampshire District Council declared a Climate Emergency in 2019, agreeing to match the Government's target of net zero carbon by 2050

¹ [Atmospheric CO2 concentrations in 2020](#)

² [2022 Progress Report to Parliament - Climate Change Committee \(theccc.org.uk\)](#)

Legislation/Regulation/Policy	Summary of requirements
Havant Borough Council – Climate Change and Environment Strategy 2021-2026 ³	A five-year plan that provides a clear statement for the Council's climate change and environmental objectives and priorities. One of the key objectives is 'to reduce carbon emissions in line with the Climate Change Act 2008 to net zero carbon by 2050 for all Council services, whether they are delivered by us, or through a partnership. To use the authority's mandate as Planning authority for sustainable development. To influence and support our residents and enterprises in every sector to reduce carbon emissions to net zero by 2050'.
Hampshire County Council Climate Change strategy 2020 - 2025 ⁴	Hampshire County Council have set the target of being carbon neutral by 2050, prioritising Scope 1 and 2 emissions and then focusing on Scope 3 from 2025 onwards

Study area

- 16.10. 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.
- 16.11. 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).
- 16.12. 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.
- 16.13. For each of the elements above, the assessment considers the following life cycle stages and source categories, selected with reference to PAS 2080:2023 'Carbon Management in Buildings & Infrastructure':
- Construction emissions including from:
 - Raw material extraction, manufacturing and intra-manufacturing transport;
 - Transport of materials and workforce to the works site;
 - 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.
- 16.14. 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.
- 16.15. 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.

³<https://cdn.havant.gov.uk/public/documents/Havant%20Borough%20Council%20Climate%20Change%20and%20Environment%20Strategy%202021-2026.pdf>

⁴ [Hampshire-Climate-Change-strategy-2020-2025.pdf \(hants.gov.uk\)](#)

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](#)

⁶ LULUCF - land use, land use change and forestry

Assessment methodology

Approach to the assessment

- 16.16. 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 the following guidance:

- IEMA's 'Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance'⁷; and
- PAS 2080:2023 'Carbon Management in Buildings & 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

- 16.17. Data for the assessment has been collected directly from the design and environmental assessment teams.

Calculations

- 16.18. 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.
- 16.19. Calculations have been undertaken in the Carbon Knowledgebase (CKB)⁸. The CKB is a web-based tool that allows the 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), 2.0 and 3.0), the DEFRA Greenhouse Gas Reporting Conversion Factors, and the EMEP/ CORINAIR Emission Inventory Guidebook.

Comparison to UK carbon budgets

- 16.20. The UK has in place carbon budgets for five-year periods up to 2037⁹. The UK is currently in the fourth carbon budgetary period (2023-2027), the budget for which is 1,950 MtCO₂e. The UK cannot legally emit more greenhouse gases than this within the budgetary period. The carbon budget for the fifth budget for 2028-2032 is 1,725 MtCO₂e and the carbon budget for the sixth budget (2033 – 2037) is 965 MtCO₂e. Whilst budgets are not set beyond this, there is a legal requirement for the UK to reach 0 MtCO₂e by 2050.
- 16.21. The results of emissions calculations are presented in terms of their percentage contribution to the UK Government carbon budget period.

Significance assessment

- 16.22. The method of assessment of whether the calculated emissions from the Project will have a significant effect on climate has been determined in accordance with IEMA's 2022 guidance. There is no legal limit for emissions for any one development, given that emissions from all projects will contribute to climate change. The guidance suggests that the level of significance should be related to how a project contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050, as stated in section 6.2: "The crux of

⁷ <https://www.iema.net/preview-document/assessing-greenhouse-gas-emissions-and-evaluating-their-significance>

⁸ <https://carbonknowledgebase.com/>

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

significance...is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050.”

16.23. The IEMA 2022 guidance document notes that practitioners need to consider whether project emissions are aligned to achieving net zero by 2050, using the science-based 1.5°C trajectory. Where this is not the case, then the effects are judged to be moderate adverse or major adverse, and thus can be classed as a significant effect. Projects that are compatible with the trajectory can have their effects classed as minor adverse, or where the project achieves emissions mitigation that goes beyond the trajectory, negligible. In both cases, the effects are not considered to be significant. Projects that cause GHG emissions to be avoided or removed from the atmosphere can be considered to have a beneficial effect, which is significant. The IEMA 2022 guidance notes that the 2050 target and interim carbon budgets are considered by the Climate Change Committee to be compatible with the required trajectory.

16.24. The percentage contribution of the Project to the national carbon budget has been determined in accordance with IEMA guidance on significance. Although the IEMA guidance suggests that for context, it would be good practice to consider the Project's emissions in relation to sector-based targets, there are currently no sector budgets for the water sector or any other sector, provided by the Climate Change Committee, the body responsible for developing the UK and devolved administrations' carbon budgets.

Materials data

16.25. Material quantities per component were provided by the design team, based on current design details in paragraph 16.56.

16.26. 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 (this is line with the RICS (2023) guidance¹⁰).

16.27. The 'empty' return journey is also accounted for, by calculating emissions for 100 km at 50% load.

Construction data

16.28. 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.

16.29. 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.

16.30. For the updated pipeline assessment, construction activity data has been provided by the Principal Contractor. It includes the number and type of construction plant used on site and their duration. This has been used to calculate the emissions associated with the use of construction plant for the pipeline.

Carbon factors

16.31. The following material carbon factors were used in the assessment.

¹⁰ [Whole Life Carbon Assessment for the Built Environment \(rics.org\)](https://www.rics.org/whole-life-carbon-assessment/)

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)
Steel – rebar	1.99 kgCO ₂ e/kg	Bath ICE (3.0)
Stone – crushed	0.079 kgCO ₂ e/kg	Bath ICE (2.0)
Portland Cement	0.912 kgCO ₂ e/kg	Bath ICE (3.0)

- 16.32. For the 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

- 16.33. 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.
- 16.34. The UK's emissions for 2022 (the latest reported year) were 406.2 million tonnes of CO₂e¹¹.
- 16.35. In 2021 (the latest reported year), emissions for Havant Borough were 400.8 ktCO₂e¹², a reduction of 46% against a 2005 baseline for the Borough¹³. Emissions for East Hampshire over the same period reduced from 977.0 ktCO₂e to 596.5 ktCO₂e.
- 16.36. The project baseline is defined as the Do-Minimum scenario, which is continued operation of the existing infrastructure, without the Scheme. Currently there is no existing infrastructure onsite, hence, it is assumed that there are no emissions from the current site and that the baseline is therefore 0 tCO₂e emitted per year.
- 16.37. 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

- 16.38. 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.
- 16.39. 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://assets.publishing.service.gov.uk/media/65c0cf2e70428200137521cd/2022-final-emissions-statistics-one-page-summary.pdf>

¹² kt CO₂ = Kilo tonnes of carbon dioxide

¹³ <https://www.gov.uk/government/collections/uk-local-authority-and-regional-greenhouse-gas-emissions-national-statistics>

Design, mitigation and enhancement measures

- 16.40. 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.
- 16.41. Design enhancement measures which have contributed to a reduced carbon footprint are described in paragraphs 16.42 to 16.54.

Embankments

- 16.42. 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.
- 16.43. 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 tCO_{2e} (~9.12% reduction).
- 16.44. 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.
- 16.45. 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

- 16.46. 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.
- 16.47. The design of the wetland and associated spillways has been carried out using an interface of several 3D modelling platforms, as described in paragraph 16.44.
- 16.48. 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

- 16.49. 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

- 16.50. The design team for the visitor centre building has recommended that the building should aim for a minimum target of BREEAM 'Very Good'.
- 16.51. 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.
- 16.52. 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

- 16.53. Considerable improvement in the Scheme's carbon footprint has been achieved by implementing the carbon reduction hierarchy in the design process. This has led to several carbon saving design changes including:
- Changing the location of the Emergency Discharge chamber to reduce the amount of 1200mm diameter pipework required;
 - Reduction in number of bends to reduce hydraulic losses during operations; and
 - Reduction in the numbers of washouts and air valves required by reducing the number of high and low spots in the pipe's alignment.
- 16.54. The use of selected as-dug¹⁴ materials will be adopted **where reasonably practical** in the construction of the pipeline to minimise the quantities of imported pipeline bedding material.

Assessment of effects

- 16.55. This section presents the results of the carbon assessment of the construction and operation of the design elements described in paragraph 16.11.

Construction

Embankments

- 16.56. 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

- 16.57. 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.

¹⁴ Selected as-dug material refers to on-site excavated material which is suitable for use without processing.

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

- 16.59. Construction of the embankments will generate a total of 165,861 tCO₂e.

Wetland retaining structure and islands

- 16.60. 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

- 16.61. 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.

- 16.62. 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.

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

Control house and structures

- 16.64. 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

- 16.65. 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.

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

Access roads

- 16.67. 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

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

Visitor centre and educational hide

- 16.70. 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.
- 16.71. There are ambitions to apply the LETI Climate Emergency Design Guide¹⁵ 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.**

Pipeline

- 16.72. The quantities of materials associated with the construction stage of the pipeline are presented in Table 16-7.

Table 16-7 - Quantity of materials used in construction stage

Material	Quantity (m ³)
Concrete	10,942
Steel rebar	127
Iron	454
Grout	750
Excavated material waste	27,291
Other waste	235
Aggregate	15,639
Total	55,438

¹⁵ [LETI Climate Emergency Design Guide](#)

16.73. Emissions associated with the construction stage of the pipeline are presented in Table 16-8.

Table 16-8 – Production of pipeline materials

Component	Material type	Embodied emissions (tCO ₂ e)
Shafts	Materials	1,883
Pipes	Materials	10,815
Haul Roads	Materials	68
Work Compounds	Materials	79
Reservoir components	Materials	1,563
Excavated material	Waste	40
Total		14,448

16.74. Transport of the above materials to site and waste from site will generate 1,071 tCO₂e.

16.75. The construction plant and equipment required to construct the scheme will generate 11,635 tCO₂e.

Operation

Reservoir site

16.76. 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'¹⁶ 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.

16.77. 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.

16.78. 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.

16.79. 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.

Pipeline

16.80. Due to the nature of the Pipeline, it is assumed that there will be no operational energy or material requirements. The Pipeline has been designed to operate for over 60 years and therefore there are no planned maintenance activities. These activities will therefore take place on an ad-hoc basis and therefore it is not possible to determine the carbon emissions that will be emitted as a result of the Pipeline.

16.81. It is assumed that there are no operational emissions for the Pipeline Scheme.

Reservoir site

16.82. Total emissions for the construction and operation of the reservoir are shown in Table 16-9. 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 [Science Report SC070010](#)

- 16.83. It should be noted that emissions are likely to be underestimated due to lack of construction process information during this assessment.

Table 16-9 - 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

- 16.84. Emissions associated with the production of materials for construction of the pipeline are presented in Table 16-10. The pipeline itself is assumed to have no operational emissions. The Pipeline will emit 27,154 tCO₂e from the construction phase of the Scheme. The majority of emissions will come from the materials required to construct the pipeline, accounting for approximately 53% of total emissions.

Table 16-10 - Construction stage emissions for pipeline

Component	Material type	Embodied emissions (tCO ₂ e)	Transportation emissions (tCO ₂ e)	Total Emissions (tCO ₂ e)
Shafts	Materials	1,883	152	2,035
Pipes	Materials	10,815	219	11,034
Haul Roads	Materials	68	115	183
Work Compounds	Materials	79	134	213
Reservoir components	Materials	1,563	100	1,663
Excavated material	Waste	40	350	390
Construction plant and activities	Diesel	11,635	n/a	11,635
Total		26,083	1,071	27,154

Note: Rounding may cause totals to not completely add up.

Comparison to original pipeline scheme

- 16.85. The original EIA (2020) calculated the emissions for the construction phase of the original pipeline scheme to be 3,972 tCO₂e.
- 16.86. This assessment of the revised pipeline scheme has calculated the whole life carbon assessment to be 27,154 tCO₂e, a large increase on the previous assessment. The primary reason for this increase is due to the dualling of the pipeline as well as the increase in the length of the pipe extending into the reservoir. These changes have led to an increase in quantity of materials

consumed and construction processes required to build the scheme. It should also be noted that some of the increase can be accounted for by the original scheme's assessment being a much higher-level assessment with limited design data available. This led to only the key bulk materials being modelled and no construction plant emissions being included. As noted in Table 16-10, construction plant account for 11,635 tCO₂e for the current design option, more than the entire emissions for the original scheme.

- 16.87. Due to the limited scope of the original assessment, a fair comparison cannot be drawn between the two assessments. However, mitigation has been included within the revised design that has reduced the carbon emissions. This is detailed in paragraph 16.53.

Significance assessment

- 16.88. The contribution of the Scheme to the UK's overall carbon budgets are presented in percentage terms in Table 16-11 below.

Table 16-11 - 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)
2023-2027	1,950 MtCO ₂ e	Construction	0.096 MtCO ₂ e (0.0049%)	0.027 MtCO ₂ e (0.0014%)
2028-2032	1,725 MtCO ₂ e	Construction and Operation	0.0042 MtCO ₂ e (0.0024%)	0.001 MtCO ₂ e (0.00005%)
2033-2037	965 MtCO ₂ e	Operation	Not assessed in this update	0 MtCO ₂ e (0%)

Reservoir site

- 16.89. 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 0.0024% 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.
- 16.90. There are no UK carbon budgets set beyond 2037, 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.
- 16.91. Whilst the emission of greenhouse 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

- 16.92. The largest source of emissions will be the construction of the Scheme. Construction activities are assumed to take place between 2024 and 2028, within the fourth and fifth carbon budgets period (2023-2027 and 2028-2032 respectively). Data for the activities taking place in each year of the scheme was provided by the design team. The construction of the Scheme would contribute 0.0014% to the fourth carbon budget. The Scheme would contribute 0.00005% to the fifth carbon budget. The Scheme would contribute 0% to the sixth carbon budget.
- 16.93. Due to the scale of emissions, it is determined that the pipeline will not impact the UK Government's ability to meet its fourth carbon budgets.

- 16.94. As the UK Government Carbon Budgets align with the 1.5°C trajectory set out in the IEMA guidance, the pipeline is deemed **unlikely to cause significant effects on climate, or significantly affect the UK's ability to meet its emissions reduction targets.**

Monitoring

- 16.95. 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.
- 16.96. 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

- 16.97. 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.
- 16.98. 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 **0.0014%** of the **fourth** carbon budget **and 0.00005% to the fifth carbon budget.**
- 16.99. The ES Addendum Effect on Climate has been reviewed, it confirms that the increase in GHG emissions from proposed changes to the Scheme is not deemed material, as the changes are anticipated to make a small contribution to overall national emissions. As such, the conclusion of the 2020 ES, that the scheme is deemed unlikely to cause a significant effect on climate change, remains unchanged.

AtkinsRéalis
The Hub
500 Park Avenue
Aztec West
Bristol
BS32 4RZ

© AtkinsRéalis except where stated otherwise