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# **SCOPING OPINION:**

## **Proposed SDC M40 Campus**

**Case Reference: EN0110030**

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Adopted by the Planning Inspectorate (on behalf of the Secretary of State)  
pursuant to Regulation 10 of The Infrastructure Planning (Environmental  
Impact Assessment) Regulations 2017

**09 June 2026**

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## 1. INTRODUCTION

1.0.1 On 29 April 2026, the Planning Inspectorate (the Inspectorate) received an application for a Scoping Opinion from Slough Holdings UK Limited (the applicant) under regulation 10 of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (The EIA Regulations) for the proposed SDC M40 Campus (the proposed development). The applicant notified the Secretary of State (SoS) under regulation 8(1)(b) of those regulations that they propose to provide an Environmental Statement (ES) in respect of the proposed development and by virtue of regulation 6(2)(a), the proposed development is 'EIA development'.

1.0.2 The applicant provided the necessary information to inform a request under EIA regulation 10(3) in the form of a Scoping Report, available from:

[EN0110030-000007-EN0110030\\_SDC M40 Campus EIA Scoping Report.pdf](#)

1.0.3 This document is the Scoping Opinion (the Opinion) adopted by the Inspectorate on behalf of the SoS. This Opinion is made on the basis of the information provided in the Scoping Report, reflecting the proposed development as currently described by the applicant. This Opinion should be read in conjunction with the applicant's Scoping Report.

1.0.4 The Inspectorate has set out in the following sections of this Opinion where it has/ has not agreed to scope out certain aspects/ matters on the basis of the information provided as part of the Scoping Report. The Inspectorate is content that the receipt of this Scoping Opinion should not prevent the applicant from subsequently agreeing with the relevant consultation bodies to scope such aspects/ matters out of the ES, where further evidence has been provided to justify this approach. However, in order to demonstrate that the aspects/ matters have been appropriately addressed, the ES should explain the reasoning for scoping them out and justify the approach taken.

1.0.5 Before adopting this Opinion, the Inspectorate has consulted the 'consultation bodies' listed in appendix 1 in accordance with EIA regulation 10(6). A list of those consultation bodies who replied within the statutory timeframe (along with copies of their comments) is provided in appendix 2. These comments have been taken into account in the preparation of this Opinion.

1.0.6 The Inspectorate has published a series of advice pages, including '[Advice Note 7: Environmental Impact Assessment: Preliminary Environmental Information, Screening and Scoping \(AN7\)](#)'. AN7 and its annexes provide guidance on EIA processes during the pre-application stages and advice to support applicants in the preparation of their ES.

1.0.7 Applicants should have particular regard to the standing advice in AN7, alongside other advice notes on the Planning Act 2008 (PA2008) process, available from:

['Nationally Significant Infrastructure Projects: Advice pages'](#)

- 1.0.8 This Opinion should not be construed as implying that the Inspectorate agrees with the information or comments provided by the applicant in their request for an opinion from the Inspectorate. In particular, comments from the Inspectorate in this Opinion are without prejudice to any later decisions taken (e.g. on formal submission of the application) that any development identified by the applicant is necessarily to be treated as part of a Nationally Significant Infrastructure Project (NSIP) or associated development or development that does not require development consent.

## 2. OVERARCHING COMMENTS

### 2.1 Description of the proposed development

(Scoping Report sections 2 and 3)

ID	Ref	Description	Inspectorate's comments
21.1	Paras 1.1.2 and 3.17.3	Existing site infrastructure	The ES should include a full description of the existing built infrastructure on the site and confirm any demolition proposed to facilitate the proposed development, including an estimate of the volume of material(s) arising from any demolition by type. Any likely significant effects arising from demolition should be described as part of the cumulative effects assessment if this would be carried out under a separate consenting process.
21.2	Para 2.1.9	Restoration of former landfill	The ES should describe the landfill areas that have been or are proposed to be restored in accordance with relevant licences or permissions. Diagrams and sections showing the restored landfill condition should be provided to aid understanding of the future baseline in the absence of the proposed development.
21.3	Section 3	Physical characteristics	The Scoping Report presents a relatively high-level description of the proposed development, providing only an approximate maximum footprint and height of the data centre campus and energy generating station but no information on, for example, the proposed stack heights, ancillary office and administration buildings, or back-up generators. The landscaping proposals described at section 3.12 include caveats such as "where possible" or subject to "design development." At the point of application, the description of the physical characteristics of the proposed development should be sufficiently developed to include further details regarding the design, size and locations of the different elements of the proposed development. This should include the footprint and heights of all temporary and permanent structures and land-use requirements for all phases and elements of the proposed development. This should be supported by figures, cross sections and drawings that should be clearly and appropriately referenced. The applicant should make effort to fix the siting of each component and reduce uncertainty

ID	Ref	Description	Inspectorate's comments
			where feasible; where this is not possible, the applicant should provide justification and ensure the ES assesses a worst-case scenario adopting a parameters-based approach.
214	Para 3.2.1	Data centre type	The Scoping Report states that the proposal is for hyperscale data centres. The ES should elaborate on the description of the data centre type; for example it should set out if the data centre would be used to support artificial intelligence (AI), and if so any additional components and energy demand that would be required.
215	Paras 3.2.15 and 3.4.2	Energy generation technology	The Scoping Report confirms that the proposed energy generating station will contain gas technologies but remains flexible about which would be used, stating that it could be combined cycle gas turbine (CCGT), open cycle gas turbine (OCGT) or reciprocating engines. The Inspectorate considers that different impacts could arise depending on the technology selected and its comments about flexibility at ID 2.2.1 of this Opinion apply to this matter. If the final technology has not been selected at the point of development consent order (DCO) submission, the ES must include an assessment of the worst-case scenario for each remaining technology. The applicant's attention is drawn to the Environment Agency's (EA) comments (appendix 2 of this Opinion) regarding the potential need for additional abatement from selective catalytic reduction (SCR) for the energy generating station and/ or back-up generators. The ES should confirm and describe the SCR required and assess any likely significant effects arising from this component.
216	Paras 3.2.15 and 3.17.1	Retention of existing landfill-related operations	The ES should include a full description of the physical characteristics and operational requirements of the existing uses on site that are proposed to be retained and operated alongside the proposed development, including the operational period proposed. It should confirm if authorisation for these activities would be sought through the draft DCO (dDCO). Any likely significant effects arising from retention and operation of this infrastructure should be assessed in the ES, as part of the cumulative effects assessment where this does not form part of the DCO application.

ID	Ref	Description	Inspectorate's comments
21.7	Para 3.2.16 and section 3.8	Waste heat recovery infrastructure	<p>The Scoping Report states that the proposed development may potentially include the infrastructure to enable future waste heat recovery. The ES should include a full description of the infrastructure that will form part of the proposed development if this option remains at the point of DCO submission and an assessment of any likely significant effects associated with it. If the recovered heat is to be transported to a heat network, it should set out what additional infrastructure would be required to facilitate this and where this would comprise a separate project, include it in the assessment of cumulative effects.</p>
21.8	Paras 3.3.3 and 3.4.4	Data centre and energy centre cooling	<p>The Scoping Report states that air cooling rather than water cooling is expected to be used but does not fully commit to this technology. The ES should confirm the selected cooling technology and provide a full description of it. Where optionality remains, the Inspectorate's comments at ID 2.2.1 of this Opinion apply.</p>
21.9	Paras 3.3.6, 3.4.2 and 6.2.40, and section 5.9	Energy supply for the data centre	<p>The Scoping Report states that the intention is for the proposed data centre to ultimately connect into the energy grid when an off-site connection is available, and that the proposed energy generating station would only be capable of powering 2 of the 3 proposed data halls. The Inspectorate's comments about flexibility at ID 2.2.1 of this Opinion apply to this matter. The ES must explain the assumptions made in the assessments on a worst-case basis including but not limited to:</p> <ul style="list-style-type: none"> <li>• the anticipated date for connection to the grid</li> <li>• the infrastructure required to facilitate the grid connection</li> <li>• the estimated energy demand from the grid for the remaining operational life of the data centre once connected</li> <li>• whether there would be a phased approach to powering the data centre from the grid</li> <li>• the back-up generator power requirement for the data centre</li> <li>• the proposals for the energy generating station following connection to the grid, including operating hours and technology if used as a peaking plant, and</li> </ul>

ID	Ref	Description	Inspectorate's comments
			<ul style="list-style-type: none"> <li>• how the data centre would be powered during the conversion to hydrogen if it had not already connected to the grid.</li> </ul> <p>The Inspectorate agrees with the applicant's proposed overarching approach to addressing the uncertainty regarding this matter in the ES through consideration of scenarios, as described in section 5.9 of the Scoping Report. Assumptions used in the scenarios should be fully justified in the ES and effort should be made to agree the scope of assessment work with relevant consultation bodies such as Buckinghamshire Council, the EA and Natural England. It must be clear how any assumptions made in the ES align with works that would be authorised through the dDCO.</p>
21.10	Para 3.4.6	Water treatment plants	If water treatment plants form part of the proposed development, the ES must include a full description of this component including the resources and processes involved in operation and assess any likely significant effects arising.
21.11	Para 3.6.4	Hydrogen conversion	The Scoping Report states that hydrogen conversion is the decarbonisation readiness pathway that has been selected for the proposed development, and that the ES will provide an assessment where significant effects are likely from this component based on a set of assumptions. The ES should clarify if authorisation for the works required to convert to hydrogen fuel, and continued operation of the energy generating station using hydrogen, would be sought through the dDCO. The works required to facilitate transition from gas to hydrogen should be described, as should any mitigation required to address likely significant effects as required. Any assumptions used should be justified in the ES and any remaining uncertainty should be explained.
21.12	Section 3.7	Substation connection	The ES should confirm if the proposed electricity connection would be an overhead line or underground cable and describe the associated parameters, including installation method(s). Any likely significant effects arising from the construction and operation of this component should be assessed.

ID	Ref	Description	Inspectorate's comments
21.13	Para 3.5.1	Infrastructure sited on historic landfill cells	The ES must confirm which parts of the proposed development (if any) are proposed to be sited on historic landfill cells. This should be shown on a plan to aid understanding. The Inspectorate notes Buckinghamshire Council (appendix 2 of this Opinion) has advised that records of waste disposal at the site may be limited due to the time at which it started accepting waste. If there is an absence of information about the extent of former landfill or material within it, effort should be made to ascertain the baseline through surveys as relevant, or reasonable assumptions should be made and explained in the ES. The ES should identify and assess any likely significant effects arising from placement of infrastructure on historic landfill cells, and set out mitigation proposed to manage associated risks such as from landfill gas and leachate.
21.14	Section 3.9	Site security	The ES should describe the physical and digital security measures proposed, and any additional energy demand to facilitate the digital measures should be factored into the predicted energy demand of the proposed development.
21.15	Paras 3.10.2 and 7.4.11	Vehicular access strategy	Paragraph 3.10.2 of the Scoping Report states that a secondary vehicular access may be located to the south-east of the site. However, paragraph 7.4.11 states that the proposed vehicular access is likely to be a primary and secondary access from the A40 Oxford Road to the north. The ES should describe all proposed access options and include these in the assessments as relevant to the aspect.
21.16	Section 3.12	Landscaping and ecology	The ES should clearly differentiate between measures which are mitigation or compensation required to address significant adverse effects concluded in the EIA, and those which are proposed enhancement or biodiversity net gain (BNG). The ES should consider the potential for mitigation to impact on other environmental aspects. Any likely significant effects arising from the presence of bunds or screening should also be assessed as relevant, for example landscape and visual receptors. The Inspectorate advises that relevant statutory bodies are engaged during the pre-application stage on the development of any proposed mitigation and compensation package.

ID	Ref	Description	Inspectorate's comments
21.17	Section 3.13	Lighting	The ES should clearly describe the location and design of external lighting required during construction and operation of the proposed development. The ES should include a description of any likely significant effects from use of lighting such as to landscape, cultural heritage and amenity of residents, including Wapseys Wood caravan site.
21.18	Section 3.14	Foul water	If flexibility is sought, for example, to discharge to existing sewer or offsite treatment, the ES should assess available options, including any consequential effects such as increased nutrients or traffic movements.
21.19	Section 13.5 and para 5.13.9	Off-site connectivity	Where consequential works are required that fall outside of the proposed development, the ES should provide a description of these works (or worst-case parameters where details are not yet known) and assess any likely significant cumulative effects with the proposed development. This should include a description of the physical characteristics and role of off-site route and infrastructure to connect to a future water supply, which is only briefly referenced in the Scoping Report.
21.20	Sections 13.6 and 5.9	Excavated materials	Dependent on the disposal option selected, the available capacity of an off-site facility or on-site closed cells to accommodate landfill waste should be confirmed in the ES.
21.21	Para 3.19.2	Energy centre upgrade	The ES should confirm if an upgrade to the proposed energy generating station at the end of its operational life forms part of the proposed development. If it does, a description of the construction requirements and operational activities associated with the upgrade should be provided together with an assessment of any likely significant effects arising.
21.22	Para 3.19.4	Decommissioning	The Scoping Report states that the proposed energy generation station would be subject to a decommissioning environmental management plan (DEMP) agreed with the EA as part of the environmental permitting process. The Inspectorate recommends that an outline DEMP is submitted with the DCO application.
21.23	Para 6.6.32	Electricity pylons	The Scoping Report states that electricity pylons cut across part of the proposed Order Limits. The ES should explain how any electricity pylons and overhead lines will be managed and describe any likely significant effects relating to this infrastructure. The

ID	Ref	Description	Inspectorate's comments
			applicant's attention is drawn to comments from National Grid Electricity Transmission (NGET) (appendix 2 of this Opinion) about its assets.
2124	Para 6.7.124	Nature park	If a nature park forms part of the proposed development, the ES should include a full description of this component and show it on a plan. Any likely significant effects arising from this component should be assessed in the ES.
2125	Various	Permits and licences	The Scoping Report refers to existing permits that may require variation, as well as other relevant permits and licences that would need to be obtained in respect of various matters such as management of waste. In addition, the EA (appendix 2 of this Opinion) has advised that an environmental permit would be required for the proposed energy generation station, which will include the requirement for decarbonisation readiness. The ES should describe the progress made towards securing permits (or variations) and where this may impact on the effectiveness or delivery of avoidance or mitigation measures. It should describe any permits or licences in place for existing operations, and the implications of the proposed development for these.
2126	N/A	Natural resources	The ES must describe the main characteristics of the operational phase of the proposed development including the nature and quantity of natural resources used. The ES must confirm the gas (natural and hydrogen, including type) and water demand during construction and operation of the proposed development for all components. The proposed supply sources and extent to which they are secured should be confirmed. This should include a description of water abstraction if required.
2127	N/A	Residues and emissions	The ES must provide an estimate of heat emissions from the proposed energy generating station and data centre during operation.
2128	N/A	Non-road mobile machinery (NRMM)	The ES should describe any NRMM required during construction. Any best practice measures or other mitigation proposed to manage NRMM impacts should be clearly secured through the dDCO.

ID	Ref	Description	Inspectorate's comments
2.129	N/A	Piling	The ES should describe the location and methods applied for piling activities and explain any assumptions made in this regard. Any likely significant effects should be assessed using worst-case parameters and any proposed mitigation measures described.
2.130	N/A	Abnormal indivisible loads (AIL)	The ES should confirm if there would be a requirement for AIL during construction of the proposed development. The ES should include an assessment of the likely significant effects arising from transportation of AIL and identify any mitigation measures required and how these would be secured.

**2.2 EIA methodology and scope of assessment**

(Scoping Report section 5)

ID	Ref	Description	Inspectorate’s comments
221	Section 5.2	Parameters’ based approach	<p>The Inspectorate notes the applicant’s desire to incorporate flexibility into their dDCO and its intention to apply a parameters-based or ‘Rochdale Envelope’ approach for this purpose. The applicant should make every attempt to narrow the range of options and explain clearly in the ES which elements of the proposed development have yet to be finalised and provide the reasons. At the time of application, any proposed development parameters should not be so wide-ranging as to represent effectively different developments. The parameters should use the maximum envelope to ensure a worst-case assessment. The ES should describe the parameters assumed as the worst-case scenario for each aspect scoped into the assessment and ensure that interactions between aspects are taken into account relevant to those scenarios.</p> <p>The development parameters should be clearly defined in the dDCO and in the accompanying ES. The applicant, in preparing an ES, should consider whether it is possible to robustly assess a range of impacts resulting from many undecided parameters. The description of the proposed development in the ES must not be so wide that it is insufficiently certain to comply with the requirements of Regulation 14 of the EIA Regulations. The Inspectorate draws the applicant’s attention to Advice Note 9: Rochdale Envelope, which states that “it will be for the authority responsible for issuing the development consent to decide whether it is satisfied, given the nature of the project in question, that it has ‘full knowledge’ of its likely significant effects on the environment.”</p>

ID	Ref	Description	Inspectorate's comments
222	Paras 3.18.1, 5.6.2 and 5.6.4	Construction phasing	The Inspectorate notes that the construction phase is anticipated to take approximately 11 years. The ES should explain the proposed approach to delivery of mitigation identified as being required to address significant adverse effects, and how this would align with the proposed construction phasing. It should explain if later construction phases have the potential to affect delivered mitigation and how this would be managed.
223	Para 5.6.3	Environmental controls and best practice measures during construction	Notwithstanding that standard controls may be required under relevant legislation, the Inspectorate does not consider it sufficient to assume that these and best practice measures would be implemented. The ES must set out any measures relied upon to avoid significant adverse effects and demonstrate feasibility. The Inspectorate recommends that these are included in the framework construction environmental management plan (CEMP) proposed for inclusion in the DCO application.
224	Para 5.8.1	Baseline conditions	The baseline description in the ES must reflect the obligations committed to in the consented restoration strategy for the former landfill site and the likely evolution of the baseline once the strategy has been implemented.
225	Para 5.8.2	Assessment scenario for future connectivity to the grid	Impacts associated with potential future connectivity to the electricity grid should be considered in all aspects scoped into the ES. Assessment of impacts arising from connection of the proposed energy generating station and use as a peaking plant and/ or data centre to the grid should only be scoped out where it can be demonstrated that likely significant effects would not occur. Assessment work should account for the fact that different Best Available Techniques (BAT) may apply to the energy generating station as a peaking plant.
226	Section 5.10	Future scenarios for powering the data centre	The Scoping Report states that the timing of conversion of the proposed energy generating station to hydrogen supply is not known but that the proposed data centre would connect to the grid prior to decommissioning

ID	Ref	Description	Inspectorate's comments
			<p>of the energy generating station if hydrogen conversion did not come online by a cut-off of 2050. It is unclear if there is a possible scenario in which a grid connection was not secured by this date. This should be confirmed in the ES. If it is a possibility, the ES should describe what the fallback position for continued operation of the data centre would be and assess any likely significant effects arising from this scenario.</p>
227	Para 5.10.6	Decommissioning phase	<p>The Scoping Report proposes to scope out decommissioning phase effects other than for climate change on the basis that:</p> <ul style="list-style-type: none"> <li>• the decommissioning of the proposed energy generating station and data centre will occur separately in temporal terms;</li> <li>• the decommissioning works will be quicker than the construction works; and therefore;</li> <li>• the potential effects are no worse than those for the enabling and construction phase.</li> </ul> <p>Any assumption that decommissioning effects are likely to be similar to or no worse than the effects from construction should be justified in the ES.</p> <p>The ES should provide a proportionate description of activities and works likely to be required to decommission the proposed development or extend its operational life (both the energy centre and data centre), and the anticipated duration. Where significant effects are likely to occur because of such works, these should be described and assessed in the ES as relevant to each aspect scoped in for further assessment. Noting that the energy generating station could be decommissioned much earlier than the data centre, additional sensitive receptors in the baseline such as employees and recreational visitors should be considered.</p>

ID	Ref	Description	Inspectorate's comments
228	Section 5.11	Alternatives	<p>In accordance with Regulation 14 and Schedule 2 of the EIA Regulations, the ES should not only describe the main alternatives (as relevant) as stated in the Scoping Report, but must provide:</p> <p>“A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.”</p> <p>In doing so, the Inspectorate advises that the ES should ensure that the analysis of alternatives includes (but is not limited to) discussion of how the below matters have been considered in selecting the site, layout and technology, and demonstrate how the mitigation hierarchy has been applied in selecting the chosen option(s), or how it is proposed to apply it in the selection of final options where optionality remains.</p> <ul style="list-style-type: none"> <li>• pipeline of data centre provision on alternative sites and ability to meet capacity requirements</li> <li>• constraints on grid connection</li> <li>• design for energy efficiency and production of excess heat</li> <li>• current and future opportunities for combined heat and power (CHP) from the energy generating station and/ or the data centre</li> <li>• renewable electricity sources to power the data centre, and</li> <li>• water resource as a broad issue (alongside the specific water resource matters identified in Table 3.14 of this Opinion).</li> </ul>
229	Para 5.12.6	Monitoring	<p>The Scoping Report states that monitoring requirements would be summarised in the ES. The ES should confirm any monitoring proposed to validate predicted effects where there is uncertainty in the conclusions</p>

ID	Ref	Description	Inspectorate's comments
			drawn and/ or the effectiveness of required mitigation. A document that describes the monitoring activities, who has responsibility for them, frequency, any trigger points for remedial action and how it is secured through the dDCO or other legal mechanism should be provided. Given the current uncertainty about water and energy demand for hyperscale data centres, the Inspectorate advises that consideration should be given to reporting on operational consumption to improve understanding.
2210	Section 5.13	Cumulative effects	The assessment of cumulative effects should include consideration of major infrastructure projects affecting Buckinghamshire including the expansion of Heathrow extension, East West Rail and High Speed 2.
2211	N/A	Figures	There are several figures in the Scoping Report that are difficult to interpret due to scale. The ES should ensure all figures are clear and legible for information provided in them to be easily interpreted.
2212	N/A	Reference lists and footnotes	To aid readability and easy navigation of information, the applicant may wish to consider placing reference lists, and lists of policy, legislation and guidance including any footnotes into an appendix.
2213	N/A	Transboundary	<p>The Inspectorate on behalf of the SoS has considered the proposed development and concludes that the proposed development is unlikely to have a significant effect either alone or cumulatively on the environment in a European Economic Area (EEA) state. In reaching this conclusion the Inspectorate has identified and considered the proposed development's likely impacts including consideration of potential pathways and the extent, magnitude, probability, duration, frequency and reversibility of the impacts.</p> <p>The Inspectorate considers that the likelihood of transboundary effects resulting from the proposed development is so low that it does not warrant the issue of a detailed transboundary screening. However, this</p>

ID	Ref	Description	Inspectorate's comments
			<p>position will remain under review and will have regard to any new or materially different information coming to light which may alter that decision.</p> <p>Note: The SoS' duty under regulation 32 of the EIA Regulations continues throughout the application process.</p> <p>The Inspectorate's screening of transboundary issues is based on the relevant considerations specified in the annex to its Advice Page 'Nationally Significant Infrastructure Projects: Advice on Transboundary Impacts and Process', links for which can be found in paragraph 1.0.7 above.</p>

### 3. ENVIRONMENTAL ASPECT COMMENTS

#### 3.1 Air quality

(Scoping Report section 6.2)

ID	Ref	Applicant's proposed matters to scope out	Inspectorate's comments
3.1.1	Para 6.2.72	Operational traffic movements	The Scoping Report states that operational traffic flows are expected to be limited and unlikely to exceed the screening criteria set out in the Institute of Air Quality Management (IAQM) Land Use Planning & Development Control: Planning for Air Quality guidance (2017) and therefore proposes to scope out operational road traffic emissions. The Inspectorate agrees that providing traffic flows are confirmed in the ES as being less than the IAQM criteria for detailed assessment, this matter can be scoped out for human receptors. The ES should also demonstrate that cumulative vehicle movements with other developments would not exceed the IAQM thresholds based on worst case assessments. If such confirmation is not possible, an assessment should be provided.
3.1.2	Para 6.2.74	Odour assessment	In the absence of detailed information about release of odour from the landfill due to excavation and potential management and monitoring regimes, the Inspectorate cannot agree to scope this matter out for the construction phase. The ES should include an assessment of odour during construction or otherwise demonstrate an absence of likely significant effects with evidence of agreement from relevant consultation bodies.

ID	Ref	Description	Inspectorate's comments
3.1.3	Para 6.2.2 and 6.2.55	Guidance	The Inspectorate notes that there are European sites and Sites of Special Scientific Interest (SSSI) within the study area. The applicant's attention is drawn to Natural England's approach to advising competent authorities on the assessment of road traffic under the Habitats Regulations (NEA001) and the IAQM's Air Quality Impacts on Designated Sites, which provide guidance on the approach to assessment of emissions

ID	Ref	Description	Inspectorate's comments
			to air. The ES should explain how this guidance has been used to inform screening criteria for detailed assessment of phase road traffic to relevant ecological receptors.
3.14	Para 6.2.2	Guidance	The applicant's attention is drawn to the Defra advice 'PM <sub>2.5</sub> Targets: Interim Planning Guidance'. The ES should explain how key sources of air pollution within the proposed development have been identified and how action has been taken to minimise emissions of PM <sub>2.5</sub> or its precursors.
3.15	Para 6.2.6	Study area for ecological impacts	The proposed study areas align with Defra guidance Air emissions risk assessment for your environmental permit but the guidance caveats that increased screening distances may be required for emissions on protected conservation areas in certain circumstances. The ES should confirm that the screening distances are appropriate for understanding the zone of influence (Zol) during operation of the proposed energy generating station in all assessment scenarios considered. Effort should be made to agree the final study area with relevant consultation bodies such as the EA and Natural England.
3.16	Paras 6.2.33, 6.2.34 and 6.2.39	Ecological receptors and baseline	The ES should identify all ecological receptors within the study area and provide an assessment of likely significant effects from operation of the proposed development where criteria for detailed assessment is met. The ES must describe the air quality baseline for ecological receptors. As relevant to the receptors within the study area, the Inspectorate considers that background data and site relevant critical loads and/ or levels from the Air Pollution Information Service (APIS) website should be used.
3.17	Para 6.2.40	Pollution sources	In addition to nitrogen dioxide (NO <sub>2</sub> ), particulate matter (PM) <sub>10</sub> and PM <sub>2.5</sub> , the Scoping Report states that other emissions considered as part of the permitting process would be considered but does not specify pollutants. Effort should be made to agree the scope and methodology of air quality modelling for all relevant pollution sources with relevant consultation bodies. The ES should confirm if nitrogen monoxide is a potential pollution source from the back-up generators for the data centres. If so, any likely significant effects arising from emissions of this pollutant should be assessed.

ID	Ref	Description	Inspectorate's comments
3.1.8	Para 6.2.57	Acid deposition	In addition to nutrient nitrogen deposition, the Inspectorate advises that the potential for acid deposition to affect ecological receptors should be considered, noting that section 6.4 Ecology and Biodiversity of the Scoping Report identifies the presence of priority habitat and woodland in the study area, which may be sensitive to this pathway. The ES should assess this matter or demonstrate that significant effects are not likely to occur.
3.1.9	Para 6.2.58	Modelling scenarios	The ES should define “normal operating hours” for the energy centre. It should provide a full description of the “decarbonisation transition” modelling scenario. It should be clear how the parameters assessed align with controls in the dDCO. The applicant’s attention is drawn to the EA’s comments (appendix 2 of this Opinion), which advise that as part of the permitting process emissions to air from simultaneous operation of the proposed energy generating station and back-up generators in certain power outage conditions should be modelled, as well as emissions from testing and maintenance and a worst-case emergency scenario of all engines running for 72 hours. The ES should assess these scenarios where likely significant effects could occur.
3.1.10	Para 6.2.66	Determining effect significance for ecological receptors	The Scoping Report sets out the proposed approach to determining effect significance for human receptors but not ecological receptors. The ES must explain how effect significance for ecological receptors has been determined by reference to relevant guidance as appropriate.
3.1.11	Para 6.2.71	Mitigation and residual effects	The Scoping Report provides limited information about construction phase measures. The Inspectorate would expect to see an outline dust mitigation plan that outlines the relevant mitigation. The ES should appropriately cross-reference to mitigation measures within other management plans where appropriate.
3.1.12	N/A	Stack heights	A description of the methods used for determining stack height and diameter should be included within the ES, including any decisions regarding BAT and any sensitivity testing that has been undertaken. The ES should clearly explain the assumptions that have been made in the air quality assessment regarding the number, placement, height and diameter of the stack(s) and these parameters should be controlled in the dDCO.

## 3.2 Climate change and greenhouse gases

(Scoping Report section 6.3)

ID	Ref	Applicant's proposed matters to scope out	Inspectorate's comments
321	Footnote 123	Transboundary effects from manufacture and transport of components in EEA states	The Scoping Report seeks to scope this matter out as carbon emissions from manufacture and transport of components in EEA states used by the proposed development would be permitted in that state. The Inspectorate agrees that further consideration of transboundary effects arising from greenhouse gas (GHG) emissions can be scoped out on that basis, and as it is not likely to be possible to attribute emissions to a specific EEA state.
322	Para 6.3.15	Cumulative GHG emissions	The Scoping Report proposes to scope this matter out as the contribution of local or regional developments to global GHG emissions would be small and not differ from the proposed development alone, and that the assessment would be made in the context of cumulative global GHG emissions. On this basis, the Inspectorate agrees that this matter can be scoped out of the ES.
323	Paras 6.3.31 and 6.3.46	Emissions from waste and water during construction and other minor emissions' sources	The Inspectorate agrees that these emissions can be excluded from the assessment if they would contribute less than 1% of total emissions from the proposed development, and collectively less than 5%, and it would require disproportionate effort to gather the data required to assess them.
324	Para 6.3.80	Climate resilience from increased snow and ice	The Inspectorate agrees that this matter can be scoped out of further assessment on the basis that UK Climate Projection (UKCP18) projections suggest a reduction in falling and lying snow compared to the 1981 to 2010 baseline by 2100.

ID	Ref	Description	Inspectorate's comments
325	Para 6.3.5	Guidance	The Inspectorate advises that the most recent versions of guidance should be used to inform the ES. The Institute of Sustainability and Environmental Professionals (ISEP) published an updated version of Assessing GHG Emissions and Evaluating their Significance in April 2026, which should be used in the assessment.
326	Para 6.3.17	GHG emissions sources during operation	For the avoidance of doubt, the assessment of emissions arising from operational maintenance, repair and replacement should include data centre IT hardware replacement(s) (including servers) over the operational life of the proposed development, based on worst-case parameters for replacement frequency. It should include emissions associated with electricity consumption following connection of the data centre to the grid.
327	Paras 6.3.16 and 6.3.17	Scope 3 (indirect) upstream and downstream GHG emissions	The ES should describe any scope 3 (indirect) GHG emissions with a causal connection to the proposed development and provide an assessment of any likely significant effects.
328	Paras 6.3.22 to 6.3.26	Assessment method	<p>Noting that it is proposed to determine effect significance in accordance with the Institute of Environmental Management and Assessment (IEMA) (now ISEP) guidance, the Inspectorate advises that the ES should:</p> <ul style="list-style-type: none"> <li>▪ Set out direct and indirect GHG emissions of the proposed development during the first year of operation and for the full lifetime, expressed as a change compared to baseline (net emissions).</li> <li>▪ Contextualise emissions against local and national carbon budgets using the same timeframe, ie if annual emissions from the proposed development are used these should be contextualised against an annual budget proportion rather than the total budget period to ensure accurate reporting.</li> <li>▪ Benchmark calculated emissions against sector-based emissions' targets where available, or projects of a similar type, ie other hyperscale data centres. The ES should justify any benchmarking against other NSIPs to demonstrate why these would be comparable in terms of GHG emissions.</li> </ul>

ID	Ref	Description	Inspectorate's comments
			<ul style="list-style-type: none"> <li>▪ Assess each project lifecycle stage (construction, operation and decommissioning) and identify mitigation applicable to that stage before concluding on whole-life effects.</li> </ul>
329	Paras 6.3.41 to 6.3.44	Mitigation and residual emissions	The ES should describe residual GHG emissions and set out any measures proposed to offset or remove these. It should demonstrate how reduction in operational energy demand and consumption has been prioritised including reduction through use of BAT.
32.10	Para 6.3.45	Mitigation measures	The Inspectorate advises that measures identified in the ES to minimise GHG emissions should be set out in an outline or framework version of the management plan(s) and submitted with the DCO application.
32.11	Paras 6.3.62 and 6.3.76	Climate change allowances	The Scoping Report states that surface water flooding and increased precipitation are climate hazards that will be assessed in the ES. The Inspectorate advises that in addition to use of UKCP18 projections, the relevant EA climate change allowances for peak rainfall intensity should be applied in the operational assessment of the proposed development. The ES should demonstrate how the proposed energy generating station would remain resilient to a credible maximum climate change scenario.
32.12	Para 6.3.62	Climate hazards	Section 6.8 Major Accidents and Disasters of the Scoping Report states that the Thames Valley Community Risk Register identifies potential for major fires due to natural causes including hot weather as a hazard source. The ES should confirm if there is potential for increased fire risk from natural causes and include this matter in the climate resilience assessment where significant effects are likely to occur.
32.13	Para 6.3.63	Water stress	The assessment of water stress as a risk to climate resilience should consider the implications for all sources of water demand arising from the proposed development.

### 3.3 Ecology and biodiversity

(Scoping Report section 6.4)

ID	Ref	Applicant's proposed matters to scope out	Inspectorate's comments
331	Para 6.4.31	Change in water quality from discharge during operation affecting statutory designated sites	The Scoping Report does not identify this as a potential impact pathway to European and national sites but it does for non-statutory sites within 2km. The Inspectorate notes that Burnham Beeches Special Area of Conservation (SAC) and SSSI is within 2km of the proposed development. There are several other SACs and SSSIs within the wider study area, as listed at paragraph 6.4.16. It is unclear from information presented in the Scoping Report if there could be hydrological connectivity between the proposed development and these sites. The ES should include an assessment of this matter or otherwise demonstrate an absence of likely significant effects with evidence of agreement from relevant consultation bodies.
332	Para 6.4.49	Effects on otter during all phases	The Scoping Report proposes to scope otter out of further assessment on the basis that the site is suitably disconnected from potential otter dispersal habitat to be beyond the range of colonisation. The closest continuous watercourse is identified as being 3.2km north east of the site. The Inspectorate agrees that otter can be scoped out of further assessment on the basis presented in the Scoping Report.
333	Para 6.4.50	Effects on badger during operation	The Scoping Report proposes to scope badger out of further assessment of the operational phase as any potential habitat loss would be assessed during the enabling and construction phase, and the remaining habitat during operation would be suboptimal for badger and therefore disturbance would not occur. The Inspectorate agrees that effects on badger during operation can be scoped out of further assessment on the basis presented in the Scoping Report.
334	Para 6.4.51	Effects on invertebrates (excluding designated sites)	The Scoping Report proposes to scope invertebrates out of further assessment of the operational phase as any potential habitat loss would be assessed during the enabling and construction phase, and the remaining habitat during operation would be suitably

<b>ID</b>	<b>Ref</b>	<b>Applicant's proposed matters to scope out</b>	<b>Inspectorate's comments</b>
		of value to invertebrates) during operation	buffered from the proposed development. The Inspectorate agrees that effects on invertebrates (excluding designated sites) during operation can be scoped out of further assessment on the basis presented in the Scoping Report.

<b>ID</b>	<b>Ref</b>	<b>Description</b>	<b>Inspectorate's comments</b>
335	Para 6.4.4	Buckinghamshire Local Nature Recovery Strategy (LNRS)	The Inspectorate advises that the Buckinghamshire LNRS is published. The ES should explain how the LNRS has informed the development of mitigation and compensation (as relevant) for the proposed development.
336	Para 6.4.6	Study area	The ES should confirm the final study area(s) selected and illustrate this on a figure. It should provide a rationale for the extent of each study area used in the assessment based on the proposed development's ZoI and the potential for likely significant effects. The ES should consider the potential for effects to occur beyond a fixed distance, particularly for mobile species such as birds or where there is hydrological connectivity. Efforts should also be made to agree the study area(s) with relevant consultation bodies.
337	Para 6.4.12	Survey effort	The Scoping Report states that detailed habitat and botanical survey work would be carried out in the optimum survey period. The Inspectorate advises that this should include an arboricultural survey of woodland and trees that could be affected by the proposed development to establish the baseline for the assessment. Effort should be made to agree the scope and method of all survey work with relevant consultation bodies.
338	Table 32	Great crested newt (GCN)	The Scoping Report indicates that the applicant may seek to offset the effects of the proposed development on GCN by obtaining a licence through the Natural England District Level Licensing (DLL) scheme. The Inspectorate understands that the DLL approach includes strategic area assessment and the identification of risk zones and strategic opportunity area maps. The ES should include information to demonstrate whether the proposed development is located within a risk zone for GCN. If the applicant enters into the DLL scheme, NE will undertake an impact assessment and inform the

ID	Ref	Description	Inspectorate's comments
			applicant whether their scheme is within one of the amber risk zones and therefore whether the proposed development is likely to have a significant effect on GCN. The outcome of this assessment will be documented on an Impact Assessment and Conservation Payment Certificate (IACPC). The IACPC can be used to provide additional detail to inform the findings in the ES, including information on the proposed development's impact on GCN and the appropriate compensation required.
33.9	Table 32	Reptile survey	If reptiles are found to be present, additional surveys may be required to establish the representative population assessment. The applicant's attention is drawn to Buckinghamshire Council's comments (appendix 2 of this Opinion), which refer to best practice guidance stating that a minimum of 20 visits per season is recommended in this circumstance. The Inspectorate advises that the survey effort should follow the guidance, or the ES should otherwise justify why this is not required with evidence of agreement from relevant consultation bodies.
33.10	Para 6.4.16	International and national site designations	The ES should provide a full description of the international and national statutory nature conservation sites scoped into the assessment, which may be in a technical appendix.
33.11	Tables 33 and 34	Receptor sensitivity	The Inspectorate is concerned there is potential for underreporting of effect significance in the ES because the criteria for defining receptor sensitivity in Table 34 does not appear to fully account for site designations and geographic frames of reference (habitat extent or population size at geographical level) in Table 33. The Inspectorate advises that the ES must take account of the Table 33 criteria when assigning receptor sensitivity.
33.12	Para 6.4.30	Habitat loss and fragmentation during construction	The assessment of habitat loss effects to protected species should also consider habitat fragmentation, and whether this could result in barriers to movement of species during construction.
33.13	Paras 6.4.31	Air quality effects during operation to European sites and SSSIs	For the avoidance of doubt as there is inconsistency between the information in paragraph 6.4.31 (likely significant effects) and paragraph 6.4.52 (summary), the Inspectorate advises that change in emissions to air from the proposed energy generating station including backup generators and operational traffic movements should be

ID	Ref	Description	Inspectorate's comments
	and 6.4.52		assessed through the sequential approach for all internationally and nationally designated sites within the study area. The applicant's attention is drawn to the comments of Natural England (appendix 2 of this Opinion), which set out steps that should be taken in the air quality assessment.
33.14	Para 6.4.33	Ecological Impact Assessment (EclA)	An EclA should be undertaken to inform the assessment in the ES. The outcomes of the EclA should be clearly presented, which may be in the form of technical appendices. The applicant's attention is drawn to Buckinghamshire Council's comments (appendix 2 of this Opinion), which set out the ecological information required in the EclA to support decision-making. The EclA should explain the likely validity period of the survey data and set out any recommendations for repeat surveys or pre-construction checks.
33.15	Para 6.4.46	Mitigation for impacts to trees	The ES should describe mitigation proposed to address any likely significant effects to trees, including an arboricultural method statement with tree protection measures, and a strategy for replacement planting.
33.16	Para 6.4.46	Mitigation hierarchy	The ES should set out how the mitigation hierarchy has been applied regarding inclusion of the Hedgerley Green Claypits biological notification site in the development footprint.
33.17	Para 6.4.47	Mitigation and biodiversity net gain (BNG)	The Scoping Report states that habitat mitigation and compensation is likely to involve enhancement quantified and secured through the BNG mechanism. The ES should distinguish mitigation and/ or compensation proposed to address significant adverse ecology and biodiversity effects concluded in the ES from wider enhancement measures including BNG so that it is clear what these measures comprise, their predicted effectiveness and how they would be secured and monitored (as relevant).
33.18	N/A	Sensitive environmental information	<p>Under Regulation 12(5)(g) of the Environmental Information Regulations 2004 (EIR), public bodies have a responsibility to avoid releasing sensitive environmental information that could bring about harm to sensitive or vulnerable ecological features.</p> <p>Sections of the ES containing specific survey and assessment data relating to the location of sensitive species (eg badgers, rare birds, and plants) or other vulnerable</p>

ID	Ref	Description	Inspectorate's comments
			<p>environmental features should be provided in separate annexes by the applicant. This approach reduces the sensitive ecological feature's risk of disturbance, damage, persecution, or commercial exploitation arising from publication.</p> <p>The applicant's approach should be proportionate and only use these separate annexes for species where there is a genuine risk of harm.</p> <p>All other assessment information should be included in an ES chapter, as normal, with a placeholder providing a justification as to why annexes have been withheld and that a full version of the ES has been submitted to the Inspectorate.</p>
33.19	N/A	Invasive non-native species (INNS)	<p>The potential for INNS to be present on the site should be clarified in the ES. An assessment should be provided where there is potential for likely significant effects from spread of INNS, and mitigation should be identified as relevant for example through a biosecurity management plan. The applicant's attention is drawn to the EA's comments (appendix 2 of this Opinion), which identify INNS that have been recorded on site.</p>

### 3.4 Ground conditions, contamination, land take and soils

(Scoping Report section 6.5)

ID	Ref	Applicant's proposed matters to scope out	Inspectorate's comments
34.1	Para 6.5.37	Construction workers during operation	The Scoping Report proposes to scope construction workers as a receptor out of the operational phase of the proposed development, although maintenance workers would be assessed. The Inspectorate agrees that this receptor does not require assessment during the operational phase due to presence being minimal.
34.2	Para 6.5.59	Cumulative effects	The Scoping Report proposes to scope out cumulative effects as other committed developments would be required to undertake risk assessment and remediation or mitigation works in line with relevant regulations and best practice, and that effects would be localised to development sites. The Inspectorate agrees this this matter can be scoped out of further assessment on the basis presented.
34.3	Para 6.5.64	Land take	The Scoping Report proposes to scope out land take (loss of agricultural, forest and other semi-natural and natural land to urban and artificial land development) based on the site being previously developed land and other effects being considered in other ES aspects. The Inspectorate agrees that this matter can be scoped out of further assessment on the basis presented subject to the ES confirming that any land take arising from consequential offsite works would not involve likely significant effects including loss of best and most versatile agricultural land.
34.4	Para 6.5.65	Soil resources	The Scoping Report proposes to scope this matter out of further assessment as the soil resources on-site would retain their existing function as former landfill or quarry and be re-used in the proposed development or suitably disposed. There is a commitment to implementing a CEMP with methods for handling and storing soils, which would be informed by the Defra's Construction Code of Practice for the Sustainable Use of Soils. The Inspectorate agrees that this matter can be scoped out of further assessment on the basis presented.

ID	Ref	Description	Inspectorate's comments
34.5	Para 6.5.4	Study area(s)	The ES should explain how the final study area(s) have been selected including by reference to baseline data and survey results, so it is clear that these represent an appropriate Zol for the maximum extent of likely significant effects rather than an arbitrary distance from the proposed development. This should include consideration of any additional land parcels required for mitigation, compensation or enhancement. Effort should be made to agree the final study area(s) with relevant consultation bodies.
34.6	Paras 6.5.17 to 6.5.19	Baseline conditions for hydrogeology	The applicant's attention is drawn to the EA's comment (appendix 2 of this Opinion), which advise that two Water Framework Directive (WFD) groundwater bodies are present (Radlett Tertiaries and Mid-Chilterns Chalk). The ES baseline should describe these groundwater bodies and they should be included as receptors in the assessment.
34.7	Paras 6.5.27 and 6.5.61	Site investigation	For the avoidance of doubt, the ES should include a summary of all previous and current site investigation and monitoring as part of the baseline description. The Inspectorate advises that ground investigation must be carried out to inform the baseline description and assessment in the ES.
34.8	Table 36	Risks to controlled waters from landfill excavation	The ES should assess effects to controlled waters from excavation within the historic landfill site, including from handling of waste material and increased leachate production. The assessment should be informed by a hydrogeological risk assessment.
34.9	Tables 36 and 37	Unexpected contamination	The ES should consider the potential for unexpected contamination to be encountered during construction of the proposed development, and operational maintenance works. Any likely significant effects arising from this matter should be assessed and mitigation identified as relevant, for example a commitment in the CEMP to assess associated risks and implement remediation.
34.10	Table 36	Contamination of abstracted water	Effects to abstraction licences should be considered as part of the assessment of the impact pathway scoped in for mobilisation of contaminants and subsequent migration to groundwater.

ID	Ref	Description	Inspectorate's comments
	and 37		
34.11	Table 37	Firewater runoff	The assessment of effects to groundwater should include consideration of firewater runoff if there is a fire for example at the battery energy storage system (BESS) or substation. The ES should outline mitigation proposed to address any likely significant effects. The applicant's attention is drawn to the EA's comments (appendix 2 of this Opinion), which outline requirements for firewater drainage design. It should be clear how these have been addressed.
34.12	Para 6.5.61	Foundation works risk assessment	The Inspectorate acknowledges that a foundation works' risk assessment is proposed to be undertaken post-DCO consent. In the absence of a detailed risk assessment, the ES should include sufficient information on hydrogeology and foundation design to give confidence that impacts from piling activities have been properly assessed and that mitigation proposed is achievable and would ensure that unacceptable residual impacts to shallow or deep groundwater are avoided.
34.13	Paras 6.5.34 and 6.5.61	Remediation strategy	The ES must include a description of mitigation required to address likely significant adverse effects from the proposed development. In the absence of a detailed remediation strategy, the ES should include sufficient information about the baseline and works' parameters to give confidence that mitigation proposed is achievable, and that it would result in acceptable residual effects. It should explain how it is proposed to verify completion of remediation.
34.14	N/A	Minerals	The Scoping Report describes that the proposed development site was formerly used for sand and gravel extraction and may be subject to a Buckinghamshire Minerals and Waste Local Plan policy for safeguarding of minerals development. Whilst the Scoping Report is silent on the potential for likely significant effects to minerals, the Inspectorate notes the advice of Buckinghamshire Council that minerals is not a relevant topic to be considered in the EIA as there is little in the way of any minerals remaining in land affected that could be viably won. The Inspectorate is content that no further assessment is required in the ES.

ID	Ref	Description	Inspectorate's comments
34.15	N/A	Dewatering	The ES should describe any dewatering of groundwater required during construction of the proposed development for example when excavating existing ground levels. Any likely significant effects arising from this activity should be assessed and mitigation identified as relevant.

### 3.5 Built heritage

(Scoping Report section 6.6)

ID	Ref	Applicant's proposed matters to scope out	Inspectorate's comments
35.1	Paras 6.6.25 to 6.6.29, and 6.6.100	Changes to setting and effects on value of heritage assets beyond a 2km study area during construction and operation	The Scoping Report proposes to scope this matter out for heritage receptors beyond a 2km study area because of distance between the proposed development and asset(s), and from research determining there would be no significant effects beyond this distance as there is no shared setting relationship. The Inspectorate notes that maximum heights of built components including the stacks, and therefore the zone of theoretical visibility (ZTV) may be subject to change, and that the ZTV in Appendix 2 shows theoretical visibility beyond the 2km radius particularly to the north where it extends to at least 5km. The Scoping Report does not explain the basis on which specific heritage assets beyond the 2km radius are proposed to be scoped out. Therefore, the Inspectorate cannot agree to scope these matters out of further assessment at this stage. The ES should identify and provide an assessment of setting effects to all heritage assets where significant effects are likely and demonstrate an absence of significant effects for assets scoped out. Effort should be made to agree the heritage assets scoped in and out with relevant consultation bodies based on a clear evidence base.
35.2	Paras 6.6.28 and 6.6.100	Impacts to heritage receptors within the 2km study area deemed not to have potential to experience a likely significant setting effect during construction and operation	The Scoping Report proposes to scope this matter out including for Beaconsfield Conservation Area and its associated listed buildings as shown on Figures 9 and 10, on the basis that the proposed development will either be screened from view or would not result in a material change to how the value of the heritage receptor is experienced. The Inspectorate assumes that assets west of the proposed development would include Grade II* listed Hall Barn, and moated site in Bower Wood and bowl barrow on Beaconsfield golf course scheduled monuments as shown on Figure 8, and that Bulstrode Park Camp is also proposed to be scoped out at these assets are not identified in Table 43 (heritage receptors proposed to be scoped in). The Inspectorate cannot agree to scope these matters out of further assessment at this stage for the same reasons as stated at ID 3.5.1 of this Opinion.

ID	Ref	Description	Inspectorate's comments
353	Paras 6.6.25 to 6.6.28	Study area	The ES should clearly set out how the final study area was defined to represent the maximum extent of likely significant effects. Effort should be made to agree the final study area with relevant consultation bodies. The applicant's attention is drawn to Buckinghamshire Council's comments (appendix 2 of this Opinion), which state there is potential for long-range and cumulative significant effects beyond the proposed 2km study area, and that further consideration should be given to functional relationships, historic landscape character and experiential qualities. The ES should explain how these matters were addressed in selecting the final study area for setting effects.
354	Para 6.6.44	Non-designated heritage assets	The ES must describe the non-designated heritage assets within the final study area and provide an assessment of any likely significant effects arising from changes to their setting. These assets should be shown on a figure in the ES.
355	Para 6.6.46	Templars site at Manor Farm scheduled monument	The Inspectorate advises that the assessment of setting effects to the scheduled monument should draw on archaeological expertise.
356	Para 6.6.58	Indirect effects during construction and operation	The assessment of indirect effect owing to change in setting should include consideration of any external lighting proposed and/ or mitigation or compensation required for other aspects, such as bunds.
357	N/A	Assessment of non-significant effects	The applicant's attention is drawn to Historic England's comments (appendix 2 of this Opinion). The Inspectorate advises that assets scoped out of further assessment in the ES due to effects not being significant should still be assessed as part of the DCO application in accordance with policy obligations. The assessment may be presented as a technical appendix to the ES.

### 3.6 Landscape and visual impact

(Scoping Report section 6.7)

ID	Ref	Applicant's proposed matters to scope out	Inspectorate's comments
36.1	Para 6.7.125	Visual effects of vapour from flues during operation	The Scoping Report proposes to scope this matter out on the basis that vapour is unlikely to be visible. Limited information is presented about the nature and extent of vapours from flues, including whether alternative energy generating station technologies under consideration might affect vapour, and why these would not be visible to receptors. The Inspectorate cannot agree to scope this matter out from further assessment at this stage. The ES should include an assessment or demonstrate the absence of likely significant effects with evidence of agreement from relevant consultation bodies.
36.2	Para 6.7.126	All visual effects to visitors to the Beaconsfield household recycling centre during all phases	The Scoping Report proposes to scope out the visual receptor group of visitors to the Beaconsfield household recycling centre from all impact pathways to visual effects on the basis that visits are short and visual amenity is low. The Inspectorate agrees that this matter can be scoped out of further assessment based on the information presented.
36.3	Para 6.7.126	Visual effects to residents of Beaconsfield, Gerrard's Cross and Chalfont St Peter during all phases	The Scoping Report proposes to scope out the visual receptor group residents of Beaconsfield, Gerrard's Cross and Chalfont St Peter from all impact pathways to visual effects due to distance and the substantial enclosure of views towards the site. The ZTV mapping (Appendix 2 of the Scoping Report) shows potential for intervisibility in these locations and no evidence from the field survey work is presented in the Scoping Report to support the assertion that there would be substantial enclosure. The Inspectorate cannot agree to scope this matter out from further assessment at this stage. The ES should include an assessment or demonstrate the absence of likely significant effects with evidence of agreement from relevant consultation bodies.

ID	Ref	Description	Inspectorate's comments
364	Para 6.7.38	Study area	The Scoping Report states that a study area of 3km would be used based on ZTV mapping and field survey work. The ZTV mapping shows potential for intervisibility up to a 5km radius but potential receptor locations are not shown to this distance. It is not specified during which season the ZTV was produced and if this represents the worst-case for intervisibility. It is therefore unclear if there would be intervisibility with receptors beyond 3km, and no evidence from the field survey work is presented in the Scoping Report. The Inspectorate advises that a 3km study area may not be sufficient. The final study area should be based on the maximum extent of likely significant effects, and the ES should confirm how this has been identified. Effort should be made to agree the extent of the study area and methodology for the ZTV with relevant consultation bodies including Buckinghamshire Council.
365	Para 6.7.74	Landscape receptors	The ES should assess the Chilterns National Landscape as a landscape receptor. The Inspectorate notes that the designation is within the proposed 3km study area (approximately 1.75km from the proposed development). Based on the ZTV mapping, there is potential intervisibility between the proposed development and this landscape designation and the Inspectorate considers there is therefore potential for indirect setting effects. In addition, the ES should assess the Thames Valley National Character Area (NCA) as a receptor, noting that the proposed development site is located within the NCA.
366	Para 6.7.75	Visual receptors	The Scoping Report states (paragraphs 6.7.78 and 6.7.79) that there could be likely significant effects to visual receptors at Bulstrode Historic Park and Garden and the Knight Templars' site at Moat Farm but these are not listed as receptors at paragraph 6.7.75. For the avoidance of doubt, the ES should include these receptors in the assessment or otherwise demonstrate an absence of likely significant effects with evidence of agreement from relevant consultation bodies.
367	Para 6.7.83	Temporal scope	In addition to the assessment scenarios outlined in the Scoping Report, the ES should confirm if there is potential for likely significant effects arising from enabling and construction works relating to the decommissioning or replacement of the proposed energy generating station, considering any additional receptors introduced to the site during

ID	Ref	Description	Inspectorate's comments
			operation of the proposed development. An assessment should be provided where significant effects are likely, together with confirmation of any measures proposed to avoid, prevent, reduce or offset likely significant adverse effects.
368	Paras 6.7.84 to 6.7.85	Visual information	Noting the potential flexibility sought for site layout and stack heights, the Inspectorate advises that the ES should include visual information to illustrate the maximum parameters that could be built out in accordance with the dDCO, as well as the likely delivery scenario(s) for each component to aid understanding of how the buildings and stacks would be understood from the representative viewpoints.
369	Para 6.7.85	Night-time visualisations	Consideration should be given to the inclusion of night-time visualisations in the ES. If not included, the ES should provide a clear explanation by reference to relevant guidance as to how the assessment of night-time effects has been carried out in the absence of aiding visual information.
36.10	Figure 11	Determining effect significance	The applicant's attention is drawn to Buckinghamshire Council's comments (appendix 2 of this Opinion) regarding the proposal to determine effect significance using the matrix at Figure 11. The ES should use the original EIA significance evaluation matrix in IEMA's guidance The State of EIA in the UK (2011), or it should otherwise justify using the altered version in the Scoping Report and explain how it has ensured that concluded effects have not been downplayed or underreported.
36.11	Para 6.7.124	Operational stage mitigation	The Scoping Report describes a series of potential operational mitigation measures that are proposed to be embedded in the project design. The ES should identify and describe all measures relied upon to avoid, prevent, reduce or offset significant adverse effects, and these should be shown on figures as relevant. Measures should be demonstrably secured in the dDCO. Where there is uncertainty about measures, for example, because they relate to potential enhancement, this should be explained in the ES and then reflected in the assessment conclusions. For example, it is unclear from the Scoping Report if green roofs and walls, and a new nature park, are committed proposals.

ID	Ref	Description	Inspectorate's comments
36.12	Para 6.7.78	Night-time lighting effects during enabling and construction	In the absence of specific justification in the Scoping Report, and noting the construction phase could span 11 years (paragraph 3.18.1) and that night-time working requiring external lighting may be required, the Inspectorate is unclear if there is potential for likely significant effects to night-time character during enabling and construction. The ES should include an assessment of this matter or demonstrate the absence of likely significant effects with evidence of agreement from relevant consultation bodies.

### 3.7 Project vulnerability (major accidents and disasters)

(Scoping Report section 6.8)

ID	Ref	Applicant's proposed matters to scope out	Inspectorate's comments
37.1	Para 6.8.63	Effects on members of the public who wilfully trespass	The Scoping Report proposes to scope this receptor out on the basis that measures would be taken to secure the boundary of the proposed development, thereby managing risk as far as reasonably practicable. The Inspectorate agrees that this receptor can be scoped out provided that the ES includes a clear description of measures that would be implemented to secure the boundary, the predicted effectiveness of the measures and how they would be secured.
37.2	Para 6.8.63	Effects on employees of the proposed development	The Scoping Report proposes to scope this receptor out as employees would be protected by existing health and safety legislation. The Inspectorate agrees that this receptor can be scoped out provided that the ES includes a clear description of measures required under other legislation to reduce effects to not significant (or to a risk level as low as is reasonably practicable) and how these are proposed to be secured.
37.3	Para 6.8.63	Low-consequence events such as slips, trips and falls	The Inspectorate agrees that low consequence events that do not meet the criteria of a significant environmental effect as defined in the Scoping Report based on IEMA (now ISEP) guidance in Major Accidents and Disasters in EIA: A Primer (2020) would not be a potential major accident or disaster and can be scoped out of further assessment.

ID	Ref	Description	Inspectorate's comments
37.4	Para 6.8.32	Receptors	In addition to the receptors listed in the Scoping Report, the ES should explain how any potential for impacts through demand on fire and rescue service operational response has been used to inform the design of the proposed development to mitigate potential risk from project vulnerability to or from major accidents and disasters. The applicant's

ID	Ref	Description	Inspectorate's comments
			attention is drawn to the comments of Buckinghamshire Fire and Rescue (appendix 2 of this Opinion).
375	Table 61 and para 6.8.62	Fire risk from BESS	In addition to the hazard sources for fire during operation listed in Table 61 of the Scoping Report, consideration should be given to potential fire risk from the BESS, including any potential for firefighting runoff, with reference to any relevant thresholds for significance identified within industry guidance. The proposed fire management strategy should include a battery safety management plan.
376	Table 61	Water supplies	The ES should confirm the provision, location and capacity of firefighting water supplies that would be required as part of the operation of the proposed development.
377	Table 61	Airport-related incident (defence interests)	The applicant's attention is drawn to the Ministry of Defence (MoD) comments (appendix 2 of this Opinion), which confirm that the proposed development site is beneath protected airspace that must be kept free from obstruction relating to RAF Northolt. The ES must include an assessment of any likely significant effects arising where structures such as the stacks could breach the obstacle limitation surface, and set out any mitigation proposed to address identified adverse effects. Effort should be made to agree the scope of assessment and any mitigation with the MoD, and evidence in the ES.
378	Para 6.8.62	Mitigation for physical and cyber resilience	Any physical and/ or digital measures identified as being required to manage risks associated with acts of terrorism, including cyber-attacks should be described in the ES and assessed where likely significant effects could arise from implementation of such measures. The energy demand of any digital measures should be confirmed.

### 3.8 Noise and vibration

(Scoping Report section 6.9)

ID	Ref	Applicant's proposed matters to scope out	Inspectorate's comments
38.1	Para 6.9.81	Vibration effects during operation	The Scoping Report proposes to scope this matter out of further assessment on the basis that the primary source of vibration would be mechanical and electrical plant, which would be designed to minimise vibration in line with BS 6472-1 guidance and would be below perceptible thresholds to the closest human receptors (more than 100m from the proposed development). The Inspectorate agrees that this matter can be scoped out of further assessment on the basis presented but advises that the ES should confirm how the plant and equipment selection would comply with BS 6472-1.

ID	Ref	Description	Inspectorate's comments
382	Para 6.9.7	Study area	The Scoping Report states that the study area for noise and vibration effects will incorporate all sensitive receptors within the vicinity of the site. The ES should confirm the final selected study area(s) for the assessment by reference to relevant guidance. This should include the study area for construction and operational traffic effects, which should be determined based on the proposed traffic routeing. The final study area(s) and identified noise and vibration receptors within it should be shown on a figure in the ES. Effort should be made to agree the final study area(s) with relevant consultation bodies.
383	Para 6.9.15	Future baseline	The ES must substantiate the assertion that the future baseline would be comparable to current conditions following the cessation of aggregate processing and completion of the landfill restoration programme to ensure that there is a robust understanding of the baseline from which to carry out assessment.
384	Para 6.9.17	Sensitive receptors	The Scoping Report identifies the closest noise sensitive receptors in paragraph 6.9.17 and Table 62. The ES should identify and describe all noise sensitive receptors scoped

ID	Ref	Description	Inspectorate's comments
	and Table 62		into the assessment, including Hedgerley Lane residents where they may be subject to likely significant effects from construction of a secondary vehicular access route (paragraph 3.10.2).
385	6.9.73	Mitigation	The ES should include a description of any proposed external acoustic barriers relied upon to avoid, prevent or reduce significant adverse effects. This should include the height and appearance, with location(s) being shown on a plan.
386	N/A	Excavation of landfill waste and onsite landfilling	The assessment of noise and vibration effects during enabling and construction should include consideration of activities associated with excavation of landfill waste material and proposed onsite landfilling (if selected).

### 3.9 Socio-economics

(Scoping Report section 6.10)

ID	Ref	Applicant's proposed matters to scope out	Inspectorate's comments
39.1	N/A	N/A	No matters have been proposed to be scoped out of the assessment.

ID	Ref	Description	Inspectorate's comments
392	Paras 6.10.4 to 6.10.6	Study area	The ES should define the extent of the "principal economic area" if that is to be used as a study area for consideration of likely significant effects. It should also explain the wider region that has been used for construction phase impacts. All study areas should be shown on a plan.
393	Para 6.10.7	Baseline conditions	The ES baseline description should use the most up-to-date data available. The applicant's attention is drawn to Buckinghamshire Council's comments (appendix 2 of this Opinion), which identifies several more recent data sources than those used in the Scoping Report.
394	Para 6.10.30	Construction worker temporary accommodation	It is unclear from the Scoping Report what the anticipated maximum number of workers at the peak of construction is estimated to be; this should be confirmed in the ES. The impact on available temporary rented accommodation demand and affordability from the anticipated increase of workers during the construction and decommissioning phases should be considered in the assessment, particularly in respect of cumulative effects associated with other committed developments, or the ES should otherwise demonstrate an absence of likely significant effects from this impact pathway.
395	Paras 6.10.30 and 6.10.31	Effects on users of public rights of way (PRoW)	The assessment of construction and operational phase effects on residents and open space and play should include consideration of loss of amenity and recreational access effects arising from the diversion and/ or closure of any existing PRoW.

ID	Ref	Description	Inspectorate's comments
396	Paras 6.10.31 and 6.10.38	Employment during operation	The ES should provide separate estimates of the expected number of direct employment opportunities on-site with occupational breakdown, and indirect or induced roles in the supply chain. Any assumptions made in the calculation of the predicted numbers should be clearly explained.
397	Paras 6.10.31 and 6.10.38	Inward investment on the UK economy	Any assumptions made about the proposed development's contribution to securing inward investment for the wider UK economy including how this would generate benefits for any sectors identified must be clearly explained in the ES so that the assessment conclusions are transparent.
398	Para 6.10.33	Professional judgment	The ES should clearly explain how professional judgment has been used to assign impact magnitude and overall effect significance, noting that the proposed criteria are not based on defined thresholds so will involve subjective decisions.

### 3.10 Archaeology

(Scoping Report section 7.2)

ID	Ref	Applicant's proposed aspect to scope out	Inspectorate's comments
3.10.1	Paras 7.2.16 to 7.2.21 7.2.25	Impacts to below-ground archaeology in the main development area during construction and operation	The Scoping Report proposes to scope this matter out on the basis that most of the proposed development site has been subject to extensive mineral extraction and the remainder is likely to have low archaeological value. Supporting desk-based archaeological assessment is provided in Appendix 3 of the Scoping Report. The Inspectorate agrees that archaeology can be scoped out for the main development area on the basis presented.
3.10.2	Paras 7.2.16 to 7.2.21 7.2.25	Impacts to below-ground archaeology from the above ground infrastructure (AGI) and pipeline in the southwest of the site during construction and operation	The Scoping Report proposes to scope this matter out on the basis that there is a low potential of new groundworks encountering archaeology and, if present, these would be of low significance. Supporting desk-based archaeological assessment is provided in Appendix 3 of the Scoping Report and subject to engagement with Buckinghamshire Council, it is stated that further evaluation trenching may be carried out to identify any non-significant effects requiring mitigation. The Inspectorate agrees that archaeology can be scoped out for the AGI and pipeline proposal on the basis presented. The outcome of evaluation trenching should be reported in the ES, together with any mitigation proposed.

ID	Ref	Description	Inspectorate's comments
3.10.3	Para 7.2.22	Works required for hydrogen conversion	The Scoping Report states that conversion of the proposed energy generation station to hydrogen could use an existing gas connection pipeline or it may require additional pipeline to enable offsite connection to National Gas' Project Union. The location of the onsite pipeline is stated to be subject to further review at later design stages but impacts are likely to be similar to those from other project components described in section 7.2 and not significant. Where flexibility for a new onsite pipeline connection remains at the point of DCO application, the ES should confirm on a worst-case basis the likely location and

ID	Ref	Description	Inspectorate's comments
			parameters of this component and identify the potential for below-ground archaeology to be encountered following the same steps as for the AGI and pipeline.
3.104	N/A	Archaeological Desk-Based Assessment	A complete version of the Archaeological Desk-Based Assessment should be submitted as a technical appendix to the ES. It is noted that paragraph 5.6 of the current version in Appendix 3 of the Scoping Report is incomplete.
3.105	N/A	Impacts in the wider ownership area	The Scoping Report states that the wider ownership area (outside of the current proposed Order Limits shown on Appendix 1: Figures) may be used for delivery of BNG or public open space and footpaths but these land parcels do not appear to be considered in the Appendix 3. Archaeological potential in these locations should be clarified. Effort should be made to agree the need for any further evaluation trenching and assessment with Buckinghamshire Council.

### 3.11 Human health

(Scoping Report section 7.3)

ID	Ref	Applicant's proposed aspect to scope out	Inspectorate's comments
3.11.1	Section 7.3	Human health during construction, operation and decommissioning	<p>The Inspectorate agrees that human health as a standalone chapter can be scoped out of further assessment based on the approach presented in the Scoping Report, including:</p> <ul style="list-style-type: none"> <li>▪ Confirmation that there would be no likely significant effects at a population level from aspects scoped into the ES of relevance to human health, including air quality, noise and vibration and socio-economics, together with commitments to mitigation through a CEMP and appropriate management of open spaces within the proposed development.</li> <li>▪ Commitment to prepare a health and equalities impact assessment to define the health and wellbeing impacts of the proposed development at population level and on vulnerable groups, including residents of the Wapseys Wood caravan site, which would be submitted with the DCO application.</li> </ul> <p>The Inspectorate advises that the health and equalities impact assessment should also consider the potential for data centre heat island effect to result in an increase in land temperature, affecting the health of residential communities in the Zol.</p>

ID	Ref	Description	Inspectorate's comments
3.11.2	N/A	Electric and magnetic fields (EMF)	<p>The Scoping Report does not set out any information on the potential for health and well-being effects from EMF exposure due to the proposed data centre and/ or any electrical connections. The ES should provide clarification on this matter. Where relevant, the DCO application should include information demonstrating how the proposed development will comply, as a minimum, with relevant EMF guidelines in its operations. Where likely significant effects could arise, these should be assessed in the ES.</p>

### 3.12 Traffic and movement

(Scoping Report section 7.4)

ID	Ref	Applicant's proposed aspect to scope out	Inspectorate's comments
3.121	Section 7.4	All traffic and movement effects of the proposed development during construction	The Scoping Report proposes to scope out this aspect on the basis that construction vehicles would be routed via the M40 and A40 strategic road network (SRN) and that other than for peak construction period the daily HGV movements are predicted to be below the screening threshold for detailed assessment of a 30% uplift in annual average daily traffic (AADT) as specified in the IEMA guidance Environmental Assessment of Traffic and Movement (2023). A construction traffic management plan (CTMP) is proposed to manage construction impacts including construction routing restrictions and a daily cap on HGV movement and associated monitoring. It is stated that this matter would be kept under review and if the predicted daily HGV movements increase to exceed the screening threshold this matter would be assessed in the ES. The Inspectorate agrees that this matter can be scoped out of further assessment in the ES on the basis presented.
3.122	Section 7.4	All traffic and movement effects of the proposed development during operation	The Scoping Report proposes to scope this matter out on the basis that operational traffic movements are predicted to be below the screening threshold for detailed assessment of a 30% uplift in AADT as specified in the IEMA guidance Environmental Assessment of Traffic and Movement (2023), and a commitment to implementation of a travel plan to reduce single occupancy car journeys and promote sustainable transport modes. A transport assessment is proposed to be submitted as a standalone technical report. The Inspectorate agrees that this matter can be scoped out of further assessment in the ES on the basis presented.

**3.13 Waste and materials**

(Scoping Report section 7.5)

ID	Ref	Applicant’s proposed aspect to scope out	Inspectorate’s comments
3.131	Section 7.5	Waste capacity during construction	<p>The Scoping Report proposes to scope this matter based on identified landfill capacity to 2036 being able to accommodate the limited material from demolition and excavation, together with a commitment to management of waste through a CEMP, site waste management plan, materials management plan and any necessary environmental permits. This would include re-use of waste on site where possible. The Inspectorate agrees that this matter can be scoped out of further assessment in the ES on the basis presented.</p>
3.132	Section 7.5	Waste capacity during operation	<p>The Scoping Report proposes to scope this matter out as the completed development would generate low levels of waste and the implementation of measures for example an operational waste management strategy and a requirement for operators to follow the waste hierarchy. The Inspectorate is content that there would be no likely significant effects from operational waste as described at paragraph 7.5.33 (aside from electrical equipment) and agrees that this matter can be scoped out of further assessment in the ES.</p> <p>The Scoping Report does not address the potential for operational waste streams from major upgrade or replacement of IT hardware following technological advancement or e-waste. The ES should describe these waste streams and confirm capacity for disposal. Any likely significant effects arising from these waste streams should be assessed in the ES and mitigation identified as relevant.</p>
3.133	Section 7.5	Material assets during construction	<p>The Scoping Report proposes to scope this matter out based on sourcing materials locally (where possible) and in accordance with The Green Guide to Specification, and implementation of measures through a CEMP. It is proposed to include the approximate type and quantity of materials, details of procurement and sustainability credential in the ES. The Inspectorate agrees that this matter can be scoped out of further assessment in the ES on the basis presented.</p>

ID	Ref	Applicant's proposed aspect to scope out	Inspectorate's comments
3.134	Section 7.5	Material assets during operation	The Scoping Report proposes to scope this matter out on the basis that materials are likely to comprise those needed for maintenance and be reduced in quantity from those required for construction. The Inspectorate agrees that this matter can be scoped out of further assessment on the basis presented.

### 3.14 Water resources and flood risk

(Scoping Report section 7.6)

ID	Ref	Applicant's proposed aspect to scope out	Inspectorate's comments
3.14.1	Section 7.6	Flood risk and drainage	<p>The Scoping Report proposes to scope this matter out based on:</p> <ul style="list-style-type: none"> <li>▪ The site being in Flood Zone 1, at low probability of fluvial flooding (less than 1 in 1,000 annual probability of river or sea flooding).</li> <li>▪ Localised areas of the site being at high, medium or low risk from surface water flooding in current day and climate change scenarios, which could be adequately addressed through temporary and permanent drainage strategies.</li> <li>▪ The site being outside of the extent of flooding that could occur in the event of breach failure of a reservoir.</li> <li>▪ British Geological Society (BGS) mapping showing groundwater level contours at a level of approximately 48.7m above ordnance datum (AOD), which compares well with the borehole records.</li> <li>▪ Thames Water asset plans not showing any public sewers within or close to the site.</li> <li>▪ The applicant has committed to submitting a flood risk assessment (FRA) and drainage strategy with the DCO application, which will set out measures proposed to mitigate flood risk such that no significant effects are predicted.</li> </ul> <p>The Inspectorate agrees that flood risk and drainage can be scoped out of further assessment in the ES on the basis presented in the Scoping Report.</p>
3.14.2	Section 7.6	Water resources	<p>The Scoping Report proposes to scope this matter out based on:</p> <ul style="list-style-type: none"> <li>▪ The expected use of air-cooled chillers that do not rely on adiabatic or evaporative cooling such that no water is proposed for cooling of the data centre.</li> </ul>

ID	Ref	Applicant's proposed aspect to scope out	Inspectorate's comments
			<ul style="list-style-type: none"> <li>▪ The hydrant system only being used in the event of fire, which would be an emergency situation and not considered to impact water demand.</li> <li>▪ Provision of an upgraded water supply from the local potable water network by the utility provider to feed domestic facilities, fire water and process water (energy generating station).</li> </ul> <p>The Inspectorate does not agree to scope water resources out of further assessment in the ES, noting the following matters.</p> <p>There is no firm commitment to selection of air-cooled chillers. No information is presented about water demand arising from any of the potential cooling technology options. It is unclear what target temperatures would be required for the data hall equipment or if air-cooling technology would be feasible to achieve these ie during hotter periods and/ or in the future climate scenario of hotter, drier summers. It is unclear if mitigation proposed to address other likely significant effects such as bunds and lowering of levels would impact the effectiveness of air-cooling.</p> <p>No information is presented about predicted water demand for the proposed energy centre, including any cooling system. Flexibility is sought for the generating technology and some remaining options, for example CCGT, can have high water demands.</p> <p>No information is presented about the water supply strategy, such as availability of water from the utility provider or implications of water demand from the proposed development on water supply. The proposed development would be in an area identified by the EA as being of serious water stress and susceptible to drought (table 27 of the Scoping Report).</p> <p>The Inspectorate advises that all these matters must be clarified in the ES on a worst-case basis. The ES must include an assessment of water resource effects from the proposed development during construction, operation and decommissioning.</p>

ID	Ref	Description	Inspectorate's comments
3.143	N/A	Mitigation hierarchy	The ES should demonstrate how the mitigation hierarchy has been applied in the assessment of effects to water resources. It should explain how technologies were selected (including consideration of future climate change) and how significant residual adverse effects would be mitigated and monitored as required. This should include any consideration given to opportunities for non-potable water such as re-use of industrial or agricultural wastewater, rainwater and greywater harvesting.

## APPENDIX 1: CONSULTATION BODIES FORMALLY CONSULTED

**TABLE A1: PRESCRIBED CONSULTATION BODIES**

Bodies prescribed in schedule 1 of The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 (as amended) (the 'APFP Regulations (as amended)')

<b>SCHEDULE 1 DESCRIPTION</b>	<b>ORGANISATION</b>
The Secretary of State for Defence	Ministry of Defence
The relevant parish council	Beaconsfield Town Council
	Chalfont St Peter Parish Council
	Gerrards Cross Town Council
	Hedgerley Parish Council
	Burnham Parish Council
	Chalfont St Giles Parish Council
	Chenies Parish Council
	Chorleywood Parish Council
	Coleshill Parish Council
	Denham Parish Council
	Farnham Royal Parish Council
	Fulmer Parish Council
	Penn Parish Council
	Seer Green Parish Council
	Stoke Poges Parish Council
Taplow Parish Council	
Wooburn & Bourne End Parish Council	

<b>SCHEDULE 1 DESCRIPTION</b>	<b>ORGANISATION</b>
The Environment Agency	The Environment Agency
Natural England	Natural England
The Forestry Commission	Forestry Commission South East and London
Relevant AONB Conservation Boards	Chilterns Conservation Board
The Historic Buildings and Monuments Commission for England (known as Historic England)	Historic England
The relevant Highways Authority	Buckinghamshire Council
	National Highways
Transport for London	Transport for London
The Civil Aviation Authority	Civil Aviation Authority
The Health and Safety Executive	Health and Safety Executive
United Kingdom Health Security Agency, an executive agency of the Department of Health and Social Care	United Kingdom Health Security Agency
NHS England	NHS England
The relevant police authority	Police and Crime Commissioner for Thames Valley
The relevant ambulance service	South Central Ambulance Service NHS Foundation Trust
The relevant fire and rescue authority	Buckinghamshire & Milton Keynes Fire and Rescue Service

**TABLE A2: RELEVANT STATUTORY UNDERTAKERS**

‘Statutory undertaker’ is defined in The APFP Regulations (as amended) as having the same meaning as in section 127 of the Planning Act 2008 (PA2008)

<b>STATUTORY UNDERTAKER</b>	<b>ORGANISATION</b>
The relevant Integrated Care Board	NHS Buckinghamshire, Oxfordshire and Berkshire West Integrated Care Board
NHS England	NHS England
The relevant NHS Foundation Trust	South Central Ambulance Service NHS Foundation Trust
Railways	National Highways Historical Railways Estate
	Network Rail Infrastructure Ltd
Road Transport	Transport for London
Civil Aviation Authority	Civil Aviation Authority
Licence Holder (Chapter 1 Of Part 1 Of Transport Act 2000)	NATS En-Route Safeguarding
Universal Service Provider	Royal Mail Group
Homes and Communities Agency	Homes England
The relevant Environment Agency	The Environment Agency
The relevant water and sewage undertaker	Affinity Water*
	Thames Water
	Thames Water Commercial Services
The relevant public gas transporter	Cadent Gas Limited
	CNG Services Ltd
	Energy Assets Pipelines Limited
	ES Pipelines Ltd

STATUTORY UNDERTAKER	ORGANISATION
	Fulcrum Pipelines Limited
	GTC Pipelines Limited
	Harlaxton Gas Networks Limited
	Independent Pipelines Limited
	Indigo Pipelines Limited
	Inovyn Enterprises Ltd
	Last Mile Gas Ltd
	Leep Gas Networks Limited
	Mua Gas Limited
	National Gas
	Northern Gas Networks Limited
	Quadrant Pipelines Limited
	Scotland Gas Networks Plc
	Southern Gas Networks Plc
	Stark Infra-Gas Limited
The relevant electricity distributor with CPO Powers	Advanced Electricity Networks Ltd
	AGR Networks Ltd
	Aidien Ltd
	Aurora Utilities Ltd
	Eclipse Power Distribution Ltd
	Eclipse Power Network Limited
	Edge Utility Networks Ltd
	Energy Assets Networks Limited
	ESP Electricity Limited

STATUTORY UNDERTAKER	ORGANISATION
	Fulcrum Electricity Assets Limited
	Green Generation Energy Networks Cymru Ltd
	Grid Line Power Networks
	Harlaxton Energy Networks Limited
	Independent Distribution Connection Specialists Ltd
	Independent Power Networks Limited
	Indigo Power Limited
	Last Mile Electricity Ltd
	Leep Electricity Networks Limited
	London Power Networks Plc
	Mua Electricity Limited
	Optimal Power Networks Limited
	Southern Electric Power Distribution Plc
	Sphere Energy Connect Ltd*
	Stark Infra-Electricity Ltd
	The Electricity Network Company Limited
	UK Power Distribution Limited
	Utility Assets Limited
The relevant electricity transmitter with CPO Powers	National Energy System Operator (NESO)
	National Grid Electricity Transmission Plc

\* Due to technical error these consultation bodies were identified and notified after the 28 day deadline for receipt of consultation responses. Any response provided would be published on the National Infrastructure Planning website as a late response with an acknowledgment of the technical error.

**TABLE A3: LOCAL AUTHORITIES AS DEFINED IN SECTION 43(3) OF THE PA2008**

<b>LOCAL AUTHORITY</b>
Buckinghamshire Council
Central Bedfordshire Council
Cherwell District Council
Dacorum District Council
Hertfordshire County Council
London Borough of Hillingdon
Milton Keynes Council
Oxfordshire County Council
Slough Council
South Oxfordshire District Council
Three Rivers District Council
West Northamptonshire Council
Windsor and Maidenhead Council
Wokingham Borough Council

## APPENDIX 2: RESPONDENTS TO CONSULTATION AND COPIES OF REPLIES

<b>CONSULTATION BODIES WHO REPLIED BY THE STATUTORY DEADLINE:</b>
Beaconsfield Town Council
Buckinghamshire Fire and Rescue
Buckinghamshire Council
Burnham Parish Council
Central Bedfordshire Council
Chalfont St Peters Parish Council
Dacorum Borough Council
Environment Agency
Gerrards Cross Town Council
Health and Safety Executive
Historic England
Milton Keynes City Council
Ministry of Defence
National Grid Electricity Transmission (NGET)
National Highways
NATS Safeguarding
Natural England
Royal Mail
Three Rivers District Council
United Kingdom Health Security Agency
West Northamptonshire Council
Wokingham Borough Council



## BEACONSFIELD TOWN COUNCIL

### SDC M40 Campus EIA Scoping Consultation Response

27<sup>th</sup> May 2026

To: Environmental Services Infrastructure Decisions and Applications Service  
Planning Inspectorate  
c/o Quadiant  
69 Buckingham Avenue  
Slough  
SL1 4PN

Delivered By: email to [sdcm40campus@planninginspectorate.gov.uk](mailto:sdcm40campus@planninginspectorate.gov.uk)

Dear Planning Inspectorate,

Thank you for your email dated 29<sup>th</sup> April 2026 inviting Beaconsfield Town Council (BTC) as an identified consultation body to comment on the above-mentioned consultation.

BTC has reviewed the Environmental Impact Assessment (EIA) Scoping Report for the proposed SDC M40 Campus development and would like to make the following comments/observations.

We note that the consultation proposes that several topics are proposed to be 'scoped in to' and 'scoped out of' the EIA.

The following topics are proposed to be 'scoped into' the EIA:

- a. Air Quality;
- b. Climate Change and Greenhouse Gases
- c. Ecology and Biodiversity;
- d. Ground Conditions and Land Contamination;
- e. Built Heritage;
- f. Landscape and Visual Impact;
- g. Project Vulnerability (Major Accidents and Disasters);
- h. Noise and Vibration; and
- i. Socio-Economics.

And the following topics are proposed to be 'scoped out of' the EIA:

- a. Archaeology;
- b. Human Health;
- c. Odours;
- d. Traffic and Movement;
- e. Waste and Materials; and
- f. Water Resources and Flood Risk.

BTC believes that the following considerations should be considered with respect to bringing the following items 'into scope':



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### **Traffic and Movement**

One of the most concerning aspects of the Scoping Report is the proposal to take consideration of Traffic and Movement out of the EIA scope entirely.

This appears difficult to justify given:

- the substantial scale of the proposed development;
- the likely intensity and duration of construction activity;
- associated HGV and servicing movements;
- the Site's direct relationship with the M40 / A40 corridor;
- the proximity to the already constrained M40 Junction 2 and A355 network;
- the need to take cumulative development pressures across South Buckinghamshire into account (including the potential provision of over 1,500 new homes in Beaconsfield and Gerrards Cross); and
- ongoing strategic growth associated with the emerging Buckinghamshire Local Plan.

The Scoping Report itself acknowledges that the Site is accessed directly from the A40 Oxford Road, which lies immediately adjacent to the M40 and already accommodates HGV movements associated with landfill operations. It should also be noted that the nearby M40 and A355 also already accommodate HS2 HGV movements, and recently approved new housing construction projects will add further pressure onto an already constrained local road network. The nearby Pyebush Roundabout (A40/A355 junction) is already operating at full capacity.

Whilst operational traffic associated with a data centre campus may ultimately be lower than many alternative employment uses, the construction phase, servicing requirements and cumulative network effects could nevertheless be significant.

It would therefore appear reasonable for the EIA to include:

- a full construction traffic assessment;
- a cumulative traffic assessment;
- an assessment of impacts on the strategic and local highway network;
- consideration of the impacts on nearby settlements and residential communities; and
- an assessment of impacts on Public Rights of Way, local amenity and road safety.

Given the scale and regional significance of the proposal, retaining Traffic and Movement within the EIA framework would provide a more proportionate and robust approach.

### **Water Resources and Flood Risk**

The applicant proposes to scope Water Resources and Flood Risk out of the EIA primarily on the basis that the Site lies within Flood Zone 1. However, the Scoping Report also identifies several environmental sensitivities which suggest that further assessment may still be warranted, including:

- the Site's historic landfill use and continuing landfill management requirements;
- ongoing landfill gas and associated environmental control systems;
- the presence of Principal Chalk Aquifers beneath the Site;
- nearby groundwater Source Protection Zones;
- acknowledged areas of localised surface water flood risk within the Site itself; and



## BEACONSFIELD TOWN COUNCIL

- uncertainty regarding future operational water demand and utility infrastructure associated with the proposed data centre campus.

In particular, Table 3 confirms that the Site overlies a Principal Aquifer and lies within SPZ3 associated with the Bulstrode pumping station, with SPZ1 located nearby. The report also confirms that localised medium-to-high surface water flood risk exists within parts of the Site. In addition, the nearby chalk aquifers (which the surrounding towns rely heavily on for their supply) are already at capacity supporting existing requirements. In the UK Centre for Ecology and Hydrology Report 2026, it notes that without urgent intervention summer river flows could drop significantly, and global demand may exceed renewable freshwater supply by 40% as early as 2030. The cumulative impact of already approved new housing development and potential developments around Beaconsfield will only add to the problem. It also predicts a 'best-case' warming scenario of 1.5 °C will lower summer river flows by around 20% (rising to a 30% drop at a 2 °C rise, and 50% drop at a 4 °C rise).

Given the environmental sensitivity of the area, and the potential interaction between groundwater protection, landfill management, drainage, cooling demand and future utility infrastructure, it would be more appropriate for Water Resources and Flood Risk to remain scoped into the EIA process.

### **Human Health**

The report proposes to exclude Human Health from the EIA and instead prepare a standalone Health and Equalities Impact Assessment.

Potential concerns include cumulative impacts associated with:

- noise;
- air quality;
- effects of on-site power generation heat dispersal;
- lighting;
- traffic;
- visual intrusion; and
- long-term industrialisation of the area.

Of particular concern is that the Applicant is suggesting using air cooling rather than water cooling within the operation of the proposal yet is suggesting that the impact of heat transfer to the atmosphere on Human Health does not need considering. This will be of particular relevance to nearby residential communities, Wapsey's Wood Caravan Site and the nearby Crowne Plaza hotel.

BTC therefore believes that all the above three topics should be included as being 'within scope'.

BTC also notes the following:

### **The Cumulative Impact Assessment appears underdeveloped**

While Section 5.13 and topic chapters such as Air Quality (paras. 6.2.69–6.2.70) and Landscape & Visual Impact (paras. 6.7.114–6.7.119) reference the intention to undertake cumulative effects assessment, the Scoping Report currently provides limited detail regarding:

- the specific developments proposed to be included within the cumulative assessment;



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- the geographic extent of the Zone of Influence / study areas; and
- the methodology and thresholds that will determine inclusion or exclusion of schemes.

Given the substantial development pressures already affecting the Beaconsfield / Gerrards Cross corridor and the nearby important Burnham Beeches SSSI and Chilterns National Landscape, cumulative impacts may become a key issue that should be more clearly defined at the scoping stage.

### **Green Belt impacts may be understated**

While Landscape and Visual Impact is scoped into the EIA (Section 6.7), the wider strategic implications for Green Belt openness appear comparatively understated throughout the Scoping Report.

The document confirms that the Site lies within the Green Belt (Section 1.1.2) and acknowledges the Site's relationship with nearby settlements including Beaconsfield, Gerrards Cross and Hedgerley Green (Sections 2.1.5–2.1.6).

Given the scale and industrial nature of the proposed development — including three data centres, an energy generation centre, extensive infrastructure and associated lighting — the EIA should more explicitly assess:

- impacts on Green Belt openness;
- urbanising effects on the wider landscape character;
- lighting and night-glow impacts;
- effects on settlement separation between Beaconsfield, Gerrards Cross and Hedgerley Green; and
- cumulative erosion of openness when considered alongside other committed or emerging development pressures in the wider corridor.

Although cumulative landscape and visual effects are referenced in paragraphs 6.7.114–6.7.119, the current Scoping Report does not yet demonstrate how strategic Green Belt effects will be separately assessed beyond standard LVIA methodology.

### **Night-time Lighting and Visual Impacts**

While Section 6.7 scopes landscape and visual assessment into the EIA, the current methodology appears principally focused on daytime landscape and visual effects, and further detail on night-time assessment methodology would therefore be appropriate and should be added to the Scoping Report.

Table 3 already acknowledges existing sky glow within the Beaconsfield / Gerrards Cross corridor and notes that lighting associated with the M40 contributes to the existing night-time baseline.

Given the scale and operational nature of the proposed development — including a 24-hour data centre campus, energy centre, security infrastructure and associated operational lighting — the Environmental Statement should more explicitly assess:

- 24-hour operational lighting;
- security lighting;
- sky glow and night-time visibility;



## BEACONSFIELD TOWN COUNCIL

- effects on dark skies and rural character;
- long-distance visibility from surrounding settlements, PRowS and elevated viewpoints; and
- cumulative night-time effects in combination with existing motorway and urban lighting sources.

### **Reliance on Future Hydrogen Conversion and Future Grid Connection**

The proposed Energy Centre is heavily justified within the Scoping Report on the basis of “decarbonisation readiness” and the future potential for transition toward lower-carbon technologies, including hydrogen, yet assigns a life expectancy for the Energy Centre of just 20-25 years.

The current Scoping Report appears to provide limited detail regarding:

- the practical deliverability of future hydrogen conversion (it assumes a deliverability could be as late as 31<sup>st</sup> December 2049, which might be close to the life expectancy of the Energy Centre, thereby questioning whether this conversion would ever take place);
- likely implementation timescales;
- the availability of supporting regional hydrogen infrastructure;
- dependency on future electricity grid or gas pipeline upgrades;
- commercial and technical viability; and
- fallback operational scenarios if hydrogen conversion does not occur within the anticipated timeframe.

The developer assumes that a future grid connection will supply energy directly to the site from the grid, and that the Energy Centre will be converted into a ‘peaking plant’. The developer makes no reference to the fact that two grid connections are likely to be required to maintain necessary high levels of data centre availability. In 5.9.1 it states that “the timing of when sufficient power via the Grid to serve the Data Centre Campus will become available is unknown”.

The assumption that the Energy Centre will become a ‘peaking plant’ (and thereby have a reduced impact on the environment through it not being required to operate continuously) suggests that much greater clarity on these matters may be necessary to properly understand the likely long-term environmental effects and carbon implications of the proposal.

### **Natural Gas Supply**

There is little or no detail on how natural gas will be supplied to the Energy Centre, including details on supply required and capacity within the natural gas pipeline network. It is also silent on where this supply might come from, how failover resilience might be achieved, or how the Energy Centre itself will be operated. Given the significant levels of natural gas supply that will be required to generate 300 MW of power (estimated at around 50 mmscfd), and, given the Government’s moratorium on issuing new North Sea exploration licences, in all likelihood this will be supplied through increased Liquefied Natural Gas (LNG) imports to the UK (or the equivalent of around 5-6 LNG tanker movements per year).



## BEACONSFIELD TOWN COUNCIL

- Where will the full life-cycle assessment on environmental impact be made that includes sourcing and transporting natural gas from as far afield as the USA, the Middle East or even further afield?
- What assessment is to be made on the carbon emissions to be generated through the sourcing and supply and consumption of natural gas at the Energy Centre?
- How will these carbon emissions be offset in the aim of meeting Net Zero targets?
- What additional investment in the high-pressure / large capacity natural gas pipeline network will need to be made by the National Grid, and when might this take place?
- What additional risks will supplying natural gas to this site put onto the existing natural gas pipeline network which might increase the risks of network outages, including the highly dangerous situation of losing natural gas pipeline pressure in the domestic pipeline system?
- In the event of a curtailment of natural gas supply, operational maintenance or failure of the power station, what impact would there be on local electricity supply to residents if the Data Centre needs to pull power from the electricity grid?
- What additional investment would be required to upgrade the electricity grid

BTC believes that these issues should be given further consideration within the scope for this EIA.

### **Summary**

It is vital that this Environmental Statement fully assesses all potentially significant environmental impacts before the application progresses further through the NSIP process. BTC trusts that the comments made here will be taken fully into account before determining the final scope for the EIA.



Environmental Services  
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Our ref: S3860  
Enquiries to: Jonathan James  
Direct line: [REDACTED]  
Date: 05 May 2026  
Email: [REDACTED]@bucksfire.gov.uk

FAO: Laura Feekins-Bate

Dear Madam,

**Premises:** SDC M40 Campus Project – Response to EIA Scoping Consultation

Thank you for consulting with us in respect of the above proposal and the request for a scoping opinion under Regulations 10 and 11 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

This response is provided in our capacity as a consultation body. It is intended to inform the scope and level of detail of the Environmental Statement (ES) insofar as it relates to fire and rescue matters, public safety, and our operational response.

At this stage, the Fire Authority has no objection in principle to the proposed development. However, based on the limited information currently available, we consider that detail will be required within the ES to adequately assess the potential impacts on:

- Fire and rescue service operational response
- Community fire risk
- Site-specific fire hazards for the construction and operational phases
- Infrastructure resilience and emergency access

The absence of sufficient detail at this stage limits our ability to fully assess risk and may necessitate further information requests at later stages.

The ES should include a proportionate but robust assessment of the following:

**Emergency Access and Water Supplies**

- Site access arrangements for fire appliances, including:
  - Route widths, turning facilities, and weight restrictions
  - Proximity of appliances to building perimeters
- Impact of the development on surrounding road networks and response times
- Provision, location, and capacity of firefighting water supplies (hydrants, tanks, or alternative reliable provisions)



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## **Building Design and Fire Strategy**

While detailed design is not expected at this stage, the ES should outline:

- The proposed fire strategy principles
- Building heights, use types, and occupancy profiles
- Whether any tall buildings, complex, or high-risk structures are proposed
- Interaction with relevant design guidance

## **Construction Phase Fire Risk**

- Management of fire risk during construction, including:
  - Site security and arson prevention
  - Storage of combustible materials
  - Temporary fire detection and alarm arrangements
- Emergency access maintained throughout construction phases

## **Operational Fire Risk and Community Impact**

- Anticipated fire loading and risk profile of the completed development
- Potential for increased demand on Fire and Rescue Service (FRS) resources
- Consideration of vulnerable occupants
- Consideration of high-risk activities or processes

## **Major Incident and Resilience Considerations**

- Identification of major hazards associated with the development
- Site layout considerations for incident command, staging areas, and evacuation
- Business continuity and resilience of critical infrastructure (if applicable)

## **Environmental Impact of Fire Events**

Where relevant, the ES should consider:

- Potential environmental impacts arising from fire scenarios (e.g. smoke plume analysis and firefighting runoff)
- Mitigation measures to reduce environmental harm

## **Regulation 11 – Information Sharing**

In accordance with Regulation 11, the Fire Authority is willing to engage with the applicant to determine whether any information held may assist in the preparation of the Environmental Statement.



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This may include:

- Operational response considerations
- Hydrant and water supply data (subject to availability and reasonable cost recovery where applicable)
- Site-specific risk information (where appropriate and compliant with information-sharing obligations)

### **Limitations and Further Engagement**

This response is based on limited preliminary information and should not be interpreted as a final position.

The Fire Authority:

- Reserves the right to make further representations as additional information becomes available
- May require further detail at the application stage to fully assess fire and rescue impacts
- Encourages early engagement with the applicant to resolve fire safety and access considerations

### **Conclusion**

The Fire Authority requests that the ES gives due consideration to the matters outlined above to ensure that fire and rescue impacts are appropriately assessed and mitigated.

Failure to adequately scope these issues at this stage may result in delays or additional information requests at later stages of the consenting process.

Yours sincerely,

[Redacted Signature]

Jonathan James  
Fire Engineering Design Technician & Primary Authority Manager

On behalf of the Buckinghamshire & Milton Keynes Fire Authority



## **Directorate for Planning, Growth & Sustainability**

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27 May 2026

Your Ref: EN0110030

Our Ref: PI/26/03590/DCO

Email: [sdcm40campus@planninginspectorate.gov.uk](mailto:sdcm40campus@planninginspectorate.gov.uk)

Dear Ms Feekins-Bates

**Planning Act 2008 (as amended) and The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (The EIA Regulations) – Regulations 10 and 11**

**Application by Slough Holdings UK Limited (the applicant) for an Order granting Development Consent for the SDC M40 Campus (the proposed development)**

### **Scoping consultation response**

I refer to your letter dated 29 April 2026 providing an opportunity for Buckinghamshire Council ('the Council') to provide comments on the Applicant's EIA Scoping Report to inform the Environmental Statement (ES) for the proposed development referred to as SDC M40 Campus.

The following information reflects the views of the Council regarding the information contained within the submitted Scoping Report dated 29 April 2026.

This response has been prepared in consultation with Specialist Officers from the following Council service teams:

- Planning
- Environmental Health – Air Quality, Land Contamination
- Ecology and Biodiversity
- Heritage
- Archaeology
- Landscape and Urban Design
- Arboriculture
- Resilience
- Economic Development
- Human Health
- Highways and Transport (Local Highway Authority)
- Public Rights of Way
- Minerals and Waste
- Local Lead Flood Authority

## **Section - 2. Site and Project Description**

### *Ref: 2.3 Planning History*

1. Wapseys Wood has a very long history of sand and gravel extraction and subsequent infilling with a wide range of waste. It is our understanding that this pre-dates the second world war (the Scoping Report states the 1940s but we think it is older than that) and so a lot of the detail as to what has been disposed of at the site was not well-recorded. The Environment Agency are responsible for the detailed control of the waste post the Control of Pollution Act 1974 and should hold any records that the former County Council held as Waste Disposal Authority up until 1995 when the EA was created and subsequent details of what has been disposed of at the site. It was one of the main sites for the disposal of household waste in the county for many years and also took a wide range of commercial and industrial wastes.
2. The most recent substantive full planning application is reference no. SBD/8201/99 which was granted in 2000 and then subject to section 73 applications on a number of occasions largely extending the permitted time period for completion and restoration. The planning permission has an associated legal agreement covering the routing of vehicles, a limitation on the quantities of minerals and waste into and out of the site, a restoration bond, the creation of additional permissive paths and equestrian/cycleways on completion of the development, a 60-year long term woodland aftercare programme and the restoration of the adjoining Moat Farm former quarry.
3. The most recent application CM/0031/23 (referred to in the Scoping Report as a s73 application) is a new full application but is essentially for amendments to the existing approved scheme allowing a limited amount of further disposal of inert waste in the remaining void space which is in fact a significant reduction on that which was previously approved. Planning permission can be granted once a new section 106 Agreement has been completed to secure similar obligations to the extant legal agreement.
4. As there will be little in the way of any minerals remaining in the land affected, at least that could now be viably won and worked given the past history of the site, the Council agree that Minerals is not now a relevant topic to be considered as part of the EIA.

## **Section - 3. The Proposed Development**

5. It is considered that the proposed scheme is insufficiently detailed to allow an appropriate environmental impact assessment to be undertaken. It is considered essential that the scheme is more clearly defined and to include development parameters which would be the basis for assessment. This should as a minimum include

a set of drawings setting out the maximum development extent so that it can be understood in both 2 and 3-dimensions. Refer to comments under Section 5 below.

6. This detail is also considered essential for meaningful engagement with affected communities, local authorities and other statutory consultees over the proposals at the Pre-application stage.
7. Re 3.12.2. and as noted above application CM/0031/23 (referred to as a s73 application) is a new full application.

#### **Section – 4. Policy and Guidance**

8. There is no National Policy Statement for data centres as yet (4.2.5) but we expect the Applicant to have regard to the relevant policy guidance set out in the NPPF and other relevant guidance as material planning considerations. The EIA Scoping Report lacks detail in this regard.
9. In reference to the Draft Local Plan for Buckinghamshire (4.3.11.) it should be noted that there is an emerging evidence base and studies that have been undertaken which may be relevant to the proposed development.

#### **Section - 5. Approach to the EIA**

10. The Applicant states that they are adopting a parameters-based approach (5.2) primarily to enable the detail of the design to be developed in parallel to the consenting process, and that they will take account of relevant case law and guidance *“in EIA terms, the ‘Rochdale envelope’ and PINS’ Advice Note 9 will be considered. When producing the environmental statement, a reasonable worst-case scenario will be assessed for each of the relevant technical assessments to account for the flexibility in the DCO application.”*
11. It is not considered sufficient to propose to submit a parameter plan(s) with the DCO application, when development parameters are essential to enable an environmental impact assessment to be carried out, noting Advice Note 9: Rochdale Envelope<sup>1</sup>.
  - *the clearly defined parameters established for the Proposed Development must be sufficiently detailed to enable a proper assessment of the likely significant environmental effects and to allow for the identification of necessary mitigation, if necessary within a range of possibilities;*

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<sup>1</sup> The Planning Inspectorate Advice Note Nine: Rochdale Envelope (2018)

- *the assessments in the ES should be consistent with the clearly defined parameters and ensure a robust assessment of the likely significant effects;*

12. The Council considers that it is essential that clearly defined parameters are established for the Proposed Development to enable a proper assessment of the likely significant environmental effects and to allow for the identification of necessary mitigation. As a minimum a set of drawings setting out the maximum development extent so that it can be understood in both 2 and 3-dimensions, are necessary.

*Ref. 5.4 Baseline Conditions*

13. The current site conditions must be considered in the context of the site restoration process which is not yet completed. There are planning obligations to restore the site, secured as part of the consent for current operations on site, that establishes the relevant baseline e.g. for the assessment of landscape and visual effects.

*Ref. 5.11 Alternatives and Design Evolution*

14. The EIA Regulations 14 (2) states that an environmental assessment must include at least,  
*(d) a description of the reasonable alternatives studied by the applicant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment.*

15. It is considered that an assessment of alternative potentially suitable sites including the pipeline of proposed data centre provision in the area will be essential. This should demonstrate why this Green Belt and former-landfill land site has been selected in preference to non-Green Belt or brownfield alternatives, and sites with less harmful impacts.

16. Any conclusion on the appropriateness of development in a grey belt scenario would be contingent on a demonstrable unmet need for the type of development proposed (NPPF 155 b), and that the development would be in a sustainable location, with particular reference to NPPF paragraphs 110 and 115 (155 c). The consideration of alternative sites would be highly relevant if not essential to this assessment.

*Ref 5.13 Cumulative Effects*

17. Data centres currently consume around 2.5% of the UK's electricity. The sector's electricity consumption is expected to rise four-fold by 2030<sup>2</sup>. The cumulative effects assessment should recognise and consider the energy consumption implications particular to data centres. The cumulative impact of gas powered electricity generation to power data centres on the UK's climate targets must be considered. The cumulative impact on the national grid through data centre connections must be considered.

*Ref. 5.16 Consultation*

18. A draft Statement of Community Consultation for Buckinghamshire Council's consideration has been received and a response provided. At present, the Council has significant concerns that the SoCC does not yet provide sufficient clarity or detail to give confidence that consultation is proposed to be undertaken in a manner that is proportionate to the scale and potential impacts of the development.

*Ref. 5.17 Proposed EIA Scope*

19. A number of additional matters should be considered as specific topics or otherwise as part of the technical topics as proposed.
20. Noting the reference to the potential need to re-align the existing public rights of way (PRoWs) at paragraph 3.12.5. it is notable that this is not an identified topic either to be scoped in or scoped out of the EIA. PRoWs is an important consideration in terms of accessibility and recreation but also in terms of potential impacts of the development on sensitive receptors e.g. health and safety, amenity and visual impacts.
21. The scope of any compulsory acquisition powers that may be sought, particularly for any overhead line / pylon corridor across the A40 needs to be considered.
22. The EIA scoping report does not assess trees or woodlands as a standalone topic, instead addressing them within the Landscape and Ecology chapters, which identifies tree belts, woodland, scrub, and hedgerows on and around the site. The report acknowledges that the proposed development will result in some loss of trees and vegetation, particularly within the main development area, with mitigation proposed through landscape-led design, new planting, habitat creation, and biodiversity net gain.

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<sup>2</sup> Data centres: planning policy, sustainability, and resilience House of Commons Research Briefing, 03 November, 2025

23. A more thorough arboricultural assessment would be required in order to understand the impact on the trees, and this should include a BS 5837 tree survey and categorisation, an Arboricultural Impact Assessment (AIA) identifying losses and constraints (including RPAs), and an Arboricultural Method Statement (AMS) with tree protection measures. A detailed planting and replacement strategy should also be provided, including appropriate species selection and long-term management.
24. In summary, while arboricultural matters are covered indirectly, more detailed assessment is needed to ensure tree loss, retention, and mitigation are appropriately considered.

## **Section – 6. Potential Significant Environmental effects - Topics to be scoped into the EIA**

### ***Ref. 6.2 Air Quality***

25. We agree that there is the potential for likely significant effects relating to air quality and so this topic should be scoped into the EIA.
26. It is noted that an air quality assessment will be undertaken and the findings will be presented in a chapter of the ES. The proposed assessment methodology is considered to be acceptable.
27. For information the Council does not operate roadside monitors. The 2025 Air Quality Annual Status Report is available on the Council's website.

### ***Ref 6.3 Climate Change and Greenhouse Gasses***

28. We agree that there is the potential for likely significant effects relating to climate change and so this topic should be scoped into the EIA.
29. Noting the comments above under cumulative effects, given the significance of the energy requirements of data centres the impacts including through greenhouse gas emission and contribution to climate change are potentially significant.
30. The assessment should consider the emerging Local Plan for Buckinghamshire objective to help deliver the Bucks Climate Challenge to ensure that Buckinghamshire achieves net zero carbon emissions by 2050<sup>3</sup>.

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<sup>3</sup> Local Plan for Buckinghamshire, Draft Plan Consultation Part A – Spatial Strategy September 2025

## ***Ref. 6.4 Ecology and Biodiversity***

31. We agree that there is the potential for likely significant effects relating to ecology and so this topic should be scoped into the EIA. It is noted that the creation of priority habitats is included in the proposal.

### *Ecological Impact Assessment – reporting guidance*

32. An Ecological Impact Assessment (EclA) is required to identify, measure, and evaluate the potential impacts of proposed developments or other actions on habitats, species, and ecosystems. The EclA process supports the implementation of national biodiversity strategies and planning policies aimed at protecting biodiversity and promoting sustainable development. This assessment must be carried out by a suitably qualified and experienced ecologist and documented in accordance with the following guidelines:
- 1) CIEEM Guidelines for Ecological Report Writing (CIEEM, 2017)
  - 2) British Standard BS42020:2013 Biodiversity — Code of practice for planning and development
  - 3) Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2018)
33. The EclA should be accompanied by a completed EclA Checklist (CIEEM and ALGE, 2019) and fully address the items within the checklist.

### *Key Aspects of the EclA Report*

34. The EclA report should clearly present all the relevant ecological information necessary for a robust decision-making process. Key aspects include:
- **Ecological Baseline and Trends:** Describe the ecological baseline and trends if the project were not to proceed, including the survey data used to inform the baseline.
  - **Evaluation Criteria:** Outline the criteria used to evaluate ecological features and assess the significance of effects arising from the project's impacts.
  - **Justification of Methods:** Provide a justification for the methods used in the assessment.
  - **Biodiversity Data:** The assessment must include the most up-to-date biodiversity data. It is recommended to obtain this data from the Buckinghamshire and Milton Keynes Environmental Records Centre (BMERC), in accordance with the Guidelines for Accessing, Using, and Sharing Biodiversity Data (CIEEM, 2020).
  - **Impact Identification:** Identify likely impacts (both positive and negative) on ecological features and explain the significance of the overall effects for each important ecological feature.
  - **Mitigation, Compensation, and Enhancement Measures:** Detail the measures proposed to mitigate, compensate, and enhance ecological features.
  - **Legal and Policy Consequences:** Discuss the legal and policy implications of the proposed actions.
  - **Assessment Limitations:** Identify any limitations to the assessment or the surveys that underpin it and explain the implications.

- Analytical Techniques: Present any analytical techniques used and the analysis itself.
- Monitoring and Remedial Actions: The EclA should outline the ecological monitoring required to audit predicted impacts and effects against the actual situation (following the Mitigation Hierarchy). This will enable necessary remedial actions, including adjustments to the activity generating the impacts and to the mitigation or compensation measures. Monitoring methods are to be set out identifying the criteria for determining success or failure, appropriate timing, mechanisms for implementation, frequency and duration of monitoring, and frequency of reporting.
- Further Surveys and Investigations: Where full design details are not yet available or where uncertainty remains (e.g., outline application), the report should identify and justify when further surveys or investigations are required. In such cases, the report should indicate where further detailed information on proposed avoidance, mitigation, compensation, or enhancement measures will be secured through planning conditions or obligations and provided once planning permission has been granted.
- Summary of Biodiversity Gains and Losses: The EclA must provide a clear summary of biodiversity losses and gains, along with a justified conclusion of an overall net gain for biodiversity. These measures should be detailed in the report and stated definitively so they can be conditioned if the application is approved.

35. The EclA should provide sufficient detail and clarity to enable both the applicant and the decision-maker to determine whether the report's proposals and recommendations offer a practicable, deliverable, and acceptable means of incorporating biodiversity into the proposed development.

#### *Site Habitats*

36. Habitats recorded on site include:

- Lowland mixed deciduous woodland (Priority Habitat)
- Wet woodland (Priority Habitat)
- Open mosaic habitat on previously developed land (Priority Habitat)
- Native hedgerow (Priority Habitat)
- Native hedgerow with trees (Priority Habitat)
- Reedbeds (Priority Habitat)
- Ponds (Priority Habitat)
- Ponds (non-priority)
- Other woodland; broadleaved
- Other woodland; mixed
- Other coniferous woodland
- Other neutral grassland
- Mixed scrub
- Willow scrub
- Bramble scrub
- Tall forbs
- Ruderal/Ephemeral
- Rural trees

- Artificial unvegetated, unsealed surface
- Developed land; sealed surface
- Sustainable drainage system

#### *Protected and Priority Species*

37. The site is known to support great crested newts, and habitats within the site have potential to support bats (roosting, foraging and commuting), badger, hazel dormouse, reptiles, nesting and wintering birds, water vole, invertebrates, and fish.
38. It is noted that a programme of surveys is included in Table 32 of the Environmental Impact Assessment Scoping Report. The EclA should also include the results of climbing/emergence surveys of trees with PRF-M features (suitable to support maternity roosts) so the significant roosting resource of the site is fully understood.
39. The reptile surveys include 7 visits that are required to determine presence/absence. If reptiles are found to be present, additional visits will be required for representative population assessment. Best practice survey 'Reptile Survey: An introduction to planning, conducting and interpreting surveys for snake and lizard conservation' (Froglife Advice Sheet 10) recommends a minimum of 20 visits per season for estimating population size.

#### *Special Area of Conservation and Sites of Special Scientific Interest*

40. The site lies within the impact risk zone of Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) Burnham Beeches, and within several SSSIs, including Stoke Common and Littleworth Common.
41. The EclA must include an assessment of impacts on the SAC and SSSIs.

#### *Ancient Woodland*

42. The blue line boundary of the site includes parcels of ancient and semi-natural woodland and a parcel of ancient replanted woodland (north-west of the site).
43. Natural England and Forestry Commission Standing Advice Ancient woodland, ancient trees and veteran trees: advice for making planning decisions applies<sup>4</sup>.
44. The EclA must include an assessment of the impacts of the development on ancient woodland.

#### *Biological Notification Site*

45. The site includes the Biological Notification Site (BNS) Hedgerley Green Claypits.

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<sup>4</sup> Ancient woodland, ancient trees and veteran trees: advice for making planning decisions - GOV.UK January 2022

46. Biological Notification Sites are sites of wildlife importance in Buckinghamshire that are yet to be reviewed against the Local Wildlife Site criteria ([The Local Wildlife Sites Project | Buckinghamshire Council](#)).
47. The Illustrative Masterplan indicates that the majority of this BNS will be lost to development, whereas in accordance with the mitigation hierarchy impacts on this site should be avoided.
48. The EclA must include an assessment of the BNS according to the LWS criteria.

#### *Priority Habitats*

49. The site includes priority habitats which are habitats listed in the Section 41 of the Natural Environment and Rural Communities Act (NERC Act) as Habitats of Principal Importance for conservation. These include lowland mixed deciduous woodland, open mosaic habitat on previously developed land, ponds (that support population of protected and priority species such as great crested newt), reedbeds, native hedgerows and native hedgerows with trees.
50. The EclA must include an assessment of the priority habitats to be lost/affected from the proposed development and how the mitigation hierarchy is applied.
51. The Local Planning Authority has a duty under Section 40 of the NERC Act to conserve and enhance biodiversity when exercising functions, by considering the Section 41 habitats and species list.

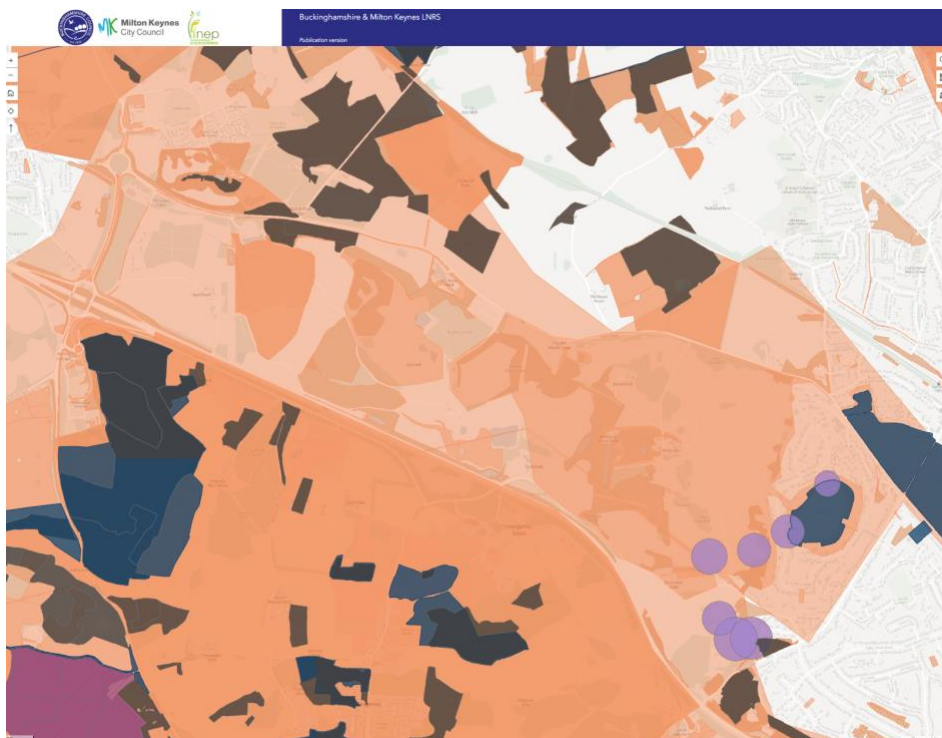
#### *Important Invertebrate Area and B-line*

52. The site lies within the Important Invertebrate Area Thames Basin Heath & Woodland.
53. Important Invertebrate Areas are areas mapped by Buglife that support nationally or internationally significant invertebrate populations and their habitats.
54. The majority of the site lies within an invertebrate B -line. B-lines are a series of 'insect pathways' produced by Buglife, indicating zones across the UK important to pollinators.

#### *Local Nature Recovery Strategy*

55. The Buckinghamshire and Milton Keynes Local Nature Recovery Strategy was published in November 2025 (adopted in October 2025) and is available here: <https://www.buckinghamshire.gov.uk/environment/ecology-and-biodiversity/the-local-nature-recovery-strategy/>
56. The production of Local Nature Recovery Strategies (LNRS) across England are an important measure in the Environment Act 2021.

57. The LNRS is a collaboratively developed vision for restoring and enhancing nature across the Council area. It identifies areas of existing biodiversity value and also where there is opportunity to restore nature via undertaken specific actions (mapped measures).
58. LNRSs are not yet referred to within local policy but are considered within the NPPF. Where development is proposed on green belt, the NPPF, paragraph 159 states that improvements to green spaces required as part of the Golden Rules should support nature recovery and where land is identified within LNRSs the proposals should contribute towards these outcomes.
59. The majority of the site is mapped with one or more potential measures:



Mapped potential measures include:

M5 - Create new woodlands/expand existing woodland using appropriate diverse species in areas where it delivers multiple benefits.

M7 - Bring more woodlands into active management

M39 - Increase the area of woodlands where they can intercept the flow of surface run-off of water and capture sediment to improve water quality in rivers.

M66 - Employ land management practices to slow surface runoff, capture sediment, reduce soil erosion and chemical runoff.

M82 - Restore and maintain existing open mosaic habitats and encourage new areas to establish

M110 - Take action in Target areas for Species Recovery.

60. The EclA should indicate how the proposal complies with the LNRS.

*Biodiversity Net Gain*

61. Biodiversity Net Gain for Nationally Significant Infrastructure Projects (NSIPs) in England will be mandatory from November 2026. Depending on the time of application submission, the application is likely to be supported by a Biodiversity Net Gain Assessment and Statutory Biodiversity Metric.

62. It is noted in paragraph 6.4.13 of the Environmental Impact Assessment Scoping Report that *“Under both existing and pending commitments, the future baseline of the Site would involve the restoration of the existing landfill under an approved restoration plan (Ref: P22-3044\_EN\_10H) and the pending restoration plan sought for approval as part of the pending Section 73 application (CM/0031/23). This would involve the cessation of all remaining landfilling activities within the Site, the retention of some existing open mosaic habitat and the creation of new areas of scrub and grassland to cap the landfill. Existing ponds at the Site margins would be retained in-situ. The habitats within the Site would also be managed positively for nature”*.

63. Upon submission of BNG information a site visit may be requested to review the baseline habitat entries.

*Note on habitat restoration of the site:*

64. It should be noted that area of the site includes land that was allocated for restoration after the uses of the site for landfill and mineral extraction. It is noted that the restoration included the creation of a range of biodiverse and important habitats such as open mosaic habitat, woodland, scrub, grassland and wetlands. Please refer to the ‘Site Wide Restoration Illustrative Landscape Design Wapsey Wood Landfill Restoration Scheme’ of Minerals and Waste Planning application CM/0031/23.

65. The Buckinghamshire Minerals and Waste Local Plan 2016-2036 Policy 25: Delivering High Quality Restoration and Aftercare states that *“Minerals and waste development of a temporary nature must include a restoration scheme that will result in the site being progressively restored to an acceptable condition and stable landform as soon as is practicable and provide for high quality aftercare arrangements including ongoing management and monitoring where necessary. The after-use of a site will be determined in relation to the land-use context and surrounding environmental character (including wider ecological networks) and should take account of landowner interests and the requirements of the local community. Schemes should include objectives that will contribute towards: biodiversity gains, enhancement of the local environment and amenity, climate change mitigation and adaptation, benefits for the local community and economy (as appropriate)”*.

## Legislation, Policy & Guidance

### *Reasonable Likelihood of Protected Species*

66. Permission can be refused if adequate information on protected species is not provided by an applicant, as it will be unable to assess the impacts on the species and thus meet the requirements of the National Planning Policy Framework (2019), ODPM Circular 06/2005 or the Conservation of Habitats and Species Regulations 2017. The Council has the power to request information under Article 4 of the Town and Country (Planning Applications) Regulations 1988 (SI1988.1812) (S3) which covers general information for full applications. CLG 2007 'The validation of planning applications' states that applications should not be registered if there is a requirement for an assessment of the impacts of a development on biodiversity interests.
67. Section 99 of ODPM Circular 06/2005 states:  
*"It is essential that the presence or otherwise of protected species, and the extent that they may be affected by the proposed development, is established before the planning permission is granted, otherwise all relevant material considerations may not have been addressed in making the decision. The need to ensure ecological surveys are carried out should therefore only be left to coverage under planning conditions in exceptional circumstances, with the result that the surveys are carried out after planning permission has been granted. However, bearing in mind the delay and cost that may be involved, developers should not be required to undertake surveys for protected species unless there is a reasonable likelihood of the species being present and affected by development. Where this is the case, the survey should be completed and any necessary measures to protect the species should be in place, through conditions and / or planning obligations, before permission is granted."*

### **Bats**

68. All species of bat native to Britain are fully protected under the Conservation of Habitats and Species Regulations 2017 (as amended) and are listed as European Protected Species (EPS). It is illegal to deliberately capture, injure, kill, disturb bats. It is also an offence to damage or destroy a breeding site or resting place of any bat. In relation to disturbance, the legislation makes particular reference to any disturbance which is likely to impair the ability of bats to survive, breed, reproduce, hibernate or migrate, or to affect significantly the local distribution or abundance of the species to which they belong.
69. Additionally, bats are protected under the Wildlife and Countryside Act 1981 (as amended). This legislation makes it illegal to intentionally kill, injure, or take a bat, to possess or control any live or dead bat, intentionally or recklessly damage or destroy any structure or place which any bat uses for shelter or protection, disturb any bat while it is occupying a structure or place which it uses for shelter or protection or obstruct access to any structure or place which any bat uses for shelter or protection.
70. Certain species of bat are listed a priority species for conservation in England through their listing under Section 41 of the Natural Environment and Rural Communities Act

2006 (as amended). Local planning authorities have a duty to conserve biodiversity under Section 40 (part 1) of this Act

### ***Great crested newt***

71. Great crested newts and their habitats are fully protected under the Conservation of Habitats and Species Regulations 2017 (as amended). It is illegal to deliberately capture, injure, kill, or disturb great crested newts. It is also an offence to damage or destroy breeding site or resting place of any great crested newt. In relation to deliberate disturbance, the legislation makes reference to any disturbance which is likely to impair the ability of great crested newts to survive, breed, reproduce, hibernate or migrate, or to affect significantly the local distribution or abundance of the species to which they belong.
72. Additionally, great crested newts are protected under the Wildlife and Countryside Act 1981 (as amended). This legislation makes it illegal to intentionally kill, injure, or take a great crested newt. It is also an offence to intentionally or recklessly damage or destroy any structure or place which any great crested newt uses for shelter or protection; disturb any great crested newt while it is occupying a structure or place which it uses for shelter or protection; or obstruct access to any structure or place which any great crested newt uses for shelter or protection.
73. Great crested newts are also listed a priority species for conservation in England through their listing under Section 41 of the Natural Environment and Rural Communities Act 2006 (as amended). Local planning authorities have a duty to conserve and enhance biodiversity under Section 40 (part 1) of this Act.

### ***Hazel Dormouse***

74. The hazel dormouse is protected under The Conservation of Habitats and Species Regulations 2017 thus deemed a European Protected Species, and under the Wildlife and Countryside Act 1981 (as amended). It is also listed in the NERC Act 2006 (8 & 15) as Species of Principal Importance (priority species). It is an offence to deliberately capture, injure or kill hazel dormice, damage or destroy a hazel dormouse resting place or breeding site, deliberately or recklessly disturb a hazel dormouse while it's in a structure or place of shelter or protection, block access to structures or places of shelter or protection, and possess, sell, control or transport live or dead hazel dormice, or parts of hazel dormice without a derogation licence.

### ***European Protected Species Licensing***

75. A High Court ruling (2009 Woolley Judgement) concluded that local authorities must consider all applications where European Protected Species are likely to be affected and a European Protected Species licence is required, by considering the three tests applicable to the Habitats Directive. The ruling stated the following:

*"When dealing with cases where a European Protected Species may be affected, a planning authority... has a statutory duty under Regulation 3(4) to have regard to the requirements of the Habitats Directive in the exercises of its functions. Further the*

*Directive's provisions are clearly relevant in reaching planning decisions, and these should be made in a manner which takes them fully into account ...".*

76. Before granting planning permission, the local planning authority should satisfy itself that the impacts of the proposed development on European Protected Species (EPS) have been addressed and that if a protected species derogation licence is required, the licensing tests can be met and a licence is likely to be granted by Natural England.
77. If a EPS licence is required the applicant will need to provide the answers to all three licensing tests, alongside a mitigation strategy. The three tests are that:
1. the activity to be licensed must be for imperative reasons of overriding public interest or for public health and safety;
  2. there must be no satisfactory alternative; and
  3. favourable conservation status of the species must be maintained

### ***Water vole***

78. Water voles are protected under the Wildlife and Countryside Act 1981 (as amended). It is an offence to intentionally kill, injure or take a water vole, damage or destroy a structure of place used for shelter or protection or disturb them in a place used for shelter or protection. It is also an offence to obstruct access to a place used for shelter or protection.

### ***Nesting Birds***

79. All wild birds, their nests and eggs are protected by the Wildlife and Countryside Act 1981 (as amended). This makes it an offence (with certain exceptions) to intentionally kill, injure or take any wild bird; intentionally take, damage or destroy the nest of any wild bird while it is in use or being built; or, intentionally take or destroy the egg of any wild bird.
80. Certain birds are afforded additional protection against disturbance whilst they are nesting through their inclusion on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). For birds listed on Schedule 1 it is an offence to intentionally or recklessly disturb them while they're nesting, building a nest, in or near a nest that contains their young, or to disturb their dependent young.
81. Certain bird species are also listed a priority species for conservation in England through their listing under Section 41 of the Natural Environment and Rural Communities Act 2006 (as amended). Local planning authorities have a duty to conserve biodiversity under Section 40 (part 1) of this Act.

### ***Reptiles***

82. There are six species of reptile native to Britain. All six species are afforded protection under the Wildlife and Countryside Act 1981 (as amended), which make it illegal to intentionally kill or injure a native reptile.

83. All six species are also listed a priority species for conservation in England through their listing under Section 41 of the Natural Environment and Rural Communities Act 2006 (as amended). Local planning authorities have a duty to conserve and enhance biodiversity under Section 40 (part 1) of this Act.
84. Four species, the slow-worm, common lizard, grass snake and adder, are present in Buckinghamshire. The other two species, the smooth snake and sand lizard, are highly restricted in distribution and are not present in Buckinghamshire and are afforded additional protection through the Conservation of Habitats and Species Regulations 2017 (as amended).

### **Badger**

85. Badgers and their setts (including tunnels) are protected under the Protection of Badgers Act 1992. The most likely offences through development include wilful killing and injury of a badger, intentional or reckless damage or destruction of a badger sett, obstruction of access to a sett, or to disturb a badger when occupying a sett.
86. Impacts on badgers are capable of being material consideration in planning decisions, as follows;

Paragraph 124 of Government Circular 06/2005 appended to the NPPF states: *"the likelihood of ... adversely affecting badgers foraging territory or links between them, or significantly increasing the likelihood of road or rail casualties amongst badger populations, are capable of being material considerations in planning decisions"*.

### **Ancient Woodland**

87. The Natural England and Forestry Commission Standing Advice (January 2022 see footnote 4) for ancient woodland, ancient trees and veteran trees is a material planning consideration for local planning authorities (LPAs). Decisions have to be made in line with paragraph 193c of the NPPF.
88. Paragraph 193c of the NPPF states that: *"Development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons 70 and a suitable compensation strategy exists"*.

*(70) For example, infrastructure projects (including nationally significant infrastructure projects, orders under the Transport and Works Act and hybrid bills), where the public benefit would clearly outweigh the loss or deterioration of habitat.*

### **Priority Habitats and Species**

89. Local planning authorities have a duty to conserve and enhance biodiversity under Section 40 of the Natural Environment and Rural Communities Act 2006 (as amended) which states: *"A public authority which has any functions exercisable in relation to England must from time to time consider what action the authority can properly take,*

*consistently with the proper exercise of its functions, to further the general biodiversity objective.*

90. The 'general biodiversity objective' is defined in Section 30 (A1) of the Act as being:

*"For the purposes of this section "the general biodiversity objective" is the conservation and enhancement of biodiversity in England through the exercise of functions in relation to England."*

91. Section 41 of the NERC Act 2006 (as amended) requires the listing of habitats and species that are of principal importance for the conservation and enhancing of biodiversity in England. This list is used by local authorities in implementing their duty under Section 40. It is for this reason that planning applications should assess potential impacts of the proposals on any relevant habitats or species listed on Section 41.

92. Previously, such habitats and species were identified as priorities within the UK Biodiversity Action Plan (UK BAP). The lists of priority species and habitats agreed under the UK BAP still forms the basis of much biodiversity work in the UK and Action Plans developed under the UK BAP remain important and valuable reference sources for background information.

#### ***Biodiversity Net Gain***

93. The Environment Act 2021 sets out the key components of mandatory biodiversity gain:

- Amends Town & Country Planning Act (TCPA);
- Minimum 10% gain required calculated using the Statutory Biodiversity Metric & approval of a biodiversity gain plan;
- Habitat secured for at least 30 years via planning obligations or conservation covenants;
- Delivered on-site, off-site or via a new statutory biodiversity credits scheme; and
- National register for net gain delivery sites

#### ***Biodiversity Net Gain Supplementary Planning Document***

94. The BNG SPD was adopted by Buckinghamshire Council. It sets out a Buckinghamshire process for achieving net gain and aids planning applicants in ensuring their development would result in a biodiversity net gain. It also sets out a Buckinghamshire process for compensating for losses of biodiversity using off-site habitats and guides landowners in offering their land for BNG.

#### ***National Planning Policy Framework***

95. The NPPF Paragraph 187d states that: *"Planning policies and decisions should contribute to and enhance the natural and local environment by ... minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures and incorporating features which support priority or threatened species such as swifts, bats and hedgehogs"*.

96. The NPPF Paragraph 192b states that: *“promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity.”*
97. The NPPF Paragraph 193a states that: *“When determining planning applications, local planning authorities should apply the following principles: a) if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused.”*
98. The NPPF Paragraph 193d states that: *“When determining planning applications, local planning authorities should apply the following principles.... development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around developments should be integrated as part of their design, especially where this can secure measurable net gains for biodiversity or enhance public access to nature where this is appropriate.”*
99. The NPPF Paragraph 187b states that: *“Planning policies and decisions should contribute to and enhance the natural and local environment by ... recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland”.*

**Core Policy 9: Natural Environment - South Bucks District Core Strategy**

100. Buckinghamshire Council resolved to withdraw the Chiltern and South Bucks Local Plan 2036 on 21st October 2020. The Core Strategy for the South Bucks District area (adopted February 2011) ‘Core Policy 9: Natural Environment’ states that:

*“The highest priority will be given to the conservation and enhancement of the natural beauty of the Chilterns Area of Outstanding Natural Beauty, and the integrity of Burnham Beeches Special Area of Conservation. The conservation and enhancement of the Chilterns AONB and its setting will be achieved by ensuring that all development complies with the purposes of the AONB and its Management Plan.*

*The conservation and enhancement of Burnham Beeches SAC, and its surrounding supporting biodiversity resources, will be achieved through restricting the amount of development in close proximity to the site, and ensuring that development causes no adverse effect on the integrity of the SAC. Further details on mechanisms for achieving this will be given in the Development Management DPD.*

*More generally, the landscape characteristics and biodiversity resources within South Bucks will be conserved and enhanced by:*

- *Not permitting new development that would harm landscape character or nature conservation interests, unless the importance of the development outweighs the harm caused, the Council is satisfied that the development cannot reasonably be*

*located on an alternative site that would result in less or no harm and appropriate mitigation or compensation is provided, resulting in a net gain in Biodiversity.*

- *Seeking the conservation, enhancement and net gain in local biodiversity resources within the Biodiversity Opportunity Areas, on other non-designated land, on rivers and their associated habitats, and as part of development proposals.*
- *Maintaining existing ecological corridors and avoiding habitat fragmentation.*
- *Conserving and enhancing landscapes, informed by Green Infrastructure Plans and the District Council's Landscape Character Assessment.*
- *Improving the rural/urban fringe by supporting and implementing initiatives in the Colne Valley Park Action Plan.*
- *Seeking biodiversity, recreational, leisure and amenity improvements for the River Thames setting where opportunities arise, for example at Mill Lane (see Core Policy 15).*

*Further guidance on the protection and enhancement of landscape and biodiversity resources will be given in the development Management DPD."*

### **Ref. 6.5 Ground conditions, Contamination, Land take and Soils**

101. We agree there is the potential for likely significant effects relating to ground conditions, contamination, land take and soils and so this topic should be scoped into the EIA. This is particularly the case given the wide variety of wastes that have been disposed of at the site over the long period of its history, including those that pre-date any proper pollution control.

102. A Ground Conditions and Geo-environmental Report and a Remediation and Verification Strategy will need to accompany the DCO. Depending on what information is submitted, the Council may recommend conditions requiring the following:

- preliminary risk assessment;
- site investigation;
- remediation strategy;
- verification plan;
- validation report;
- reporting of unexpected contamination.

103. The above would need to be undertaken in accordance with the Environment Agency's 'Land contamination risk management (LCRM)' guidance<sup>5</sup>, available online at <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>.

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<sup>5</sup> Government Guidance Land contamination risk management (LCRM) 12 June 2025

## **Ref. 6.6 Built Heritage**

104. It is to be noted that this consultation response is based on a desk-based review only. No site visit has been undertaken by the heritage officer, and therefore it has not been possible to verify topography, intervisibility, screening or experiential aspects of setting.
105. Heritage assets are an irreplaceable resource that should be conserved in proportion to their significance. The scale of the development (in excess of 40m in height) and extent of the proposed study area (75.6 Ha) means that there are a wide range of heritage assets potentially affected by the development proposals. The Council agree that there is the potential for likely significant effects relating to Built Heritage and so this topic should be scoped into the EIA.
106. The proposed scope and methodology for the assessment of built heritage are considered inadequate and require revision to ensure compliance with:
- National Planning Policy Framework (NPPF), Chapter 16
  - National Policy Statement for Energy (EN 1), particularly Section 5.9 (Historic Environment)
  - Historic England guidance on Managing Significance in Decision- Taking in the Historic Environment (GPA1)
  - Historic England guidance on Setting of Heritage Assets (GPAN3)
  - Historic England guidance on Tall Building (GPAN4)
107. There are no designated or non-designated heritage assets located within the site. The site is not located within a conservation area or Registered Park and Garden. The report highlights the large number of heritage assets in proximity to the site. The EIA scoping document recognises the following heritage assets are potentially affected by the development:
- Grade II listed Moat Farmhouse and associated buildings
  - Hyde Farmhouse and Hyde Farm Barns – Grade II listed buildings
  - Bulstrode Park (Grade II\* Registered Park and Garden 400m to the west) including Bulstrode House and Pigeon Tower by James Wyatt (Grade II listed buildings)
  - Hedgerley Green Conservation Areas (220m to the south beyond the M40, and which includes Manor Farmhouse; outbuildings NE of Manor Farmhouse; Leith Grove, Hammer Cottage and Harp Cottage, all Grade II listed buildings)
  - Hedgerley Village Conservation Area (950m to the south of the site beyond the M40 which includes a high concentration of listed buildings including the Grade II\* Parish Church of St Mary the Virgin).

108. However, this list is not considered comprehensive, creating a risk that the effects of the proposed development on heritage assets will be under-reported.

109. The Site lies within the Green Belt and forms part of a historically rural landscape. There is currently no meaningful consideration of:

- The historic landscape context of nearby heritage assets
- The role of openness in their setting
- The relationship between restored landfill landform and historic character.

110. The ZTVs in Appendix 2 indicate that visibility of the development is wide reaching and extends beyond the study area. There is therefore potential for long-range and cumulative impacts on heritage assets that have not been captured. It is also noted that the scale of the proposed development represents a step change in scale to all nearby settlements and local development patterns including in the nearby RPGs and CAs. A comprehensive assessment of the setting and significance of a wider range of heritage assets than currently scoped is therefore required.

111. Re paras 6.6.25-26 - The Scoping Report references an initial study area and its subsequent reduction to a 2Km radius. However, it does not clearly define:

- The basis for selection of study area
- Use of Zone of Theoretical Visibility (ZTV)
- The basis that heritage assets were scoped in or out of further assessment
- The tiered approach to heritage assessment
- The worst case scenario in terms of extent of built form and height

To be confident of establishing a robust baseline, the above should be reconsidered and reconciled.

112. Re paras 6.6.34-37 - The Scoping Report lists designated heritage assets potentially affected by the development. Given the current uncertainty surrounding the defined extent of the study area and the potential worse-case impacts of development, it is likely that additional assets will be identified through the planning process.

113. Re para 6.6.39 - Non-designated heritage assets, including those on the Buckinghamshire Local Heritage List, are not shown on the Heritage Asset Plan (Fig 9) nor identified as being potentially affected by the development.

114. Re para 6.6.48-49 - Whilst this provides a basic spatial/landscape overview, the assessment of whether assets should be scoped in or out of further assessment is based primarily on proximity to, and intervisibility with, the site. The setting of heritage assets is not solely visual and may include functional relationships (e.g. agricultural or estate context), historic landscape character and experiential and associative qualities.

115. Re paras 6.6.51-52 - It is acknowledged that the settings of heritage assets change over time. Traffic noise and modern infrastructure might well detract from the significance of those settings, but it does not necessarily exclude them from an asset's setting.
116. Re paras 6.6.56 -This approach relies on a generic EIA sensitivity/magnitude methodology which is not consistent with national heritage policy or best practice. The Scoping Report does not demonstrate a methodology based on the staged approach set out in Historic England's Good Practice Advice Note 3 identifying:
- A significance-led baseline assessment
  - Identification of the contribution of setting to significance
  - Assessment of harm against significance. This should all impacts (not limited to visual change) and be based on worst-case parameters (maximum building/stack height). The assessment does not currently include several important pathways by which heritage assets may be affected, including:
    - Lighting impacts (including aviation lighting on stacks)
    - Night-time character and loss of dark skies
    - Noise and tranquillity affecting setting
    - Interaction with public rights of way and heritage experience
  - Mitigation - The report suggests that visual containment (bundling, screening, landscaping) will mitigate effects. However, any proposals coming forward for planting mitigation should consider the appropriateness and existing / historic character of the landscape. Landscape mitigations can introduce permanent harm where the landscape character and views contribute to the setting and significance of heritage assets.
117. Re para 6.6.94 - The report provides only generic references to cumulative assessment and does not include heritage-specific consideration of cumulative change arising from:
- Existing infrastructure (M40, pylons, landfill operations)
  - Restored landfill landform
  - Other consented or proposed development
118. While the inclusion of built heritage within the EIA scope is supported, the Scoping Report in its current form does not provide sufficient assurance that the likely impact of the development on all heritage assets potentially affected would be assessed. This risks the significance of heritage assets and the extent of harm arising from the proposed development being systematically underestimated.

119. It is therefore recommended that the scoping methodology is amended to:
- Provide a worst-case scenario for the basis of assessment
  - Adopt a heritage-led framework based on significance
  - Revise the list of the scoped-in assets to include all heritage assets where there is potential intervisibility between heritage assets and the proposed development, or where significance is otherwise impacted by changes in the surrounding landscape. This includes circumstances where there is no direct intervisibility and/or where harm may arise through the severing of historic relationships.
  - Distinguish clearly between heritage and landscape/visual impacts
  - Address cumulative effects
  - Provide a defensible and policy-compliant methodology for assessing significance and harm
120. Without these revisions, the EIA will not provide an adequate basis for informed decision-making in respect of the historic environment.

### ***Ref. 6.7 Landscape and Visual Impact***

121. The Council agree that there is the potential for likely significant effects relating to landscape and visual matters and so this topic should be scoped into the EIA.

#### ***Baseline conditions***

122. The Council do not agree with assessing the proposed development against two baselines - i.e. the current site (part restored, part operational) and the future restored site. The current site conditions are irrelevant, as it is the current planning obligation to restore the site, secured as part of the consent for current operations on site, that establishes the relevant baseline. The 'existing baseline of a partially restored site' should not be used in the assessment of landscape and visual effects.

123. The study area should be a 3km offset from the site boundary, not from a point in the centre of the site.

#### ***Visibility***

124. The scoping document indicates there are partial views to the existing site available from locations such as public footpaths in the western part of Bulstrode Park. Similarly, there are partial/occasional views from footpath GEC/12/1 at the site's southern margins. These should be represented in the selection of photographic views used in support of the LVIA.
125. There is a lack of clarity whether there are views from Bulstrode Park House and Garden or not - the Assessment of Effects sections suggest there would be, while the description of visual receptors suggests there would not.

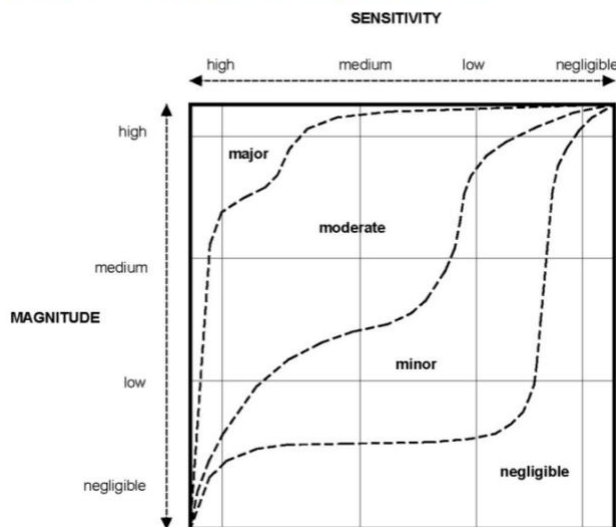
**Receptor susceptibility**

126. The Council consider people walking through residential areas to be highly susceptible visual receptors, as these will mostly be residents in the vicinity of their own homes.

**Significance of effects**

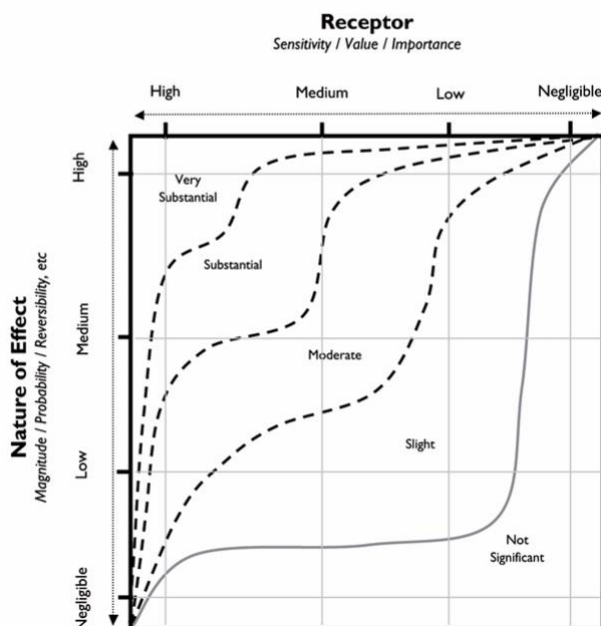
127. The Council do not agree with use of the applicant's proposed significance matrix, presented as this and stating it is based on a matrix published by the IEMA:

Figure 11 Levels of Significance for Landscape and Visual Effects<sup>190</sup>



128. The Council has considered the original figure published by the IEMA in 'The State of Environmental Impact Assessment in the UK' 2011, which presents the following figure:

Figure 6.3: EIA significance evaluation matrix



129. It is clearly evident that the applicant has simply merged effects of 'substantial' significance with those of 'moderate' significance. There's no explanation as to why this has been done. The result is it downplays the significance of effects that might otherwise be assessed as 'substantial' according to the IEMA matrix. It also indicates that that only the very worst effects (high magnitude of change in a highly sensitive landscape/view) are likely to be considered major in the applicant's matrix. This approach lacks balance, and notwithstanding the applicant's statement that both major and moderate effects will be considered significant, there is an important perceptual difference between moderate and major effects.

130. If merging of the IEMA categories is to be undertaken, a more balanced approach would be to merge the 'substantial' and 'very substantial' categories, as 'substantial' and 'major' are better aligned as descriptive terms. It is my experience that that a medium magnitude of change in a highly sensitive landscape/view, for example, is likely to result in effects of major significance. Alongside any such table, professional judgements will be applied in each scenario throughout the assessment, of course, but a balanced starting point is necessary to minimise any bias.

### ***Mitigation***

131. Mitigation measures should address all likely adverse effects upon landscape and/or visual amenity, regardless of whether they are considered significant or not, as part of good design.

132. Para 6.7.122 of the scoping document indicates that loss of openness will not be given weight if the site is identified as grey belt. The Council does not see that as relevant to the assessment of landscape and visual effects as green belt is not a landscape designation or consideration. Openness is often a key landscape characteristic, especially outside of built-up areas, and its loss cannot be excluded from assessing harm to the landscape and visual environments.

### ***Photomontages***

133. The views to be worked up into full photomontages should be agreed with the council's landscape architect prior to completion and submission of the ES.

### ***Impacts to be scoped out***

134. The Council does not think vapour plumes should be excluded from the assessment of effects, as these can be significant if temporary features.

### **Ref. 6.8 Project Vulnerability (Major Accidents and Disasters)**

135. The Council agree that there is the potential for likely significant effects relating to Project Vulnerability (Major Accidents and Disasters) and this topic should be scoped in to the EIA.
136. Depending on the nature of the site and whether it falls under COMAH or REPIR legislation will dictate whether Applicants are required to have an onsite emergency plan as well as an off-site plan. In these circumstances, if it is just an on-site plan then the Council would ask for a copy for awareness. If it includes an offsite plan then the Council would wish to have involvement and understanding of what that contains.
137. Blue light services, particularly fire, would have a significant part to play in understanding the risks and mitigation.
138. The Council's Business Assurance team manage the Council's risk register and there is a dedicated officer for that role.
139. As the Local Resilience Forum (LRF) is large in comparison to the rest of the UK there are four county wide resilience groups that cover Berks/Oxon/Milton Keynes and Bucks. The Council's Resilience Team chair's the Bucks group who meet quarterly. There is a process to highlight this development through that group for awareness.
140. Should the proposals go ahead and after it is up and running the Council's Resilience Team would wish to visit the site and to build a relationship with the emergency management leads.

### **Ref. 6.9 Noise and Vibration**

141. The Council agree that there is the potential for likely significant effects relating to noise and vibration and so this topic should be scoped into the EIA.
142. Regarding the current and future baseline conditions, it is considered that the current planning obligation to restore the site, secured as part of the consent for current operations on site, establishes the relevant baseline.
143. The noise associated with the current site activities includes gravel crushing and will cease following the cessation of the aggregate processing and completion of the restoration programme. It is stated at 6.9.15. that, *these activities do not currently appear to influence the ambient sound environment at the closest noise sensitive receptors. Therefore, the future baseline is considered comparable to current conditions*

*for the purposes of this assessment.* This statement is not considered a sufficient basis to conclude that the future baseline is comparable to current conditions. This must be substantiated.

### **Ref. 6.10 Socio-Economics**

144. The Council agree that there is the potential for likely significant effects relating to socio-economics and so this topic should be scoped into the EIA.
145. There are some recent documents that should be added (at Point 6.10.3) for consideration. These are:
- Buckinghamshire Economic Growth Plan (2025) [Appendix 1 - Buckinghamshire Economic Growth Plan.pdf](#)
  - The Buckinghamshire Works Plan and Buckinghamshire Works Evidence Pack (2026) [The Buckinghamshire Works Plan | Buckinghamshire Council](#)
  - Buckinghamshire Skills and Employment Strategy 2024 to 2029 [https://www.buckinghamshire.gov.uk/documents/29472/Appendix\\_A\\_GD001913\\_Skills\\_and\\_Employment\\_Strategy\\_2024-29\\_v8\\_web\\_6AqQfL1.pdf](https://www.buckinghamshire.gov.uk/documents/29472/Appendix_A_GD001913_Skills_and_Employment_Strategy_2024-29_v8_web_6AqQfL1.pdf)
146. Re the reference at 6.10.5 made to a principal economic area, it would be helpful to understand the area proposed. Whilst accepting that construction benefits are likely to be felt across a wider geography, the Council's focus is upon maximising the economic benefits for Buckinghamshire based residents and businesses. Ideally, the Council would be looking for an area that aligns with local ward and county boundaries. If the area is based on a defined distance from the development this could potentially include areas outside of Buckinghamshire, making assessment of the Buckinghamshire economic benefit more difficult to ascertain.
147. Reference is made to the Indices of Multiple Deprivation 2019 Point (6.10.9) as the most recent source of information of deprivation. More recent deprivation data is however available in the Indices of Multiple Deprivation 2025 [English indices of deprivation 2025: statistical release - GOV.UK](#)
148. Re Table 69 – it would be helpful to know when in 2025 the claimant count data is from. 2026 data is available
149. Re 6.10.15 – this section uses the Annual Survey of Hours and Earnings data for 2024 but the data is available for 2025
150. Re 6.10.16 – the BRES data is from 2023 but the 2024 data is available. This section also does not include any data below the Buckinghamshire level; whilst the data is not

available at the ward level, it is available for Middle Super Output Areas which could be used for an approximation of the Beaconsfield and Gerrards Cross areas.

151. Re 6.10.17 – it would be helpful to understand the actual numbers as well as the percentages – how many jobs and businesses do 6.7% and 10.9% amount to respectively? It is also worth acknowledging that the digital sector is much wider than data centres and includes sub-sectors such as manufacturing and wholesale of electronics and computers, film and television and publishing.
152. Re 6.10.21 – reference is made to the loss of 50 jobs as a result of the site redevelopment. It is noted that the site would be closing irrespective of this proposal, and perhaps not one for the Scoping, but it would be good to understand what support is being offered for those individuals impacted by this.
153. Re 6.10.23 – the proximity of the Crowne Plaza Hotel is noted. Is the potential impact on this business being considered?
154. Re 6.10.30 – there are several references to ‘local’, how is this defined?
155. Re 6.10.29 onwards - It is unclear at what geographical level the socio-economic effects from both the construction and operational phases is to be presented. There are references in the chapter to a principal economic area, study area and local. It would be helpful to clarify the geography of these terms, including how they align or differ. In line with the data presented earlier and to reflect the importance of maximising benefits for Buckinghamshire based residents and businesses, I would ask that, as well as providing overall figures, these are disaggregated where possible to show the benefits and impact expected within the Beaconsfield and Gerrards Cross area and the wider Buckinghamshire area.
156. Reference is made to “potential opportunities for the local population”. This currently seems to apply to employment and supply chain benefits but consideration should be given to extending this to the training and apprenticeship opportunities. I would also suggest that ‘local’ benefits will not simply arise but efforts will need to be made to ensure this – whilst this may not be for the scoping report I would ask that an approach to ensuring local employment, training and procurement opportunities (in both the construction and operational phases) is set out by the Applicant.
157. Re 6.10.38 – if available, it would be helpful to see an occupational breakdown of the jobs expected to be created in the operational phase

158. Re 6.10.40 – exploration of cumulative effects is welcomed. With other data centre proposals, particularly in the south of the county, there is not only the cumulative impact but the potential that Buckinghamshire based residents are accessing the employment and training opportunities from other schemes, meaning this scheme has to look further afield for its employees, thereby reducing its local economic impact.
159. Are the cumulative effects relating to other data centres only or does it also include other major infrastructure projects? Again, with other developments in the area, there is potentially a demand for construction workers that cannot be met by Buckinghamshire residents alone. Again, this could have an impact on the extent of the local benefit.
160. It could be fair to assume that those individuals who are most employment ready will benefit from the opportunities presented by this, and other, schemes. As such, those left will be those with greater barriers to employment and requiring more intensive support; consideration needs to be given to how this will be addressed.
161. Social value adding – will construction and operation be sourcing workers from outside of the county or offering employment opportunities to local people to boost local economy? This would be a possible way to mitigate some of the inevitable negative impacts of the project for residents of Buckinghamshire.

## **Section 7 – Topics Proposed to be Scoped Out of the EIA**

### **Ref. 7.2 Archaeology**

162. Buckinghamshire Council Archaeological Service maintain the local Historic Environment Record and provide expert advice on archaeology and related matters. The Council welcome the inclusion of archaeology within the scoping report. The Council note that the Tetra Tech RPS Archaeological Desk-Based Assessment includes:

*7.2.13. A combination of LiDAR (Figure 3, Appendix 3: Archaeology) Ordnance Survey mapping, historic landfill mapping, Historic Landscape Characterisation (HLC) (see Figure 2c) (refer to the DBA within Appendix 3: Archaeology for these figures) held by the Buckinghamshire HER261 and a site visit by the author of this technical section of the EIA Scoping Report, have confirmed that the entire main Site area has been severely truncated by minerals extraction, with later landfill and landscaping creating an undulating entirely modern formation topography. These historic activities would truncate a large portion of the Site, removing any buried archaeology assets.*

*7.2.14. There is a relatively minor exception to this high level of truncation in terms of the western end of the proposed southern internal route which links to the Main Development Area (as indicated on Figure 22) and the contiguous area at the*

*southwestern extent of the Site (see Figure 3, Appendix 3: Archaeology HLC map), which shows a small area of extant farmland enclosure and wood here).*

163. Whilst the Council does not object to archaeology being scoped out, the Council would expect archaeological evaluation to be undertaken as included in section 7.2.17 in the Justification of Scoping Out and sections 7.2.23 and 7.2.24 under Summary of Mitigation.

### **Ref. 7.3 Human Health**

164. The Council acknowledge that many of the health impacts have been covered in other chapters, namely related to noise, air quality, water, climate change, traffic and socio-economics. Therefore we do not object to human health being scoped out of the EIA subject to the following comments.

165. The Gypsy, Roma and Traveller site is located in close proximity to the proposed development. The Chapter recognises this is a vulnerable group and concludes that given the existing condition and location of the site, construction and operation of the proposed development is not expected to result in a material impact on the site or its residents. Given the proximity of a vulnerable group, the Council consider that a combined Health and Equalities Impact Assessment will be appropriate to assess potential effects on health and wellbeing impacts for the location population, including vulnerable groups.

166. The Council would like to see some consideration of the cumulative effects of construction eg: HGV movements, noise, dust, air pollution, vibrations, water usage and ongoing effects post construction, on health and wellbeing, especially on mental health, for nearby residents and vulnerable groups.

167. Similarly, there ought to be some consideration of how the development interacts with other Nationally Significant Infrastructure Projects affecting Buckinghamshire such as HS2, Heathrow expansion and EWR, as the impacts of these occurring simultaneously will not be experienced individually by residents. Large infrastructure projects need coordination and cannot be looked at in isolation.

### **Ref. 7.4 Traffic and Movement**

168. The Council has reviewed the Scoping Report and can agree that transport can be scoped out. The peak traffic movements would be during the construction phase of the development and whilst a relatively high number of HGVs would be expected, these

movements would occur on the strategic road network and are unlikely to result in a significant impact in EIA terms on any sensitive receptors.

169. The Council is therefore satisfied that any impacts of the construction phase of the development can be suitably mitigated through the use of a strict CTMP which secures measures including the routing of vehicles and a daily cap on HGVs.

### ***Ref. 7.5 Waste and Materials***

170. The Council agree that waste that can be scoped-out insofar as it relates to waste created during the construction and operation of the proposed development, on the assumption that the presence of the existing waste and any significant effects on the environment arising from its disturbance will be addressed through the Ground Conditions and Contamination chapter and other chapters as may be pertinent following the assessments proposed.

### ***Ref. 7.6 Water Resources and Flood Risk***

171. The Council have reviewed the information submitted in the EIA Scoping Report (Trium Environmental Consulting LLP, dated April 2026) to accompany this Scoping Request. In terms of water resources (usage) it is noted at 3.4.4. that air cooling *is expected* (our emphasis) to be used (rather than water cooling) for the operational Energy Centre. Should water be required for cooling purpose this could have a significant bearing on the environmental impact of the proposals and should be addressed in the EIA.
172. Buckinghamshire Council as the Lead Local Flood Authority (LLFA) agrees with the conclusions of Chapter 7.6 - Water Resources and Flood Risk, that surface water flood risk and surface water drainage should be scoped out of the EIA.
173. The EIA should be accompanied by technical documents including a site-specific Flood Risk Assessment and Drainage Strategy which will need to assess surface water flood risk and detail suitable mitigation measures.

**From:** [Clerk](#)  
**To:** [SDC M40 Campus](#)  
**Subject:** SDC M40 Campus  
**Date:** 20 May 2026 16:55:12

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You don't often get email from [clerk@burnhamparish.gov.uk](mailto:clerk@burnhamparish.gov.uk). [Learn why this is important](#)

Good morning

Thank you for the letter of 29th April concerning this site.

Burnham Parish Council maintains an open position on the application in general, and will submit its view when a full application is received.

We wish to raise the following points with regard to the scoping report.

1. Section 3.4: Energy Centre. We are concerned about the impact of the gas turbines, particularly given that they are air cooled.
  1. Has sufficient consideration been given to greener and more sustainable options?
  2. Is the intended gas based solution planned as an initial stage, before the National Grid has capacity, or is it a middle stage using existing capacity?
  3. Is the mitigation of this proposed solution sufficient, particularly with regard to the heat generated?
  4. Why has greater consideration not been given to using this heat for local use at an initial stage, rather than *potentially* using it in the future?
  5. Has sufficient consideration been given to the impact on the transport network of the proposed solution?
  6. Has sufficient work been carried out to measure the likely impact on air quality of the proposed solution?
  
2. Section 3.14 Drainage and Utilities We are further concerned that the work done on water, drainage and sewage is insufficient.
  1. Minimal detail is given about the treatment - rather a set of possible options - and significantly more work is needed on these.
  2. Clarity is needed as to where contaminated water would be removed to and how it would be processed.
  3. Further work is required to ensure that the use of the “local potable water network” does not affect local supply.
  
3. Section 2: The site. Whilst brief reference is made to the Burnham Beeches Special Area of Conservation under ‘ecology and diversity’, we are concerned that insufficient work has been done on this potential impact and how it will be managed. We feel that much greater consideration is required of this aspect, and that this must be done in conjunction with the Beeches’ owners and with specialist agencies.

With thanks for your consideration,

Adam Killeya, Clerk, on behalf of Burnham Parish Council

--

Adam Killeya (pronouns [REDACTED])  
Parish Clerk and Responsible Financial Officer  
Burnham Parish Council

# Development Management

## Central Bedfordshire Council

Priory House, Monks Walk  
Chicksands, Shefford  
Bedfordshire SG17 5TQ  
www.centralbedfordshire.gov.uk



Environmental Services  
Infrastructure Decisions and  
Applications Service  
Planning Inspectorate  
c/o QUADIENT  
69 Buckingham Avenue  
Slough  
SL1 4PN

**Your Ref** EN0110030  
**Date** 07 May 2026

Dear Sir/Madam,

**Application No:** CB/26/01366/OAC  
**Location:** SDC M40 Campus  
**Proposal:** Planning Act 2008 (as amended) and Infrastructure Planning  
(Environmental Impact Assessment) Regulations 2017:  
Scoping consultation response

Thank you for your letter of 29 April 2026 regarding the scoping consultation for the proposed SDC M40 Campus Nationally Significant Infrastructure Project.

Central Bedfordshire Council has reviewed the Environmental Impact Assessment Scoping Report (April 2026) and, given the distance of the proposed development from the Council's administrative area, has no comments to make at this stage.

Yours faithfully,

**Ben Borthwick**  
Principal Planning Officer

# CHALFONT St. PETER PARISH COUNCIL

Council Offices, Gravel Hill, Chalfont St Peter, Bucks, SL9 9QX

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Clerk: Mrs Debbie Evans

Environmental Services  
Infrastructure Decisions and Applications Service  
Planning Inspectorate  
c/o QUADIENT  
69 Buckingham Avenue  
Slough  
SL1 4PN

13th May 2026

Email: [sdcm40campus@planninginspectorate.gov.uk](mailto:sdcm40campus@planninginspectorate.gov.uk)

Dear Planning Inspectorate,

## Scoping Response – SDC M40 Campus (Ref: EN0110030)

Please find below the response of Chalfont St Peter Parish Council to the Environmental Impact Assessment Scoping Consultation for the proposed SDC M40 Campus (EN0110030).

Chalfont St Peter Parish Council welcomes the opportunity to comment on the scope of the Environmental Statement (ES). Our comments reflect the characteristics of the site, including its history as an extensive former landfill, the presence of areas of original un-landfilled land, its role as a significant wildlife corridor used by three deer species, and the sensitivity of the surrounding Green Belt landscape.

### 1. Ground Conditions, Landfill and Contamination

A comprehensive contaminated land assessment is required, including intrusive ground investigation, waste characterisation, landfill gas risk assessment, leachate pathways, settlement modelling, excavation volumes, waste removal strategy, and human health and ecological risk assessment. Quantification of excavation volumes, HGV movements, and waste classification must be included.

### 2. Ecology, Biodiversity and Wildlife Movement Routes

The ES must include UKHab mapping, protected species surveys, deer population and movement surveys, mapping of wildlife travel routes, habitat connectivity analysis, assessment of fencing and lighting impacts, Biodiversity Net Gain calculation, and assessment of impacts on semi-natural habitats. The site functions as a major wildlife corridor, and the ES must assess barrier effects, severance of movement routes, and mitigation such as green corridors, underpasses, and wildlife friendly fencing.

### 3. Landscape, Visual Impact and Green Belt

The ES must include a Zone of Theoretical Visibility, viewpoints from PRowers and settlements, night-time lighting assessment, assessment of effects on Green Belt openness, assessment against Green Belt purposes, and mitigation planting and massing strategies. A comprehensive LVIA is essential.

### 4. Green Belt Harm Assessment

The ES must include a spatial and visual openness assessment, assessment against the five purposes of Green Belt, a Very Special Circumstances case, and an alternative sites assessment.

### 5. Noise and Vibration

The ES must include baseline noise monitoring, construction and operational noise modelling, assessment of noise impacts on residential receptors, assessment of noise impacts on wildlife including deer, and mitigation measures such as acoustic barriers and plant enclosure.

### 6. Air Quality

The ES must include a dust risk assessment, construction emissions modelling, operational emissions assessment, and ecological receptor assessment. Dust and emissions associated with landfill excavation are of particular concern.

## **7. Traffic, Transport and Public Rights of Way**

The ES must include construction HGV movements, routing strategy, PRow impacts and diversions, assessment of wildlife severance caused by new roads or fencing, and operational staff traffic. Further detail is required on PRow impacts and wildlife movement.

## **8. Water Environment**

The ES must include hydrogeological assessment, leachate migration modelling, surface water drainage strategy, pollution prevention measures, and assessment of impacts on ponds and wetland habitats.

## **9. Cumulative Effects**

The ES must include inter-project cumulative effects, inter-topic effects such as noise, lighting and habitat loss, and cumulative impacts on wildlife corridors.

## **10. Missing Information in the Scoping Report**

The Scoping Report omits several essential elements that must be included in the ES, including wildlife movement routes and deer population assessment, quantification of landfill excavation volumes, waste classification and disposal strategy, PRow diversion detail, Green Belt harm assessment, alternative sites assessment, visualisations and LVIA figures, noise modelling, air quality modelling, and hydrological and hydrogeological modelling.

These omissions must be addressed in the ES.

## **11. Heritage, Archaeology and Historic Landscape**

The ES must include a full assessment of designated and non-designated heritage assets within the study area, including their setting, significance, and sensitivity to change. This must cover built heritage, archaeological potential, historic landscape character, and any assets identified through local heritage lists or historic environment records.

A setting assessment is required to understand how the proposed development, associated earthworks, lighting, traffic, and massing may affect the appreciation, tranquillity, or historic context of nearby heritage features. The ES must also assess cumulative effects on heritage significance, including indirect impacts such as noise, lighting, changes to landscape character, and loss of openness.

Given the site's long history of landfilling and the presence of areas of undisturbed ground, the ES must include archaeological desk-based assessment, geophysical survey where feasible, and a strategy for intrusive investigation that accounts for contamination risks. Mitigation measures, including preservation in situ, design-led avoidance, and recording strategies, must be clearly set out.

## **Conclusion**

Chalfont St Peter Parish Council requests that the Planning Inspectorate require the applicant to include all of the above information in the Environmental Statement. The site's sensitivity as a former landfill, semi-natural landscape, and key wildlife corridor demands a comprehensive and robust EIA.

Yours faithfully,

Prof Cllr Diane Mynors  
Chairman of Amenities and Planning Committee  
**On behalf of Chalfont St Peter Parish Council**  
**Amenities and Planning Committee**

**From:** [REDACTED]  
**To:** [SDC M40 Campus](#)  
**Subject:** Ref: EN0110030 - SDC M40 Campus (26/00990/CON)  
**Date:** 14 May 2026 09:37:52  
**Attachments:** [image001.jpg](#)

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You don't often get email from [REDACTED]@dacorum.gov.uk. [Learn why this is important](#)

Dear Sir / Madam,

Please be advised that Dacorum Borough Council does not have any comment to make on the EIA scoping opinion.

Yours faithfully,

**James Gardner**  
**Principal Planning Officer**

[REDACTED]

E: [REDACTED]@[dacorum.gov.uk](mailto:[REDACTED]@dacorum.gov.uk)

A: The Forum | Marlowes | Hemel Hempstead | Hertfordshire | HP1 1DN

*Please note that the officer advice in this letter is given in good faith on the basis of the information available at the present time. The advice may be subject to revision following further examination or consultation, or where additional information comes to light and is therefore not binding on any future recommendation which may be made to the Council or any formal decision by the Council*

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Planning Inspectorate  
Email: [sdcm40campus@planninginspectorate.gov.uk](mailto:sdcm40campus@planninginspectorate.gov.uk)

Our ref: OR-0003633/01  
Your ref: EN0110030  
Date: 27 May 2026

Dear Sir/ Madam,

**Planning Act 2008 (as amended) and The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (The EIA Regulations) – Regulations 10 and 11**

**Application by Slough Holdings UK Limited (the applicant) for an Order granting Development Consent for the SDC M40 Campus (the proposed development) Scoping consultation**

Thank you for consulting us on the above Scoping Consultation which was received on 29 April 2026.

The Environment Agency has reviewed the *SDC M40 Campus - Environmental Impact Assessment Scoping Report undertaken by Slough Holdings UK Ltd for the above scheme, Dated: April 2026*.

We have the following comments to make regarding the proposed scope of the Environmental Statement (ES).

For the topics within our remit, we broadly agree with the topics that have been scoped in. We further recommend inclusion of the following detailed advice that we have addressed in Appendix A in issue/impact/solution format.

There are currently topics proposed to be scoped out, which we consider should be scoped in which are addressed below and discussed in detail in Appendix A and highlighted in bold:

- **Water Resources and Flood Risk**

Final comments

Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact me on the details below.

Yours sincerely

**Ms Noreen Nargas (MRTPI)**

**Planning Specialist**

Direct dial [REDACTED]

Direct e-mail [REDACTED]@environment-agency.gov.uk

## **Appendix A**

### **Regulated Industry - Permitting**

#### **Energy Centre**

The mandatory EPR permitting for natural gas Energy Centre (clearly >50MWth) is not detailed and hence the full implications on plant design and abatement requirement are not present in the scoping report (*attached guides for information, please see email attachments*):

- Regulatory Framework for Embedded Generation at Data Centres - March 2026
- Combustion (Part A) pre-app basic advice

The absence of detail on the installed plant energy centre design and configuration risks that final implementation might not be permissible under EPR and IED BAT without modifications or additional controls.

Pre-application or twin-tracking for EPR >50MWth IED permit. Review/update the current baseline scoping with the additional information regarding the Energy Centre operations BAT (Best Available Technique) in detail and specifically energy efficiency.

<b>Document Reference(s):</b> Environmental Impact Assessment Scoping Report April26 4.2.16 National Policy Statement for Natural Gas Electricity Generating Infrastructure (EN-2) 3.6. Decarbonisation Readiness including 5.10. and 6.2.64, 6.5.50 etc 3.8. Waste Heat Recovery – efficiency of combustion plant	
<b>Issue</b>	EPR for Energy Centre Aggregated >50MWth
<b>Impact</b>	Emission to air of NOx and dust/particulate Energy efficiency of power plant Decarbonisation and carbon capture options <a href="#">Decarbonisation readiness in environmental permit applications - GOV.UK</a>
<b>Solution</b>	LCP BAT and additional abatement (SCR and DPF) need to be more detailed. Clear target for energy efficiency meeting BAT needs to be outlined.

Heat recovery, only mentioned in the context of the Data Centre, should also potentially include the power plant operations (e.g. CCGT mode or Combined Heat and Power (CHP))

Scoping should ideally consider both decarbonisation routes. Outline detail of decarbonisation readiness if hydrogen fuel availability is limited i.e. carbon capture plant readiness.

**Additional narrative/ explanation (if necessary)**

Review/update the current baseline scoping with the additional information regarding the Energy Centre operations BAT in detail and specifically energy efficiency. BAT for emission to air and abatement is also needed. Outline of detail of Decarbonisation readiness including carbon capture plant readiness (or provide space to retrofit).

The report does not specify the scale or technology of the proposed >50MWth energy centre (e.g. OCGT, CCGT, or engines). As a result, it is unclear how Best Available Techniques (BAT) may influence the output of the Air Quality assessment, beyond general references in planning policy and brief mentions on air quality impacts.

Combustion plant >50MWth falls under Part A(1) of the Environmental Permitting Regulations. Installations of 20MWth or more must also assess opportunities for high-efficiency cogeneration under the Energy Efficiency Directive.

If the scheme comprises either multiple units >15MWth totalling over 50MWth (into a common stack), or a single OCGT/CCGT >50MWth, it would be classed as a Large Combustion Plant under IED Chapter III. Applicable emission limits depend on annual operating hours, with stricter requirements above 1,500 hours/yr.

The Environment Agency must base permit conditions on published BAT conclusions. Current BAT does not support baseload OCGT operation or CCGT in open-cycle mode due to poor efficiency, typically around 20% lower than combined-cycle operation (45%–55%).

The data centre is expected to reach up to 300MWe IT load. The associated gas-fired energy centre could supply up to 350MWe, and it is uncertain whether hydrogen supply via the gas network is feasible. A technical and economic assessment of CO<sub>2</sub> capture, transport, and storage is therefore likely required (previous CCS and readiness threshold was >300MWelec).

The following issues will be considered as part of the permitting process for aggregated plant as an energy centre:

1. OCGT/CCGT as IED Chapter III LCP – LCP Bref directly applicable for 24/7 baseload power plant (>1500hours)
  - i. LCP BAT and BAT AELs
  - ii. IED LCP ELVs
  - iii. Different BAT criteria may apply for when the power plant moves to peaking <1500hours and exports to the grid i.e. the data centre goes fully on electricity grid (if/when grid capacity is available)
2. Or reciprocating engines typically each <15MWth under IED Chapter II >50MWth aggregated.
  - a. Environment Agency minimum the selection of emissions optimised ignition engines meeting 95mg/m<sup>3</sup> as new plant MCP (covering legal minimum as specified generator under SG regs).
  - b. BAT under EPR permitting may require Selective Catalytic Reduction (SCR) to reduce NOx emissions to tighter than 95mg/m<sup>3</sup>; typically, 40mg/m<sup>3</sup> – target LCP equivalent
    - i. the scale of the energy centre
    - ii. proximity to M40 motorway
    - iii. proximity of NOx source landfill gas plant (24/7 operation)
    - iv. proximity to proposed standby engines and their engine test and maintenance emissions
    - v. proximity of downwind sensitive receptors (e.g. Beaconsfield) & SSSI (Burham Beeches, Hodgemoor Wood)
    - vi. Reliability and maintenance of the energy centre power plant (being a substitute for the UK Grid) may require the standby engines to run more often in support and hence affect standby AQ modelling impacts and potentially standby permitting.
    - vii. Possible applicability of NOx and Dust/particulate damage costs emissions to air as policy like (e.g. [Air Quality SPD](#)) (being a local authority remit)
3. Efficiency BAT and waste heat (LCP Chapter III or Chapter II)
  - a. Heat recovery is mentioned only in the context of the Data Centre not as part of efficient power plant operations (e.g. CCGT mode or Combined Heat and Power (CHP))

- b. Embedded generation at data centres should use combined cycle generation or increase the efficiency of open cycle generation to an equivalent energy efficiency of LCP BATc
4. Decarbonisation readiness is proposed through hydrogen conversion only; it is not clear if this is limiting the scope of appropriate plant OCGT/CCGT, gas engines for the prior period running on natural gas and thus compromising other BAT generally i.e. the plant BAT for energy efficiency may not be readily convertible to hydrogen (or readily convertible to hydrogen may not be very energy efficient) and hence item 5 below
5. Risks that provision of decarbonisation readiness through hydrogen conversion only, without any detailed justification or assessment, precludes the option for Carbon Capture readiness in plant design and layout [Carbon Capture Readiness \(CCR\): a guide on consent applications - GOV.UK \(Post-combustion carbon dioxide capture: emerging techniques - \)](#)
6. Stacks for the exhaust of baseload 24/7 emissions are of sufficient height for acceptable dispersion reducing impacts to sensitive receptors.
7. Noise and vibration levels are acceptable and to BAT for EPR permitting. <https://www.gov.uk/government/publications/noise-and-vibration-risk-assessment-using-the-noise-advisory-tool/noise-and-vibration-environmental-permit-application-guidance#:~:text=5.2%20Power%20generation%20or%20back%20up%20and%20peaking%C2%A0>

### Standby Generators

The mandatory EPR permitting for Standby Generators is not detailed and hence the full implications on plant design and abatement requirement is not present in the scoping report (attached guides):

- Regulatory Framework for Embedded Generation at Data Centres - March 2026
- Combustion (Part A) pre-app basic advice 2
- Data Centre Air Quality Appendix to Combustion Pre App v1.1\_external circulation

The absence of detail on the proposed standby plant design and configuration risks that final implementation might not be permissible under IED and BAT.

Pre-application or twin-tracking for EPR >50MWth IED permit aggregated standby.  
 Review/update the current baseline scoping with the additional information regarding the standby engine BAT in detail and AQ impacts (testing, maintenance and major outages of the energy centre).

Incorporate EA Pre-application guidance on modelling air impacts of data centres into Air Quality Assessment

<b>Document Reference(s):</b> Environmental Impact Assessment Scoping Report April 26 6.2. AIR QUALITY specifically 6.2.58 page 84. Also 3.2.12 for >50MWth	
<b>Issue</b>	EPR for Standby Aggregated >50MWth for the data centre
<b>Impact</b>	Emission to air of NOx and Dust/particulate for the standby engines. Fuel storage and potential spills
<b>Solution</b>	Standby BAT including fuel type, additional abatement (SCR and DPF), noise, stacks, minimised test regime.  BAT for fuel and SCR reagent storage and protection of ground and surface water  Review/update the current baseline scoping with the additional information regarding the Standby operations BAT in detail.  Whether the applicant will need to go beyond BAT and install and optimise Selective Catalytic Reduction (SCR) to reduce emissions further. This is likely where air quality is poor, multiple sites using aggregated back-up engine co-locate, or engine test regimes include testing multiple engines at once.
<b>Additional narrative/ explanation (if necessary)</b>  Review/update the current baseline scoping with the additional information regarding the Standby operations BAT in detail.  The report does not indicate the actual scale of the MWelec installation of standby emergency diesel plant and hence the number and size of engines. Combustion activities above 50MWth net rated input are Part A(1) activities under the Environmental Permitting Regulations. The applicant has not discussed Best Available Techniques (BAT) in detail {but under Scoping document: Policy and Guidance 4.1.14(k) Pollution Control and Regulatory Regimes (4.12) makes some reference to BAT; also standby gensets Air Quality 6.2.59 "Selective Catalytic Reduction (SCR) Maintenance"}  	

The data centre is understood to be up to 300MWelec IT load (3x100MW blocks) in total; depending on Power Usage Effectiveness (PUE) (1.2-1.3) and n+1 resilience this might equate to 150-200 2MWelec rated standby gensets.

The natural gas energy centre powering the site may be up to 350MWelec (for 2x100MW IT) but this would not substitute the diesel standby requirement, as both are needed; and could well share the load demand and operate in parallel under certain power outage conditions.

The following issues will be considered as part of the permitting process for aggregated diesel generators:

Impacts from air emissions from both (a) the testing and maintenance regime and (b) the worst-case emergency scenario of all engines running continuously for 72 hours. Air Dispersion modelling will assess impact to both air quality standards and Acute Exposure Guideline Levels for Oxides of Nitrogen.

The applicant has not discussed Best Available Techniques (BAT) namely;

1. Environment Agency minimum the selection of emissions optimised ignition engines that are compliant with USA EPA Tier II / TA Luft standards '2g'. The physical configuration should be 'SCR-ready' for retrofit of additional abatement if needed. Further guidance on BAT for engine design standards is published here <https://www.gov.uk/guidance/emergency-backup-diesel-engines-on-installations-best-available-techniques-bat>;
2. However EPR permitting engagement and BAT review there may be a need for **Standby diesel beyond-BAT and Selective Catalytic Reduction (SCR) to reduce NOx emissions (<190mg/m<sup>3</sup>) and diesel particulate filter (DPF)**. This is because *{operator is mentioning SCR in the scoping for additional emission abatement but not specifically stated as being fitted as standard}*
  - a. the scale of the installed standby (possibly equivalent to exceeding 150+ 2WMelec gensets)
  - b. proximity to M40 motorway
  - c. proximity of NOx source landfill gas plant (24/7 operation)
  - d. proximity to proposed continuous >50MWth energy centre as a NOx source
  - e. proximity of downwind sensitive receptors (e.g. Beaconsfield) & SSSI (Burham Beeches, Hodgemoor Wood)

- f. Possible applicability of NOx and Dust/particulate damage costs (engine testing and one-off electrical outage) emissions to air as policy like [Air Quality SPD](#) (being a local authority remit)
- g. Reliability and maintenance of the energy centre power plant (being a substitute for the UK Grid) may require the standby to run more often in support including electively for energy centre maintenance and overhaul works. This could potentially impact on standby AQ impacts and permitting.
- 3. Maintenance and testing regime that minimises the impact to air quality by minimising and sequencing of testing.
- 4. Fuel storage (COMAH quantities?) and, where applicable, SCR reagent (urea) storage standards for ground and surface water protection.
- 5. Stacks for the exhaust of emissions for back-up diesel generation are vertical and of sufficient height above nearby buildings and flow is unimpeded.
- 6. Use of an Air Quality Manage Plan (AQMP) to manage and monitor air quality risks during site standby maintenance, testing and outage operations. Potential inclusion of ambient AQ monitoring stations.
- 7. Choice of fuel as BAT: diesel or Hydrotreated vegetable oil (HVO)

### COMAH

The scoping document does not assess the likely total standby fuel storage quantities as potentially elevating the site to a lower tier COMAH. This may require a Major Accident Prevention Policy - MAPP and meet the other Core Lower Tier Requirements. We recommend that you review/update the current baseline scoping with the additional information regarding the total fuel stored on site for standby operations and handling under COMAH.

<b>Document Reference(s):</b> Environmental Impact Assessment Scoping Report April26. 6.8.14 PROJECT VULNERABILITY (MAJOR ACCIDENTS AND DISASTERS)	
<b>Issue</b>	COMAH
<b>Impact</b>	Is potential a lower Teir COMAH for the total quantity of standby diesel fuel stored
<b>Solution</b>	May require a Major Accident Prevention Policy - MAPP and meet the other Core Lower Tier Requirements.  Link <a href="#">understanding-comah-new-entrants.pdf</a>

**Additional narrative/ explanation (if necessary)**

The site needs to address directly COMAH in relation to the total quantity of fuel stored on site used primarily for the standby engines.

Lower Tier: 2,500 tonnes diesel. This may equate to roughly 150 gensets with standard 20,000litre belly tanks. We think the site may be at a scale reaching lower tier COMAH but the detail is not clear.

Hazardous Substances and Major Accidents (4.14): Developments involving hazardous materials or presenting major accident risks must comply with the Control of Major Accident Hazards (COMAH) Regulations. Applicants should demonstrate robust containment, safety management, and emergency response measures proportionate to identified risks. Is reference in the report overall.

**Groundwater and Contaminated Land**

Water Resources and Flood Risk has been scoped out (discussed in section 7.6 of the Scoping Report). We **disagree** with this decision due to several important topics being omitted from the justification.

<b>Document &amp; chapter: Section 7.6</b>	
<b>Issue</b>	Effects on water resources, including groundwater, have been scoped out without sufficient consideration of potential impacts (construction, operation and decommissioning). Justifications are not currently sufficient.
<b>Impact</b>	Potential risks to groundwater if risks are not adequately assessed.
<b>Solution</b>	Consider scoping in groundwater (construction, operation and decommissioning) or provide more robust justification and proposed mitigation for its omission.
<b>Additional dialogue / commentary:</b>	
The justification for scoping out the Water Environment includes insufficient detail regarding,	
<ul style="list-style-type: none"><li>• BESS operation, drainage, fire risk, and firewater management</li><li>• Substation drainage, fire risk and firewater management</li><li>• Piled foundations for BESS and substations</li><li>• Identification of all groundwater receptors</li></ul>	

- Sensitivity of groundwater receptors at the site

Further work is needed. We are not satisfied the applicant sufficiently understands the geological and hydrogeological setting of the site to justify scoping it out of further assessment.

Some of the proposed further works and mitigation are likely to be sufficient, but they do not cover all aspects of the proposed development. Higher risk elements, such as the BESS, have not been adequately considered.

It is not clear how a battery fire, a reasonable worst-case scenario, would be managed. We have no information about how drainage will be managed at the BESS and substation which makes it difficult to agree to scoping out groundwater from further assessment at this stage.

See informatives at end of response relating to BESS design and Substation drainage.

**Document Reference(s): 4.2.15**

<b>Issue</b>	Water Framework Directive groundwater bodies are present beneath the site but have not been mentioned within the scoping report.
<b>Impact</b>	Impacts to WFD receptors could be unmitigated
<b>Solution</b>	Assess all receptors by completing a WFD assessment in accordance with Environment Agency guidance

**Additional narrative/ explanation (if necessary)**

Reference is made to the need for Applicants to demonstrate compliance with the objectives of the Water Framework Directive, but it is not mentioned within the water resources section.

Two groundwater bodies are present, the Radlett Tertiaries (GB40602G602800) and the Mid-Chilterns Chalk (GB40601G601200).

[Nationally Significant Infrastructure Projects: Advice on the Water Framework Directive - GOV.UK](#)

<b>Document &amp; chapter: 3.3.4 and 3.4.7</b>	
<b>Issue</b>	The scheme will include excavation of existing ground levels. The anticipated depth of this excavation is not known. The potential need to dewater groundwater and/or leachate to facilitate this excavation has not been discussed.
<b>Impact</b>	Dewatering without ensuring the appropriate licences and mitigation measures are in place could lead to impacts to existing abstractions and leachate management systems.
<b>Solution</b>	Consider groundwater levels and receptors across the entire scheme and ensure any permitting requirements are fully understood prior to commencement of works.
<b>Additional dialogue / commentary:</b>	
See Informatives for general notes on dewatering and water abstraction.	
<i>3.3.4. As set out below, the landscaping proposals could involve both excavation and filling of the existing ground levels to accommodate the buildings within the landscape. The exact levels of excavation will be subject to further testing, and will be reported upon within the ES.</i>	
<i>3.4.7 As for the Data Centre Campus, the landscaping proposals involve excavation of the ground level to enable the lowering of the buildings within the landscape, within some areas of historic landfill.</i>	

#### 6.5 Ground Conditions, Contamination, Land Take and Soils

We concur with Ground Conditions, Contamination, Land Take and Soils have been scoped in.

<b>Document Reference(s): 6.5.6 &amp; 6.5.27</b>	
<b>Issue</b>	The report references land contamination reports that have not been included with this scoping report.
<b>Impact</b>	Limited information has been submitted for us to agree that the assessment of risk is acceptable.
<b>Solution</b>	Submit documents that have been used to support decisions regarding risk with the Environmental Statement.
<b>Additional narrative/ explanation (if necessary)</b>	

We are aware that the results of the most recent ground investigation are outstanding and will be submitted with the Environmental Statement, but we do want to review the other reports mentioned too.

*6.5.6 The baseline conditions considered in this assessment have been determined using information gathered within a Preliminary Geo-environmental Risk Assessment of the Study Area (prepared by Delta Simons, dated July 2022167); a Proposed Ground Investigation Summary (prepared by Terrell, dated May 2025); and a Construction Quality Assurance Plan for Ground Investigation and Monitoring Well Installation (prepared by Terrell, dated September 2025).*

6.5.27. A ground investigation was undertaken at the Site in November and December 2025 and comprised of approximately 26 boreholes and 22 trial pits (information such as exploratory hole logs and soil chemical results pending and will be summarised within the ES). Groundwater monitoring and sampling and ground gas monitoring and will be undertaken in 2026. The ground investigation and subsequent monitoring will assess the ground conditions at the Site and will help inform subsequent risk assessments.

**Document Reference(s): 6.5.61**

<b>Issue</b>	Section 6.5.61 states that the application may include a ground investigation, CEMP, Foundation Works Risk Assessment and Remediation strategy
<b>Impact</b>	The language used, 'may include', does not provide the reassurance we seek in terms of ensuring risks to controlled waters are appropriately managed within the development
<b>Solution</b>	Ensure that language is clear and unambiguous

**Additional narrative/ explanation (if necessary)**

**Document Reference(s): Table 37, 3.4.5 & 6.3.35**

<b>Issue</b>	It is not clear how potential firewater at the BESS and substation will be managed. Firewater as a pollutant is not explicitly mentioned in table 37 firewater, just contamination in groundwater in general, with a focus on landscaped areas.
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<b>Impact</b>	Risk of contamination of groundwater receptors if firewater is not suitably managed.
<b>Solution</b>	Demonstrate how firewater will be contained and and managed to prevent release into the controlled water environment.
<b>Additional narrative/ explanation (if necessary)</b>	
Management of firewater is mentioned earlier in this response. See also informatives at the end regarding BESS and substation drainage.	

<b>Document Reference(s):</b>	
<b>Issue</b>	Decommissioning is not discussed in Ground Conditions section
<b>Impact</b>	Decommissioning activities could have an impact on controlled waters that requires mitigation
<b>Solution</b>	Consider risks to controlled waters throughout all stages of the development
<b>Additional narrative/ explanation (if necessary)</b>	
The applicant should refer to regulatory guidance and general best practice at the time of decommissioning.	

<b>Document &amp; chapter:</b>	
<b>Issue</b>	The possibility of encountering unexpected contamination during and beyond the construction of the scheme is not mentioned within the report. It should have been included in Table 36 and Table 37
<b>Impact</b>	If a protocol for how to manage unexpected contamination in accordance with Land Contamination Risk Management guidance is not proposed risks to controlled waters may not be adequately assessed mitigated.
<b>Solution</b>	Ensure that a commitment to managing unexpected contamination is included in the OCEMP, OOEMP and ODEMP.
<b>Additional dialogue / commentary:</b>	
Our suggested process is:	

1. In the event that contaminated land, including groundwater, is found at any time when carrying out the authorised development, which was not previously identified in the environmental statement, then no further development (unless otherwise approved in writing by the relevant authorities) shall be carried out within the identifiable perimeters of the area in which the suspected contamination is located. It must be reported as soon as reasonably practicable to the local planning authority, and where necessary, the Environment Agency, and the undertaker must complete a risk assessment of the contamination in consultation with the local planning authority, and where necessary, the Environment Agency.
2. Where the undertaker determines that remediation of the contaminated land is necessary, a written scheme and programme for the remedial measures to be taken to render the land fit for its intended purpose must be submitted to and approved in writing by the local planning authority, following consultation with the Environment Agency.
3. Remediation must be carried out in accordance with the approved scheme under sub paragraph (2).
4. Following the implementation of the remediation strategy approved under sub-paragraph (2), a verification report, based on the data collected as part of the remediation strategy and demonstrating the completion of the remediation measures must be produced and supplied to the relevant planning authority and the Environment Agency.

Additional comments

<b>Document Reference(s):</b> 3.14.1, Table 61	
<b>Issue</b>	Various activities at the site, during construction and operation, may require environmental permits. These have not been listed within the scoping report.
<b>Impact</b>	Ambiguity concerning how activities will be regulated could lead to uncontrolled emissions to the controlled water environment
<b>Solution</b>	Ensure the Environmental Statement clearly lists the permits that will be needed for which activities and what will be controlled via the DCO
<b>Additional narrative/ explanation (if necessary)</b>	

Table 61 states that firewater run-off will be managed in accordance with environmental permitting requirements. At this stage it is not clear whether the BESS and substation will be within the energy centre and therefore regulated under that environmental permit.

*3.14.1. There are no existing sewers or watercourses located within the vicinity the Site, but there is the potential for new sewers to be established (subject to further conversations with utility authorities). It is highly likely that all surface, ground and foul water will therefore be dealt with on-site. This will be dealt with either through a new connection to off-site sewers if feasible, or through the use of infiltration techniques or underground tanks. Solid waste from the foul systems will need to be dealt with in a treatment plant sized to suit (e.g. Klargester or similar) with occasional solids removal off site.*

*6.8.18. The existing risks to the current site operations relate to the potential for pollution incidents and contamination of the ground through the landfilling activities, and operation of the gas-fired energy centre. This is controlled through the existing environmental permit for the landfill, will be controlled through a new permit being applied for the Energy Centre, and through the associated consented capping and restoration works that are ongoing.*

<b>Document Reference(s):</b> Section 7.5 Waste and Materials	
<b>Issue</b>	An assessment of the risks to controlled waters from the excavation within permitted and historic landfill and subsequent development on the landfill, has not been mentioned. Waste and Materials has been scoped out despite an up-to-date conceptual site model not being presented in the scoping report.
<b>Impact</b>	Risks to controlled waters from mishandling of waste material and potentially increased leachate production.
<b>Solution</b>	Produce a waste management plan that sets out how waste material will be handled. This should be supported but a hydrogeological risk assessment. Ensure that all necessary permits are applied for at an early stage. Discuss the proposed works with the National Permitting Service as early as possible.
<b>Additional narrative/ explanation (if necessary)</b>	
<i>3.16. Excavated Materials 3.16.1. As set out above, to facilitate the construction of the Proposed Development, excavation of the ground level will be required, some of which will be within areas of historic landfill. The quantity and composition of any landfill</i>	

waste that is due to be excavated is subject to further ongoing site investigations and design considerations. Where excavated material is categorised as landfill waste, this will be transported to and disposed of at an appropriate off-site facility, and / or disposed of within the closed modern landfill cells (those with remaining capacity) located within the Wider Ownership Area. A review 31 is underway at the time of the preparation of this EIA Scoping Report as to whether a change to the Environmental Permit (Ref EPR/XP3636KW) would be required for this waste disposal option

5.9.11. As set out above, to facilitate the construction of the Proposed Development, excavation of the ground level within the Main Development Area will be required, some of which will be within areas of historic landfill. The quantity and composition of any materials, including landfill waste, that is due to be excavated is subject to further ongoing site investigations and design considerations, as is the method for disposing of any material categorised as waste.

<b>Document &amp; chapter:</b>	
<b>Issue</b>	Batteries may need to be replaced during the lifetime of the project – no information at this stage. Potential for contaminant leakage from waste batteries stored on site prior to disposal.
<b>Impact</b>	Risk to land and controlled waters. For example, this could be due to chemical leakage, or fire water runoff in the event of extinguishing a waste battery fire.
<b>Solution</b>	The Applicant should ensure that waste and/or damaged BESS batteries are stored and managed such that they do not pose a contamination risk. Detail can be given in the outline Battery Safety Management Plan
<b>Additional dialogue / commentary:</b>	
Any temporary holding area for batteries awaiting loading for removal should be suitable to avoid presenting a contamination risk. The applicant should also note that stored damaged batteries are susceptible to spontaneous combustion. A fire watch may be necessary.	
<b>Document Reference(s):</b> 3.19.4, 5.10.5	
<b>Issue</b>	The scoping report refers to construction, completed development, decarbonisation and some mention of

	decommissioning. Standard practice is to consider three phases of the development – construction, operation and decommissioning.
<b>Impact</b>	Lack of clarity around how impacts from the three stages of development will be managed and mitigated.
<b>Solution</b>	Refer to construction, operation and decommissioning. We expect outline CEMP, OEMP & DEMP to be submitted with the Environmental Statement application
<b>Additional narrative/ explanation (if necessary)</b>	

<b>Document Reference(s):</b> 6.8.62, 7.6.36	
<b>Issue</b>	The list of assessments and management plans that will be included in the DCO application is not complete. We acknowledge that the scheme is at the early stage of design.
<b>Impact</b>	Risks to controlled waters from activities that are not controlled by suitable management plans
<b>Solution</b>	Ensure the Environmental Statement is supported by a full suite of outline management plans. See detail below.
<b>Additional narrative/ explanation (if necessary)</b>	
Consider including:	
<ul style="list-style-type: none"> <li>• Drainage Strategy – including pollution prevention measures</li> <li>• Outline Construction Environmental Management Plan</li> <li>• Outline Operational Environmental Management Plan</li> <li>• Outline Decommissioning Environmental Management Plan</li> <li>• Outline Battery Safety Management Plan</li> <li>• Foundation Works Risk Assessment</li> </ul>	

**Document & chapter:** 3.15.2

<b>Issue</b>	It is not clear if buried high-voltage cables will be included within the development. They are mentioned in section 3.15.2. but there is limited additional information.
<b>Impact</b>	Risk from the installation process, for instance HDD, and of heat pollution in groundwater from the thermal impact of buried high voltage cables during operation
<b>Solution</b>	Consider the impacts of installation and operation of buried high voltage cables on hydrogeology.

**Additional narrative/ explanation:**

Heat as a groundwater pollutant was introduced in 2023 via the [Environmental Permitting \(England and Wales\) \(Amendment\) \(England\) Regulations 2023 SI No.2023/651](#). As such, discharges that might lead to an input of heat into groundwater are groundwater activities. We aim to be proportionate and pragmatic in our application of the principles of the Environmental Permitting Regulations and requiring a permit would feel disproportionate for many activities at or near the ground surface.

At this stage we require the potential thermal implications of buried high voltage cables, in relation to risks to groundwater, to be considered via desk-based assessment. In those rare instances where we are concerned that there are risks which require ongoing control or management, we may opt to regulate it as a groundwater activity under schedule 22 of the Environmental Permitting Regulations (EPR) 2016.

The EA currently has no specific guidance relating to the potential thermal implications of buried infrastructure including cables. We suggest that our guidance for ground source heating and cooling systems should be used as a guide. The following link contains relevant information, including thermal plume modelling and an interactive system map and spreadsheet: [Environmental impacts of temperature changes from ground source heating and cooling systems - GOV.UK](#).

**Informatives**

<b>Informative</b>	<p><a href="#">BESS Site Design</a></p> <p><b>Please see attached:</b> <a href="#">OFFICIAL_Battery Energy Storage Sites internal guidance_Version 2</a> and complete tracker here <a href="#">Site-Specific Planning</a></p> <p>We refer the applicant to ‘The Environment Agency’s approach to groundwater protection’ (February 2018, version 1.2), particularly policies, A2 Precautionary principle, A4 Responsibility for</p>
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assessments, A5 Supply of adequate information and C1 Nationally or regionally significant schemes.

The National Fire Chief's Council has published detailed guidance on recommended fire protection measures for BESS sites. We recommend the applicant refers to this when designing the scheme: [Grid Scale Battery Energy Storage System planning – Guidance for FRS \(nfcc.org.uk\)](https://www.nfcc.org.uk/guidance-for-frs)

Firewater drainage from the BESS units should therefore be contained within a sealed, impermeable drainage solution, unless the developer can demonstrate an alternative method which provides sufficient mitigation. Without this sealed drainage the level of risk present will depend on the receiving receptors and the Planning Inspectorate will decide if this risk is acceptable. We assess the reasonable worst-case consequence of a failure not the likelihood. It is the applicant's responsibility to demonstrate that risk to the water environment will be safely managed.

The drainage solution should demonstrate that contaminated firewater can be adequately contained within the site to ensure that there is no discharge of polluted water to ground or surface water bodies. The scheme should include an impermeable base or layer beneath the battery unit compound to ensure infiltration beneath the site can be controlled.

Any system for the storage of contaminated firewater should have sufficient capacity/headroom for the volumes expected in the event of a fire, even during periods of intense rainfall. The system for containing firefighting effluent should be automatic with a backup system in place in case of power failure.

Where BESS sites are designed with fire extinguishing systems that do not rely on water, fire crews may still use water for boundary cooling, and this can contain pollutants from the burning units, including any associated chemical leakage, and dust and ash from the air. As such, we expect firewater capture to be included in any design.

The drainage system should incorporate a penstock valve automatically triggered in the event of a BESS fire. The oOEMP should include details of ongoing maintenance and testing of penstock valve(s) as traditional penstocks, when not operated for a long period of time, have historically been known to seize up and thus be inoperable at times of emergency. The maintenance programme

	<p>should include clearly defined frequency of checks to guarantee these remain operational at all times to ensure that they perform in the event of a fire. The automatic shutoff valves should also include a manual override in case the automation fails.</p> <p>Drainage solutions at BESS often include a permeable substrate above an impermeable lining. The impermeable lining will prevent any infiltration and protect groundwater but there is the potential for pollutants to attach to the surface of the permeable stone in the lined areas which could be re-mobilised in surface water runoff and reach the water environment, unless the containment areas are managed after a fire event.</p> <p>To ensure that the permeable stone does not act as a source of secondary pollution once drainage is reinstated following a fire event, we seek a commitment from the Applicant that, in the event of a fire, the stone surfacing is fully cleaned, or removed and replaced before any drainage valves can be reopened.</p>
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<p><b>Informative</b></p>	<p><u>Substation drainage</u></p> <p>The Applicant should clearly outline the committed design mitigation to prevent contaminants from substation plant containing hazardous chemicals, such as oil transformers, from releasing contamination to the surface water drainage system from both spills and leaks during operation and any fire events.</p> <p>Suitable lining and a sealed drainage systems are important to prevent any contaminants reaching groundwater or surface waters via runoff. The Applicant should confirm that the Substation will be impermeably lined.</p> <p>In addition to comments above, the Applicant could commit to using a dry-type transformer which does not contain flammable oil, and can decrease the risk of fire at a substation.</p> <p>Even if a dry-type transformer is used, and the risk of a substation fire is significantly lowered, the equipment at the substation still has a risk of leaks or spills. Therefore, the Applicant should provide more detail of the hazardous and polluting substances anticipated to be present within Substation plant and equipment, including</p>
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transformer type, and the design and operational measures to contain these substances, such as:

- Secondary containment systems such as double-skinned tanks and bunding;
- Leak detection and level monitoring systems;
- Bund water management;
- Oil water interceptors/separators in the drainage system.

Oil containment must be in accordance with the Control of Pollution (Oil Storage) Regulations 2001 and the Applicant should employ best practice pollution controls for oils and other hazardous and polluting substances. Further information available here: [Pollution prevention for businesses - GOV.UK](#)

Example response text re: BESS in SPZ

In accordance with Section C of 'The Environment Agency's Approach to Groundwater Protection' we would recommend objecting to a proposed BESS site anywhere within Zone 1 and/or Zone 2 of a Groundwater Source Protection Zone, and encourage this to be repositioned to a less sensitive groundwater location.

The applicant should submit a proposed development plan confirming that the BESS compound will not be positioned within Zone 1 and/or Zone 2 of a Groundwater Source Protection Zone.

The applicant should provide a detailed drainage plan for the site. This information must satisfactorily demonstrate that the risks to controlled waters have been fully understood and can be addressed through appropriate measures.

This information should include, but not be limited to:

- A detailed drainage plan which demonstrates, in the event of an emergency, that contaminated firewater can be adequately contained within the site to ensure that there is no discharge of polluted water to ground or surface water bodies. The scheme should include an impermeable base or layer beneath the battery unit compound to ensure infiltration beneath the site can be controlled.
- Any system for the storage of contaminated firewater should have sufficient capacity/headroom for the volumes

	<p>expected in the event of a fire, even during periods of intense rainfall.</p> <ul style="list-style-type: none"> <li>• The system for containing firefighting effluent should be automatic with a backup system in place in case of power failure.</li> </ul>
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<p><b>Informative</b></p>	<p><u>Environmental permits</u></p> <p>If dewatering is required, it will require an abstraction licence if it doesn't meet the criteria for exemption in <a href="#">The Water Abstraction and Impounding (Exemptions) Regulations 2017 Section 5: Small scale dewatering in the course of building or engineering works</a>. It may also require a discharge permit if it falls outside of our <a href="#">regulatory position statement for de-watering discharges</a>.</p> <p>If the applicant does not meet the exemption and requires a full abstraction licence, applicants should be aware that some aquifer units may be closed for new consumptive abstractions in this area. More information can be found on GOV.UK: <a href="#">Abstraction licensing strategies (CAMS process)</a> and <a href="#">Apply for a water abstraction or impounding licence</a>.</p> <p>If the dewatering activity can be demonstrated to be discharged to the same source of supply without intervening use (i.e. non-consumptive), this will increase the likelihood of a licence being granted.</p> <p>Please note that the typical timescale to process a licence application is 9-12 months. <u>The applicant may wish to consider whether a scheme-wide dewatering application rather than individual applications would be beneficial. We suggest talking to our National Permitting Service early in the project planning.</u></p> <p>Temporary dewatering of wholly or mainly rainwater that has accumulated in an excavation may be exempt from an Environmental Permit for a Water Discharge Activity. More information can be found on our website: <a href="#">Temporary dewatering from excavations to surface water: RPS 261</a>. Note that this does not permit discharge of groundwater from a passive or active dewatering activity or permit the abstraction of groundwater.</p>
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	<p>The applicant may also need to consider discharge of groundwater, especially if it is contaminated. More information can be found on our website: <a href="#">Discharges to surface water and groundwater: environmental permits.</a></p> <p>The use of drilling muds for the directional drilling may require a groundwater activity permit unless the 'de minimis' exemption applies. Early discussion about this is also recommended.</p>
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<p><b>Informative</b></p>	<p><u>Sustainable drainage systems</u></p> <p>The Government's expectation is that sustainable drainage systems (SuDS) will be provided in new developments wherever this is appropriate. The Environment Agency supports this expectation.</p> <p>Where infiltration SuDS are to be used for surface run-off from roads, car parking and public or amenity areas, they should:</p> <ul style="list-style-type: none"> <li>• be suitably designed</li> <li>• meet Governments non-statutory technical standards for sustainable drainage systems – these standards should be used in conjunction with the National Planning Policy Framework and Planning Practice Guidance</li> <li>• use a SuDS management treatment train – that is, use drainage components in series to achieve a robust surface water management system that does not pose an unacceptable risk of pollution to groundwater</li> </ul> <p>Where infiltration SuDS are proposed for anything other than clean roof drainage in a SPZ1, a hydrogeological risk assessment should be undertaken, to ensure that the system does not pose an unacceptable risk to the source of supply.</p> <p>See the Environment Agency's approach to groundwater protection, position statement G13: <a href="#">Groundwater protection position statements.</a></p>
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## **Water Resources**

The Environment Agency seeks confidence that there is a sustainable and practical source of supply of water to meet all demands of the project in order for it to be viable. There is insufficient detail provided in the conceptualisation of the site; approach and viability of air cooling; and some aspects of the design of the project remain ambiguous as regards to water demand.

NPS EN-1 (Energy infrastructure) 5.16.7 states that the ES should in particular describe existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Abstraction Licensing Strategies) and also demonstrate how proposals minimise the use of water resources and water consumption in the first instance.

The location of this development is in an area of serious water stress (as identified in our report Water stressed areas – 2021 classification (<https://www.gov.uk/government/publications/water-stressed-areas-2021-classification>)).

We acknowledge that the cooling requirement for both the Data centre and the associated Energy centre will be air cooled and that it is anticipated that there will be no water demand. **We do not agree that Water Resources should be scoped out of the assessment for the following reasons:**

<b>Document Reference(s): 3 – The proposed development; 7 – Water Resources &amp; Flood Risk</b>	
<b>Issue</b>	Despite air cooling being preferable, the project description does not provide enough detail of the options appraisal undertaken for best available techniques for cooling. The Environment Agency seeks further clarity on the confidence that this method of cooling is adequate for example during peak demand during prolonged periods of hot weather.
<b>Impact</b>	Worst case contingency planning for peak demand may include water cooling. Water availability in this region is poor and this should be evaluated accordingly should contingency be needed and problem solving required as the design stages evolve.
<b>Solution</b>	A full appraisal of sources of supply available to the project should be undertaken as part of a water supply strategy. This should provide (estimates of) all water known water demands and include an appraisal of

	<p>the <a href="#">abstraction licensing strategy</a> which outlines the limitations of any potential groundwater and surface water abstraction.</p> <p>Engagement with the water undertaker should be early and ongoing in order to provide certainty that potable (and/or raw water) can be provided within the scope of the Water Resources Management Plan.</p> <p>Water brought to site via tankering should be accounted for in traffic management and is subject to local authorities' approval.</p>
<b>Additional narrative/ explanation (if necessary)</b>	

<b>Document Reference(s): 3 – The proposed development; 7 – Water Resources &amp; Flood Risk</b>	
<b>Issue</b>	<p>Section 3.4.4 describes boiler blow down treatment before discharge. 7.6.33 identifies that a supply of process water is required in energy production. This is not accounted for in the description of the project or assessment of impacts to water resources. 7.6.33 is ambiguous in specifying if this will be potable or raw water and whether it is all intended to be provided by the water undertaker.</p> <p>Similarly, section 3.8 describes heat exchange infrastructure for which water requirements or implications have not yet been explored.</p>
<b>Impact</b>	Water resources should not be scoped out until the water demands of the project are established in more detail and a sustainable and practical source of supply has been clearly identified.
<b>Solution</b>	<p>A full appraisal of all water demands should be undertaken as part of a water supply strategy. This should provide (estimates of) volumes broken down by purpose and, include an appraisal of the sources of supply which are available to the project.</p> <p>For example, this should include evaluation of the abstraction licensing strategy which outlines the limitations of any potential groundwater and surface water abstraction.</p> <p>Engagement with the water undertaker should be early and ongoing in order to provide certainty that potable (and/or raw water) can be provided within the scope of their Water resources management plan.</p> <p>Raw water brought to site via tankering should be accounted for in traffic management and is subject to local authorities approval for example.</p>

**Additional narrative/ explanation (if necessary)**

**Document Reference(s): 3 – The proposed development; 7 – Water Resources & Flood Risk**

<b>Issue</b>	<p>Water demands during construction are not described, and sources of supply have not been identified.</p> <p>Projects of this scale typically have water demands which exceed 20m<sup>3</sup> per day for the purposes of dust suppression; concrete batching; wheel wash; potable for welfare stations and drilling fluids should HDD be employed for cable laying.</p>
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<b>Impact</b>	<p>The Environment Agency has witnessed projects experience significant delays post consent and pre-commencement when permits are required as a result of underestimating water availability and the limitations of supply options upon the scheme.</p>
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<b>Solution</b>	<p>A water supply strategy (see comments above) should also include construction phases in its appraisal of water demands and suitable supply options.</p>
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**Additional narrative/ explanation (if necessary)**

**Document Reference(s): 6.5. Ground Conditions, Contamination, Land Take And Soils**

<b>Issue</b>	<p>We do not agree that impacts to abstraction licences should be scoped out (the licences and other lawful water users for example private water supplies are not identified as receptors in chapter 6.5 where, the aquifer itself remains scoped in). Whilst the project identifies secondary aquifers, much of the region overlays primary Chalk aquifer which is considered to be unconfined.</p>
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<b>Impact</b>	<p>The report correctly identifies that the project is in proximity to Affinity Water abstraction licences (SPZ 1 &lt;500m) and lies partly within SPZ 2 and 3 – there may be pathways for interference with these abstractions.</p>
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<b>Solution</b>	Further detailed conceptualisation of the geology and the risks posed by the scheme are required to provide confidence that there will be no impacts to these extremely high sensitivity receptors.
<b>Additional narrative/ explanation (if necessary)</b>  The Environment Agency does not hold records of private water supplies (<20m <sup>3</sup> /day which, may also be for potable/domestic uses). This information can be requested from the Local Authority.	

### **Water Quality**

The project intends to provide fuel-storage which could potentially raise water quality concerns should any accidents or spillages occur. We seek clarification on how this risk will be mitigated and managed to prevent any contamination of water quality.

Section 3.14. Drainage and Utilities (p. 31) mention the potential for new sewers to be established as well as a high likelihood of surface, ground and foul water to be dealt with on-site. The EA seeks confidence that wastewater infrastructure management can be established to meet the demands of the project as a priority action. If the intention to treat on-site is upheld, this will require consultation and agreement with the EA. Further clarification on this matter will be sought in the additional Drainage Strategy Utilities Statement, which should outline all demands and details of the intended treatment methods to ensure compliance with sustainable wastewater management procedures.

We are pleased to see the intention to ensure sufficient site drainage and use of SuDS, alongside the proactive management and maintenance of these systems under section 6.3 Climate Change and Greenhouse Gases.

We note the risk of mobilising contaminants from the historic landfills, which we are pleased to see has been considered within the EIA scope under section 6.5. Ground Conditions, Contamination, Land Take and Soils. Section 6.5.61. mentions in the mitigation that this issue will be scoped in for further assessment (also stated in section 6.8.40. Project Vulnerability (Major Accidents and Disasters)) and suitability should be assessed when further mitigation details are made available.

## **Biodiversity**

<b>Document Reference:</b> EIA Scoping Report, Chapter 3: The Proposed Development	
<b>Section Reference:</b> Section 3.12.1	
<b>Issue</b>	Excavation works will be required to lower the floor levels of buildings.
<b>Impact</b>	Compounds and trenches associated with excavation present a risk of entrapment of wildlife, such as badgers.
<b>Solution</b>	Cover-over open trenches to prevent wildlife from falling in and place a ramp to enable wildlife to escape. Securely fence compounds and trenches during construction.  Cap exposed pipe systems when contractors are off-site, to prevent wildlife becoming trapped.

<b>Document Reference:</b> EIA Scoping Report, Chapter 3: The Proposed Development	
<b>Section Reference:</b> Section 3.12.2	
<b>Issue</b>	Lack of detail regarding planting and landscaping strategy.
<b>Impact</b>	Consultees are unable to comment on proposed plans, such as proposed habitats or chosen species to plant.
<b>Solution</b>	Please provide further information on landscaping strategy in the next consultation.  Species planted in mitigation areas should consist of native species of local provenance. If possible, the species selected should also be resilient to the predicted impacts of climate change.

<b>Document Reference:</b> EIA Scoping Report, Chapter 3: The Proposed Development	
<b>Section Reference:</b> Section 3.18.1	
<b>Issue</b>	Construction for the proposed development is estimated to take 11 years to complete. Further repeat species surveys have not been proposed.

	CIEEM's Advice Note 'On the lifespan of ecological reports & surveys' states that species survey data may be out of date around 12-18 months following a survey.
<b>Impact</b>	Changes in the baseline of species presence and distribution. Some species are transitory; therefore, a species could colonise a site prior to construction. This may result in damage or destruction of a resting place or disturbance during construction. If a species is protected, the applicant could commit an offence under the Conservation of Habitats and Species Regulations 2017 (as amended).
<b>Solution</b>	Commit to delivering pre-construction checks/surveys prior to construction.

<b>Document Reference(s):</b> EIA Scoping Report, Chapter 6: Ecology and Biodiversity	
Section(s): N/A	
<b>Issue</b>	No mention of INNS surveys to determine presence, distribution and abundance, nor is there any mention of an INNS or Biosecurity Management Plans.
<b>Impact</b>	Lack of biosecurity planning can lead to the accidental spread of INNS. Without an INNS Management Plan, there is also the risk of not appropriately responding to/managing INNS should they be discovered during construction. Lack of INNS planning can lead to accidental spread, which is an offence under the Wildlife and Countryside Act 1981.
<b>Solution</b>	Submit an INNS or biosecurity management plan as part of the Environment Statement. A pathway specific risk assessment should be considered identifying any pathways for spread during construction, operation and decommissioning.  Plan and deliver dedicated INNS surveys prior to construction, to inform proposed management and embedded biosecurity measures.
<b>Additional narrative/ explanation (if necessary)</b>	
Our mapping system shows that multiple INNS have been recorded within the site boundary, including Pale Galingale, New Zealand Pygmyweed, Fringed Water-Lily and Least Duckweed.	

<b>Document Reference(s):</b> EIA Scoping Report, Chapter 6: Ecology and Biodiversity	
Section(s): 6.4.47	
<b>Issue</b>	The applicant mentions they aim to deliver habitat mitigation and compensation in the Ecological Study Areas through BNG; but has not specified what BNG target the project will aim to provide.
<b>Impact</b>	Although BNG has not yet become a legal requirement for NSIPs, the guidelines will likely require developers to achieve a minimum of 10% BNG. Delivery of BNG is now also best practice, and many NSIPs have committed to deliver BNG prior to the release of government guidelines. By refusing to commit to BNG early in the project and planning suitable assessments, they run the risk of not considering BNG appropriately and needing to plan delivery further along in the project, when resources may not be available.
<b>Solution</b>	I appreciate that at this stage there is little specific design information, however we have the following points for the applicant to consider moving forward.  Propose to deliver at least 10% BNG through the scheme. For potential biodiversity net gain opportunities, we recommend the applicant refers to both the mitigation measures within the Water Framework Directive and opportunities identified within the Local Nature Recovery Strategy.
<b>Additional narrative/ explanation (if necessary)</b>	

### **Flood Risk**

The site has no flood zones, main rivers or ordinary watercourses on site so we have no concerns from a flood risk perspective and are happy for flood risk to be scoped out.

## **Appendix B – Permitting/licensing requirements**

A number of permits and licenses may be required to facilitate this scheme.

Should you wish to disapply any element of these proposals and bring within the scope of the Development Consent Order (DCO) details of this should be provided to the Environment Agency a minimum of 6 months prior to DCO submission.

We will require a consenting strategy document to be submitted in support of the proposals which outlines a programme of managing the various consents and permits, and confirmation of whether this will be subsumed within the DCO process or as standalone permits.

We recommend early engagement with our National Permitting Service (NPS) and full use of their enhanced pre-application advice service to ensure the permitting requirements and implications are fully understood and addressed in good time to inform the Planning Inspectorate (PINS) decision making process. Twin tracking is recommended for those applications considered fundamental to the DCO.

Please refer to PINS Annex D advice note for further information on how the Environment Agency's planning and permitting process can be best aligned within DCOs: [Nationally Significant Infrastructure Projects - Advice on working with public bodies in the infrastructure planning process, Annex D: Environment Agency - GOV.UK](#).

Permitting pre-application advice: <https://www.gov.uk/guidance/get-advice-before-you-apply-for-an-environmental-permit>.

### **Land Remediation**

Any remediation of land contamination may require site permits and mobile treatment licence

#### Waste on site

Excavated materials that are recovered via a treatment operation can be re-used on-site under the CL:AIRE Definition of Waste: Development Industry Code of Practice. This voluntary Code of Practice provides a framework for determining whether excavated material arising from site during remediation or land development works are waste.

Developers should ensure that all contaminated materials are adequately characterised both chemically and physically, and that the permitting status of any proposed on-site operations are clear. If in doubt, the Environment Agency should be contacted for advice at an early stage to avoid any delays.

The Environment Agency recommends that developers should refer to:

- Position statement on the Definition of Waste: Development Industry Code of Practice

- our website at <https://www.gov.uk/government/organisations/environment-agency>

### Waste to be taken off site

Contaminated soil that is, or must be disposed of, is waste. Therefore, its handling, transport, treatment and disposal is subject to waste management legislation, which includes:

- Duty of Care Regulations 1991
- Hazardous Waste (England and Wales) Regulations 2005
- Environmental Permitting (England and Wales) Regulations 2010

The Waste (England and Wales) Regulations 2011

Developers should ensure that all contaminated materials are adequately characterised both chemically and physically in line with British Standards BS EN 14899:2005 'Characterisation of Waste - Sampling of Waste Materials - Framework for the Preparation and Application of a Sampling Plan' and that the permitting status of any proposed treatment or disposal activity is clear. If in doubt, the Environment Agency should be contacted for advice at an early stage to avoid any delays.

If the total quantity of waste material to be produced at or taken off site is hazardous waste and is 500kg or greater in any 12-month period, the developer will need to register with us as a hazardous waste producer. Refer to our website at [www.gov.uk/government/organisations/environment-agency](https://www.gov.uk/government/organisations/environment-agency) for more information.

### **Waste management**

The recycling, storing, treating or disposing and use of waste is an activity that will require an Environmental Permit under the Environmental Permitting (England and Wales) Regulations 2016, unless a waste exemption applies or compliance with a Quality Protocol or Code of Practice can be demonstrated, for example Definition of Waste: Development Industry Code of Practice ('DoWCoP') published by CL:AIRE. Further information about permitting is available on GOV.UK: [Environmental permits - GOV.UK](#).

Where the applicant intends to use the Definition of Waste: Development Industry Code of Practice ('DoWCoP') for the re-use of excavated materials on site, this should be followed in full. Materials not used in accordance with the DoWCoP process in full may be deemed waste and will require a relevant permit for deposit. A formal Declaration must be submitted by a QP before any use of materials on site or transfer is permitted. Declarations deal with the re-use of materials. The receipt of a declaration does not remove the need for an environmental permit where treatment is required prior to re-use.

The applicant should note that granting of planning permission is independent of a permit determination, and a permit application considers factors such as operator competence and operating techniques which have not been considered here.

The Environmental Protection (Duty of Care) Regulations 1991 for dealing with waste materials are applicable to any off-site movements of wastes.

The code of practice applies to you if you produce, carry, keep, dispose of, treat, import or have control of waste in England or Wales.

The law requires anyone dealing with waste to keep it safe and make sure it's dealt with responsibly and only given to businesses authorised to take it. The code of practice can be found here: [Waste duty of care code of practice - GOV.UK](#) If you need to register as a carrier of waste, please follow the instructions here: [Register or renew as a waste carrier, broker or dealer - GOV.UK](#)

In order to meet the applicant's objectives for the waste hierarchy and obligations under the duty of care, it is important that waste is properly classified. Proper classification of the waste both ensures compliance and enables the correct onward handling and treatment to be applied. More information on this can be found here: <https://www.gov.uk/how-to-classify-different-types-of-waste>.

# **Regulatory Framework for Embedded Generation at Data Centres**

## **March 2026**

The Environment Agency is receiving an increasing number of requests for pre-application advice from developers of large data centres who wish install on site power generation (embedded generation) to overcome development constraints with connection to the National Grid.

Such generation at data centres may have benefits by reducing pressure on local and regional energy networks, offset electricity market impacts from rapid increased electrification and offer opportunities for decarbonised power generation.

However, most proposals for on-site generation put forward to date are based on less efficient open cycle combustion technologies. These may be attractive to developers to solve short term delays with grid connection, are scalable, can be rented and repurposed when grid connections become available, have shorter supply lead times and reduce complexities associated with combined cycle generation.

Combustion activities above 50MWth net rated input are Part A(1) activities under the Environmental Permitting Regulations and are subject to Chapter II of the Industrial Emissions Directive (IED). The Environment Agency is required to use published BAT conclusions (BATc) as the basis for setting permit conditions, or where there are no BAT conclusions (BATc) for a particular activity BAT, is determined under Article 14(6) of the IED.

For combustion activities, BATc are only available for Large Combustion Plant (LCP), however the Environment Agency uses these BATc as the basis for deriving BAT for all combustion activities subject to IED Chapter II, as combustion technologies can be similar irrespective of whether they exhaust through a common windshield.

LCP BATc provide a range of efficiencies associated with new and existing power generation (see Table 23 in Appendix) and require the use of combined cycle generation to maximise energy efficiency, unless generators operate less than 1500hrs per year (BAT 40).

The use of open cycle combustion plants is therefore restricted to 1500hrs per year as BAT on Part A(1) combustion activities. Whilst we have recently consulted on extending this annual cap to 4000hrs where low emissions of Oxides of Nitrogen (NOx) and energy efficiency requirements can be met, combined cycle is BAT for baseload generation.

We are also required to have regard to the Energy Efficiency Directive which seeks opportunities for high efficiency co-generation for combined heat and power from certain installations. Combustion activities with a thermal input of 20MWth net rated input or greater (including aggregated plant operated by the same Operator) are required to undertake a cost benefit analysis of the cogeneration of power and heat.

The environmental benefits of this approach are illustrated in Table 1 (Appendix) where a theoretical increased demand of 5GWe from data centre growth is met through different combustion technologies, estimating the associated thermal capacity and NOx and CO2 releases from open cycle, combined cycle and combined heat and power solutions with illustrative efficiencies.

Under the current regulatory framework embedded generation at data centres should therefore use combined cycle generation or increase the efficiency of open cycle generation to an equivalent energy efficiency using a combination of techniques that could include;

non-lean burn spark ignition (SI) engines coupled with Selective Catalytic Reduction;

Organic Rankine Cycle;

Combined Heat and Power - integration of cooling demand for the data halls and/or supplying waste heat to a local heat network;

use of waste heat in carbon capture.

Developers will also need to have regard to minimising localised impacts of air pollutants through considering abatement and use of effective stack height and design, which includes combining exhaust flues of multiple engines.

## Environment Agency

## Appendix

### Figure 1 – Extracts from Large Combustion Plant BAT Conclusions

Table 23

BAT-associated energy efficiency levels (BAT-AEELs) for the combustion of natural gas

Type of combustion unit	BAT-AEELs <sup>(1)</sup> <sup>(2)</sup>				
	Net electrical efficiency (%)		Net total fuel utilisation (%) <sup>(3)</sup> <sup>(4)</sup>	Net mechanical energy efficiency (%) <sup>(5)</sup> <sup>(6)</sup>	
	New unit	Existing unit		New unit	Existing unit
Gas engine	39,5–44 <sup>(7)</sup>	35–44 <sup>(7)</sup>	56–85 <sup>(8)</sup>	No BAT-AEEL	
Gas-fired boiler	39–42,5	38–40	78–95	No BAT-AEEL	
Open cycle gas turbine, $\geq 50$ MW <sub>th</sub>	36–41,5	33–41,5	No BAT-AEEL	36,5–41	33,5–41
<b>Combined cycle gas turbine (CCGT)</b>					
CCGT, 50–600 MW <sub>th</sub>	53–58,5	46–54	No BAT-AEEL	No BAT-AEEL	
CCGT, $\geq 600$ MW <sub>th</sub>	57–60,5	50–60	No BAT-AEEL	No BAT-AEEL	
CHP CCGT, 50–600 MW <sub>th</sub>	53–58,5	46–54	65–95	No BAT-AEEL	
CHP CCGT, $\geq 600$ MW <sub>th</sub>	57–60,5	50–60	65–95	No BAT-AEEL	

<sup>(1)</sup> These BAT-AEELs do not apply to units operated < 1 500 h/yr.

<sup>(2)</sup> In the case of CHP units, only one of the two BAT-AEELs 'Net electrical efficiency' or 'Net total fuel utilisation' applies, depending on the CHP unit design (i.e. either more oriented towards electricity generation or heat generation).

<sup>(3)</sup> Net total fuel utilisation BAT-AEELs may not be achievable if the potential heat demand is too low.

<sup>(4)</sup> These BAT-AEELs do not apply to plants generating only electricity.

<sup>(5)</sup> These BAT-AEELs apply to units used for mechanical drive applications.

<sup>(6)</sup> These levels may be difficult to achieve in the case of engines tuned in order to reach NO<sub>x</sub> levels lower than 190 mg/Nm<sup>3</sup>.

#### 4.1.1. Energy efficiency

**BAT 40. In order to increase the energy efficiency of natural gas combustion, BAT is to use an appropriate combination of the techniques given in BAT 12 and below.**

Technique	Description	Applicability
a.	Combined cycle See description in Section 8.2	Generally applicable to new gas turbines and engines except when operated < 1 500 h/yr. Applicable to existing gas turbines and engines within the constraints associated with the steam cycle design and the space availability. Not applicable to existing gas turbines and engines operated < 1 500 h/yr. Not applicable to mechanical drive gas turbines operated in discontinuous mode with extended load variations and frequent start-ups and shutdowns. Not applicable to boilers

Table 1 - Comparison of Combustion Technologies delivering 5GWe demand (7)					
Combustion Technology	Equivalent GWth Capacity	Tonnes NOx/annum		Tonnes CO2/annum	NOx Cost Damage (4) (5)
		Without SCR	With SCR		
High speed engines NG (45% efficient)	11.1 GWth	27,529 (@ 95mg/m <sup>3</sup> )	8,672 (@ 30mg/m <sup>3</sup> )	24,922,200 (1)	£31,400,000 (2) £99,500,000 (3)
Medium speed engines NG (51% efficient)	9.8 GWth	25,492 (@ 95mg/m <sup>3</sup> )	8,059 (@ 30mg/m <sup>3</sup> )	20,761,200 (1)	£29,100,000 (2) £92,000,000 (3)
New diesel reciprocating engine (41.5% efficient) Abated	12.05 GWth	638,319 (@ 2000mg/m <sup>3</sup> )	60,640 (@ 190mg/m <sup>3</sup> )	N/A	£220,000,000 (2) £2,300,000,000 (3)
Existing OCGT (38% efficient)	13.2 GWth	17,126 (@ 50mg/m <sup>3</sup> )	N/A	21,602,206	£53,000,000
New OCGT (41.5% efficient)	12.0 GWth	12,001 (@ 35mg/m <sup>3</sup> )	N/A	21,602,206	£37,000,000
H class CCGT (60% efficient) with SCR	8.33 GWth	N/A	6,482 (@30 mg/m <sup>3</sup> )	13,954,406	£20,000,000
CHP (80% overall efficiency) Assumed to be medium speed engines NG (51% efficient)	6.25 GWth	15,295(6) (@ 90mg/m <sup>3</sup> )	4,836(6) (@ 95mg/m <sup>3</sup> )	12,456,720 (1)	£17,465,898 (2) £55,245,396 (3)

NG = Natural gas (1) Low methane slip (2) With SCR (3) Without SCR (4) GTs stack height 50-100m, engine stack height <50m. Population <250/km<sup>2</sup> (5) [Air quality appraisal: damage cost guidance - GOV.UK](#) (6) The figures quoted are those for the engine. (7) 5GWe is to provide BOTH electrical demand for the data centre PLUS associated cooling. In the case of CHP this demand is the total of electrical output plus low-grade heat.

# Supplementary combustion sector (Part A installations) basic pre-application advice

This document provides supplementary basic advice for the above sector and is in addition to the generic advice provided.

## How much will my permit cost?

We have already given generic advice about application charges, this document is intended to give more sector specific advice which might help you to supply the correct fee for your application.

### Baseline charge

Refer to Table 1.10 – activity reference 1.10.1 of the [charging scheme](#) - Section 1.1 - combustion plant - rated thermal input of 50MWth or more.

### Multiple Activities on an Installation

The [charging scheme](#) classifies application activities differently to the Environmental Permitting Regulations. In part 2 “Application Charges” it states an “application activity” means a single activity described in a single sentence in column 2 of the Application Charge Table, and in section 8(2) it explains how to charge where there is more than one application activity.

Where there are distinct activities such as separate Large Combustion Plants (LCP) then they should be treated as separate “application activities” with regards to the charging scheme. If there are multiple activities the applicant pays the full fee for the first activity, the fee then reduces by 90% for subsequent activities which fall in the same activity description in the table.

Examples of multiple activities on an Installation:

- There is more than one large combustion plant (LCP) on site. These will each be counted as an activity e.g. if you have 3 open cycle gas turbines on a site each >50MWth they will be charged 100% of the fee for the first, 10% for the second and 10% for the third.
- There is at least one large combustion plant on site, and there are a number of smaller units <15MWth on a site that don't form part of an LCP but aggregate to over 50MWth together. The LCP(s) and aggregated smaller units will be counted as separate charging activities and will be charged 100% of the fee for the first and 10% for the subsequent activities.
- There are no LCPs on site but there are a collection of combustion activities adding up to over 50MWth input. Where there are different distinct units of operation that can operate independently from each other and are each

>50MWth e.g. two data centres 200m apart which provide services to different clients and have different connections to the national grid and are both >50MWth. The charge will be 100% of the fee for the first data centre and 10% for the subsequent data centre.

If your application includes post-combustion carbon capture (PCC) for geological storage, this will be considered as a separate activity (S6.10 Part A1(a)) and charged under Table 1.10 – activity reference 1.10.4 of the charging scheme - Carbon capture and storage. However, post-combustion carbon capture (PCC) for utilisation will be considered a directly associated activity serving the combustion activity.

## Variations

Refer to charging guidance for variations:

<https://www.gov.uk/government/publications/environmental-permitting-charges-guidance/environmental-permitting-charges-guidance#vary-a-permit-charges>

## Add-on charges

There will be additional charges for the following if assessments are required to be submitted as part of your application.

A fixed charge of £779 for a **habitats assessment** if:

- There is European Site within the meaning of the Conservation of Habitats and Species Regulations 2017 or a site referred to in the National Planning Policy Framework 2018 as requiring the same assessment as a European Site within 10 km of the Installation.
- If there is a site of special scientific interest within the meaning of the Wildlife and Countryside Act 1981 within 2 km of the installation.
- If emissions could impact on marine conservation zone within the meaning of the Marine and Coastal Access Act 2009.

If any of the following plans are required, also additional fees for:

- noise and vibration management plan – a fixed charge of £1,246
- an emissions management plan – a fixed charge of £1,241
- odour management plan – a fixed charge of £1,246

## Supporting information and guidance specific to the combustion sector (Part A installations)

In addition to those already mentioned in the generic advice document you may also need to supply some specific supporting information associated with the combustion sector Part A installations (i.e. installations falling under reference **S1.1 Part A(1) (a)** of EPR) with your application. Refer to the additional guidance provided in the following sections.

### Combustion units and aggregation rules

You must provide the **net rated thermal input in megawatts** (MW) for each combustion unit and a detailed description of the stack configuration (e.g. whether multiple flues emit through a common stack). This is essential to understand the classification of your combustion activity and the aggregation of single combustion units under EPR and IED.

You must also provide details of any proposed physical or software constraints on MWth rating of combustion plant as these will be conditioned as part of your Environmental Permit.

Combustion installations with aggregated net rated thermal input of 50 MW or more fall under reference S1.1 Part A(1) (a) of EPR. Refer to [Regulatory Guidance Note 2 - Appendix 1 and 2](#) for guidance on **aggregation of combustion equipment**. Please note there is no de minimis on the size of combustion plant under the Part A(1) aggregation rule.

Combustion installations with aggregated net rated thermal input of 50 MW or more are also subject to the regulatory controls set out in **Chapter II** of the [Industrial Emissions Directive](#) (IED), Directive 2010/75/EU.

Combustion installations which are also **Large Combustion Plant (LCP)** are subject to the regulatory controls set out in **Chapter III of IED**. Aggregation rules for Large Combustion Plant (LCP) are addressed in Article 29 of IED.

Individual combustion units with net rated thermal input between 1 and 50 MW, contributing to the aggregation under Chapter II of IED, are also subject to the regulatory controls set out in the [Medium Combustion Plant Directive](#) (MCPD).

Aggregation of arrays of Emergency Back-up diesel generation (e.g. Data Centres) shall consider proximity and coherence of the generators that operate on the same site by the same operator for the same purpose. For example, generators that are physically separated but will operate in the event of loss of a common power supply, and that share common infrastructure or management systems may be considered to be a single site.

You must confirm whether your proposal is part of phased development of a larger datacentre (e.g. hyperscale) as this may influence how we assess BAT.

MWth rating for generators can be calculated in accordance with AMPS guidance.

### **BAT Assessment – general requirements**

Your application must include a comprehensive **BAT assessment** for the proposed operations.

The BAT assessment should include, but not be limited to, the following areas:

- Proposed types of combustion plant and reasons for selection;
- Considerations on type of operation and operating regime, frequency, duration of operation;
- Considerations on the size of units (net rated thermal input);
- Considerations on fuel selection;
- Emission abatement and minimisation and relevant BAT-associated emission limit values (BAT-AELs);
- BAT assessment for dispersion of pollutants to air, including where relevant stack height assessment and stack configuration (i.e. vertical, no impediments, and whether flues should be combined in a common windshield to improve dispersion of pollutants, etc.);
- Energy efficiency and waste heat recovery (Combined Heat and Power);
- Water and resource efficiency;
- BAT for cooling;
- BAT for monitoring of emissions and process operation;
- BAT for noise control.

General guidance on the combustion sector can be found on the Environment Agency sector guidance note for Combustion Activities, EPR 1.01, available at <https://www.gov.uk/government/publications/combustion-activities-additional-guidance> . This guidance note was withdrawn in August 2018, following the publication of BREF for Large Combustion Plants (LCPs) in 2017 and the changes introduced by the 2018 amendment of EPR and associated requirements for Medium Combustion Plants and Specified Generators. This leaves a guidance gap for combustion sites which are not LCPs (< 50 MWth per stack), i.e. IED Chapter II sites. In the interim, awaiting a revised version of EPR 1.01 or other guidance that reflects the regulatory changes that have occurred over the last few years for the combustion sector, the narrative BATs from EPR 1.01 are still considered broadly appropriate for IED Chapter II installations. You can use the chargeable [enhanced pre-application service](#) if you need to discuss your BAT proposal with us before submitting an application.

Additional specific requirements are set out in the following sections for specific activities in the combustion sector. Note that the following sections are not mutually

exclusive, for example a Peaking Plant operating in the balancing market may also consist of a Large Combustion Plant (LCP), therefore be subject to the requirements applicable to LCP.

### **Drainage infrastructure and pollution prevention measures**

Include details of the soil and groundwater **pollution prevention measures** proposed in your application. Refer to: [pollution prevention guidance](#) for advice.

When the proposal includes storage of large inventories of **liquid fuels, or other hazardous pollutants**, you should provide a review of the proposed primary, secondary and, where appropriate, tertiary **containment infrastructure** proportionate to the risk of your operations. This should be determined by establishing a source/pathway/receptor model and taking into account the sensitivity of the potential receptors. Unless the storage and use of hazardous pollutants is covered by a [Systematic Appraisal of Risk](#) you may have to undertake periodic monitoring of groundwater and land in certain locations on the installation.

Storage of most fuel oils in above ground tanks greater than 201ltrs that are not located in a building are required to meet the [oil storage regulations](#). Parts of this guidance may also be considered BAT for in-building storage and associated pipework for fuels and reagent.

The review of the containment infrastructure for combustion sites including storage of large inventories of liquid fuels, or other hazardous pollutants, should follow the framework and take into account the requirements set out in the [CIRIA guidance: Containment systems for the prevention of pollution](#).

### **Energy Efficiency**

You must describe how your proposal maximises energy efficiency.

If the application is for new or substantially refurbished combustion plant with an aggregated net thermal input of >20 MW you may need to provide a **cost-benefit assessment (CBA) of opportunities for cogeneration** (also known as combined heat and power) **or supplying a district heating or cooling network** when this required by Article 14 of the Energy Efficiency Directive. Refer to the [Draft guidance on completing cost-benefit assessments for installations under Article 14 of the Energy Efficiency Directive](#).

If the application is for a new power station or a variation to add >50MWth you may need to provide a **combined heat and power readiness assessment**, following the requirements of [CHP readiness guidance](#).

For variations you will need to describe any new equipment energy efficiency measures.

## **Additional requirements for Medium Combustion Plant and generators aggregated on Part A combustion installations permits**

If your proposal include medium combustion plants contributing to the aggregation of scheduled activity S1.1 A(1) (a), the proposed combustion equipment must comply with the emission limits specified in the **Medium Combustion Plant Directive** (MCPD), as transposed into domestic legislation by Schedule 25A of EPR 2018. However, for installation permits, emission limits more stringent than those set in MCPD might be required based on **environmental impact assessment** grounds, or if there are **specific BAT considerations** that apply to the proposed activity or operating regime (for example engines proposed to operate in the mid-merit balancing market would be expected to achieve better environmental performance than that associated with MCP emission limits).

Although generators operating within installation permits are excluded from the scope of Schedule 25B of EPR 2018 – Specified Generators, these generators will be subject to the same requirements of specified generators as minimum BAT and, where applicable, to MCPD requirements. The air **dispersion modelling guidance** developed for specified generators (<https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment>) is also applicable to generators installed within combustion installations.

If the application is to add a MCP to an installation (either existing or new) or for a new bespoke installation with MCP, you must provide the information listed in **Annex 1 of the Medium Combustion Plant Directive** (MCPD). Complete:

- [Application Form Part C2.5 and the accompanying Combustion Plant List Spreadsheet](#) when adding or varying MCP plant at an installation site.
- [Application Form Part B3](#), Appendix 1, Question 13 for Installation sites applying for new bespoke permits with MCP.

If your application is for a limited operating hours MCP the Combustion Plant List Spreadsheet or Question 13 of Appendix 1 of Part B3 must be submitted with the application. Where the Combustion Plant List Spreadsheet is submitted the “*Will the medium combustion plant be operated as a limited operating hours plant?*” column must be completed for all plant.

### Emergency standby diesel generators

If your proposal includes new standby emergency diesel generators with a net rated thermal input above 1 MW, which are exempted from MCPD emission limits because they operate for less than 500 hours per year, you will need to demonstrate that the engines are specified to be BAT, which include:

- Emissions optimised engines specified to **TA-Luft 2g, or US EPA Tier 2 standard or equivalent** NO<sub>x</sub> emission levels in the range of 2000 mg/m<sup>3</sup> of NO<sub>x</sub> at 5% oxygen and reference conditions. Deviations from these standards will need to be justified based on sound technical reasons (for example if it can be demonstrated that engines meeting this standard are not available for safety critical standby diesels on nuclear installations).
- **Dispersion of flue gases optimised** through vertical stacks, no caps and cowls impediments.
- **Maintenance testing minimised** and kept to less than 50 hours per year;
- Provision of flue gases **sampling ports** to allow for monitoring of NO<sub>x</sub> and Carbon Monoxide in line with web guidance '[Monitoring stack emissions: low risk MCPs and specified generators](#)'.

If your application includes a proposal to bring into regulation under an installation permit existing standby diesel generators, you should still provide a BAT assessment. Whilst it is acknowledged that it would not be practical to require existing standby emergency diesel generators that were procured outside of a regulatory regime to meet all the BAT standards required for new standby emergency diesel generators, you should propose practical improvements that can be implemented in the shortest reasonable timeframe as part of an improvement plan to meet BAT. In these scenarios, you may be required to provide cost information to justify the non-viability of certain improvement options.

For new and expanded data centres you may be expected to go beyond BAT and fit abatement in the form of Selective Catalytic Reduction (SCR) to manage the impact of peak emissions from emergency operation and/or testing and maintenance on long term Air Quality Standards. This is most likely if your Data Centre is;

- predicted to cause unacceptable peak air quality impacts on local sensitive receptors;
- located in a “cluster” of data centre arrays;
- co-located with a number of standby generator arrays that will operate following the same realistic power outage event;
- in an Air Quality Management Area and/or the Local Authority specifies stricter standards through Planning (e.g. as is the case with London Boroughs);
- A hyperscale data centre (including all phases of development).

Clusters are identified by the Environment Agency based on proximity of multiple sites using large scale back up generation where impacts to local air quality are of concern. They currently include the **Slough Trading Estate**, and the **London Boroughs of Tower Hamlets** and **Enfield**.

New Data Centres that fit these criteria should therefore be SCR Ready (i.e. planned with available space to retrofit equipment for abating emissions).

BAT assessments for the expansion of data centres (i.e. permit variation) shall consider the applicability of abatement to both the proposed new plant and existing permitted plant to reduce impacts to air quality for the installation as a whole. For phased developments that are initially below the capacity threshold for a BAT assessment you should ensure the design and specification accounts for proposed or potential future developments that will need to meet BAT (beyond BAT) standards if the capacity threshold is met.

Arrays of standby diesel generators, such as applications within electronic **data centres**, must include an **air quality risk assessment** following the guidance on <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>. You may also find it useful to use <https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment>.

The air quality risk assessment for arrays of standby diesel generators should be based on a realistic operating envelope detailing the maintenance testing scenarios in terms of numbers of plant operating at any one time, duration and load of plant operation. **You will be expected to operate within the risk envelope described in the permit application.**

The air quality risk assessment for arrays of standby diesel generators must also address **power outages** based on realistic full load response for at least 72 hours. The assessment should also have consideration of nearby sites that may influence predicted peak NO<sub>x</sub> concentrations from simultaneous emergency operation of more than one site. In-combination effects do not need to be modelled but applications should detail which sites need to be considered. The web guidance [Specified generators: dispersion modelling assessment - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment) provides a methodology to assess the operating envelope and operational hours by using **statistical analysis** for short term predictions.

For arrays of standby diesel generators, you should also provide an **acute exposure risk assessment**. This is a quantitative assessment of the potential human health impacts and the amount of risk to members of the public associated with short-term exposure to NO<sub>2</sub>. There is no absolute hourly limit environmental standard for the acute exposure to NO<sub>2</sub>, but there can be effects on health over a certain threshold. Your acute exposure risk assessment must compare the 100th percentile predicted environmental concentrations (PEC) of NO<sub>2</sub> against appropriate acute exposure criteria, such as the US EPA acute exposure guidelines levels (AEGLs) or other relevant acute exposure criteria.

In most combustion situations the NO<sub>2</sub> environmental standard is protective of nitrogen monoxide (NO) EAL, however this is often not the case for arrays of standby diesel generators due to their limited operating times. You must therefore **assess the short-term NO EAL** if your backup generators add up to 50MWth or more. The EALs for nitrogen monoxide are included in the list of EALs in our air emissions risk assessment (AERA) guidance provided at <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#environmental-standards-for-air-emissions>.

Additional specific guidance relevant to emergency standby diesel generators within electronic data centres can be found in the document titled '**Data Centre FAQ Headline Approach**'. The Data Centre FAQ document is not presently an official release but forms the basis for discussion of a common methodology and liaison with individual operators and their industry association and summarises the framework for our approach in applying EPR/IED to data centres.

If the proposed diesel generators are also operated under non-emergency **elective operations**, such as operations entailing exporting electric power to the grid or on-site elective power usage (for example Triad avoidance), emissions will need to be abated to meet as a minimum MCPD and/or Specified Generators **emission limits will apply** (or more strict limits according to the results of the environmental risk assessment and specific BAT considerations that apply to the proposed activity or operating regime).

Whether you are required to go beyond BAT will depend on the results of the environmental risk assessment and specific BAT considerations that apply to the proposed activity or operating regime. You are strongly advised to seek [enhanced pre-application advice](#).

Maintenance and testing regimes must be managed in a manner that minimises the impact on local air quality and should include co-ordination with other nearby sites if your site is in a Cluster or Air Quality Management Area. Applications should include the proposed maintenance and testing regime and identify any restrictions on the flexibility of these regimes. Sites that have the potential to cause short term exceedance of air quality standards, or those in a cluster will be required to develop via an improvement condition in the permit, an Air Quality Management Plan to manage and mitigate the impacts of prolonged emergency running of the facility on sensitive receptors.

### **Additional requirements for Large Combustion Plant**

If your application includes a Large Combustion Plant, you should demonstrate how the proposed operating techniques will comply with the relevant requirements of **Chapter III** of the [Industrial Emissions Directive](#), including but not limited to: determination of **start-up and shut-down** periods according to the [Commission Implementing Decision \(2012/249/EU\)](#); provisions for **malfunction and breakdown** of abatement equipment; **multi-fuel** firing, if applicable; **emission limits values** and averaging periods; **monitoring**, including continuous emissions monitoring system (**CEMS**), and **reporting** requirements.

Emission limits should be proposed by referring to the **most stringent between IED Chapter III (Annex V) and the BAT-AELs** set out in the [LCP BAT conclusions 2017](#), for all the relevant averaging periods covered by both these standards. Environmental risk considerations may determine a requirement for more stringent emission limits than those set according to IED and the LCP BAT conclusions.

Additional guidance on monitoring, reporting and compliance requirements of Directive 2010/75/EU on industrial emissions can be found in [Electricity Supply Industry – IED Compliance Protocol for Utility Boilers and Gas Turbines \(LCP BREF Update\)](#).

For any new proposed **LCP** you must provide a **BAT assessment** consisting of a systematic review of the proposed operating techniques against the [LCP BAT conclusions 2017](#).

For variations to the way existing LCP operate, you should provide a BAT assessment against the LCP BAT conclusions focussing on the aspects proposed to be varied.

An application for a new LCP should also include a **BAT assessment of the cooling options** following the relevant guidance provided at <https://www.gov.uk/guidance/post-combustion-carbon-dioxide-capture-best-available-techniques-bat#cooling> (note this guidance strictly covers power plants with carbon capture, however the same principles and requirements apply to LCP without carbon capture).

If the cooling system will be water based, you will need to provide an assessment of the environmental impacts associated with the **discharge of the thermal plume**. When the application includes new or revised discharges of cooling water to cooling water discharges on transitional & coastal waters (TraC), the thermal dispersion model based should be based on the framework agreed with industry (refer to [JEP Protocol on Projects Modelling Cooling Water Discharges into TraC Waters within Power Station Developments](#)).

If your application includes **biomass combustion**, you should also provide a BAT review of the proposed operating techniques to **prevent fire related accidents**, against our web guidance:

<https://www.gov.uk/government/publications/pulverised-combustion-of-wood-pellets-in-power-plant-best-available-techniques>.

### **Additional requirements for peaking plant operating in the balancing market**

If your application includes a proposal to operate a Chapter II combustion plant you should note that, in general, single cycle combustion installations (for example open cycle gas turbines and reciprocating engines), or combustion installations that do not operate as combined heat and power (CHP) plants, are permitted to operate for **less than 1500 hours per year** (as a rolling average over a period of five years and with operation in any individual year limited to a maximum of 2,250 hours).

The 1500 hour rolling average limit can now apply **per engine, per aggregated MCP or to the installation as a whole**. You must specify the operational hour envelope you require in your application and be able to demonstrate no significant impact via the Air Emissions Risk Assessment and any other risk/impact assessment required for your site (e.g. Noise Impact Assessment).

The **modelling must reflect the worst case**. So, if you want the maximum 5-year rolling average per year for each engine, then you must model the impact for all engines running up to a max of 2,250 hours per year.

Specific BAT assessment considerations apply to combustion plant proposed to operate in the **mid-merit market** (i.e. between 1,500 and 4,000 hours per year). In this case you should demonstrate how your proposal meet enhanced environmental performance compared to single cycle peaking plants or combustion plants which don't recover waste heat in a CHP configuration; for example your proposal should include technologies able to provide **higher energy efficiency** and abatement of NOx capable to achieve **lower NOx intensity**. We recommend that you to contact us through the [enhanced pre-application service](#) if your proposal includes a combustion plant operating in the mid-merit market.

### **Additional requirements for post-combustion carbon capture (PCC) and storage**

A proposal for a **post-combustion carbon capture** (PCC) plant for geological storage or utilisation must include a **BAT assessment** consisting of a systematic review of the proposed operating techniques against the post combustion carbon capture BAT guidance available at [Post-combustion carbon dioxide capture: best available techniques \(BAT\) - GOV.UK \(www.gov.uk\)](#).

Refer to [AQMAU recommendations for the assessment and regulation of impacts to air quality from amine-based post-combustion carbon capture plants report](#) for advice on air emissions risk assessment of emissions of amines and their degradation products from PCC plants.

We recommend that you to contact us through the [enhanced pre-application service](#) if your proposal includes post-combustion carbon capture.

### **Decarbonisation Readiness**

If you are applying for an environmental permit for a new or substantially refurbished electricity-generating combustion power plant on or after 28/02/2026, you may be required to demonstrate Decarbonisation Readiness (DR) as part of your permit application. DR is demonstrated through a DR report, which shows there are no known barriers to converting the plant in future to low-carbon route operation (carbon capture or hydrogen), should you be required to. You should refer to the published [external guidance for operators](#) and our [consultation response](#) for full details of applicability and exemptions.

### **DR Transition**

Where an environmental permit (or permit variation) is issued containing DR conditions, those decarbonisation readiness conditions will supersede the existing Carbon Capture Readiness (CCR) conditions imposed through the 2013 Regulations. No further action is required to remove existing CCR conditions – they cease automatically once the permit containing DR conditions is issued.

If your plant is subject to existing CCR conditions under the planning regime and you wish to voluntarily transition to decarbonisation readiness, you may apply for a permit variation to include DR conditions.

You may have carbon-capture-related requirements in your Development Consent Order (DCO) that were not imposed to meet the CCR 2013 Regulations. These requirements will not always be automatically superseded by DR conditions. You should seek your own planning/legal advice on how your DCO requirements interact with DR.

### **The four tests**

Your DR report must address all four DR tests: spatial availability, technical feasibility, access to CO<sub>2</sub> transport and storage or to a hydrogen supply, and economic feasibility.

If you are applying for a Standard Rules permit, you must complete and document your own assessment for all four tests and provide self-certification statements with your permit application to confirm that the requirements have been met. Your DR report must be kept and made available to the EA upon request.

If you are applying for a bespoke permit, you must submit a DR report with your application. We will assess the spatial availability and technical feasibility tests as part of determination. You must still complete and document your own assessment for the other two tests (access to CO<sub>2</sub> transport and storage or to a hydrogen supply, and economic feasibility) and provide a statement of self-certification as part of your DR report.

The level of detail evidenced in your DR report should be proportionate to plant size and complexity.

You should refer to the [published DR guidance](#) when producing your DR report to ensure you meet the requirements. The guidance is supported by, and should be reviewed in conjunction with, the:

- [carbon capture readiness technical study](#)
- [hydrogen readiness technical study](#)

## **Charges**

A charge will apply if you need to submit a DR report for assessment. You must pay the add-on charge when applying for a new permit or if you need to submit a new report when applying for a permit variation.

The draft charges proposed are:

- **£5,090** for plants **≥50 MWth** or **any energy-from-waste plant**;
- **£3,181** for plants **<50 MWth**.

A **£100 per hour** time-and-materials rate is also proposed for any DR-related compliance work (for example, assessing updated DR reports). Final charges will be confirmed following consultation.

## **Reviewing Decarbonisation Readiness**

You will be required to review and update your DR report at intervals not exceeding two years, to ensure that the proposed decarbonisation route remains feasible as technologies and infrastructure develop. An up-to-date DR report must be made available upon request.

If your preferred decarbonisation route changes, you may update your DR report at any time. We may request the updated report as part of compliance activities.

## Guidance on Air Dispersion Modelling for Back-up Engine Arrays at Data Centres (IED Chapter II)

### 1. Introduction

- 1.1 This pre-application guidance sets out the Environment Agency's approach to air dispersion modelling for arrays of back-up engines at Data Centres regulated under Chapter II of the Industrial Emissions Directive (IED).
- 1.2 It is intended to support Applicants and their consultants in preparing air dispersion modelling assessments for environmental permit applications and variations, and to promote consistency in the assessment of impacts from routine testing and emergency operation of back-up engines.
- 1.3 The focus of this document is back-up engines for Data Centres, however the principles and approaches outlined here are also applicable to any other installation with an array of back-up gas oil engines.
- 1.4 This document does not replace existing guidance but aims to consolidate and clarify key requirements. It should be read in conjunction with current guidance, including:
- [Emergency backup diesel engines on installations: best available techniques \(BAT\) - GOV.UK](#),
  - [Air emissions risk assessment for your environmental permit - GOV.UK](#),
  - [Environmental permitting: air dispersion modelling reports - GOV.UK](#),
  - The supplementary combustion sector (Part A installations) basic pre-application advice
- 1.5 In the event of any contradictions, the published GOV.UK guidance takes precedence.

### 2. Operational Scenarios – routine testing, emergency, and commissioning

2.1.1 Your modelling must include both testing and emergency use operating scenarios. Modelled scenarios must represent a reasonable 'worst-case' arrangement of plant, taking account of the location of engines in relation to sensitive offsite receptors.

#### 2.2 Routine testing

2.2.1 Routine testing represents operation of the back-up engines during regular testing and maintenance procedures. Back-up engines are limited to a maximum of 50 operating hours for their routine testing per engine per year. Testing should be minimised where practicable, and it is expected that sites will operate well within

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this threshold. BAT is to minimise how much you test the engines and to only test one engine at a time. See Section 5.3

2.2.2 You must complete a table for **each** testing scenario (provided in Annex 1 of this document) and provide the following:

- Total number and identification of the specific engines operated during each test.
- Frequency and duration of the test.
- Engine loading.
- Confirmation of whether engines are tested together or individually.
- Confirmation of the maximum number of engines which could reasonably operate within the relevant pollutant averaging periods (i.e. 1-hour or 24-hour).
- Where Selective Catalytic Reduction (SCR) is installed, explain whether the engines are being tested with or without active SCR and the duration of the SCR cold-start period (see Section 5.4).

2.2.3 The routine tests you identify in your permit application must be clearly reflected by your air dispersion modelling scenarios. You should only model the testing you propose to undertake.

2.2.4 You must identify any potential overlap of routine tests within the relevant pollutant averaging periods (such as the 1-hour or 24-hour periods), as overlapping tests may combine to produce higher short-term emissions. Any overlap must be fully accounted for in your modelling.

### 2.3 Emergency/Loss of Off-Site Power (LOOP)

2.3.1 An emergency or 'Loss of Off-Site Power' (LOOP) operational scenario must also be considered within your modelling. In line with our guidance ([Air emissions risk assessment for your environmental permit - GOV.UK](#)), you must include a worst-case modelling scenario based on a full-load response lasting for 72-hours. The 72-hour duration is derived from national 'black start' contingency planning for a major power failure.

2.3.2 Emergency operation modelling should be representative of a realistic loss of off-site power scenario at your installation. Where your modelling assumes either fewer than all permitted engines operating, or operation at less than 100% load, you must provide a clear justification for this in your assessment report.

2.3.3 The total capacity of fuel storage tanks cannot be used to justify a shorter duration emergency scenario.

2.3.4 Your report must also include an assessment of grid reliability to demonstrate the likelihood of a power outage. This may include:

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- Historical performance data for the local electricity network, including frequency and duration of outages.
- Any relevant national or local reliability standards or published metrics.
- How many engines will operate with the loss of each separate grid connection.

### 2.4 Commissioning

- 2.4.1 In the case of new engines, commissioning tests must also be considered within your air quality assessment. Where it can be demonstrated that the operational scenarios modelled for routine testing are equivalent to or worse than commissioning, commissioning does not need to be modelled separately.
- 2.4.2 If commissioning details are not included in the application, Applicants will be required to provide a commissioning schedule and/or risk assessment as a pre-operational condition.

## 3. **Pollutants**

- 3.1.1 The greatest air quality risks from arrays of back-up engines typically arise during short-term operation, although annual impacts must also be assessed.

### 3.2 Main pollutants

- 3.2.1 In the case of engines running on gas oil or agreed substitute fuels such as Hydrotreated Vegetable Oil (HVO), Applicants should consider emissions of oxides of nitrogen ( $\text{NO}_x$  and  $\text{NO}_2$ ) in their air quality assessments.
- 3.2.2 If your back-up engines aggregate to 50MWth or more, you must also assess against the short-term nitrogen monoxide (NO) EAL (1-hour 100<sup>th</sup> percentile).
- 3.2.3 If SCR is proposed, then we also expect you to consider annual and 1-hour ammonia ( $\text{NH}_3$ ), to account for ammonia 'slip'. You must justify the  $\text{NH}_3$  emission concentration used in your assessment.
- 3.2.4 Consideration of other pollutants (e.g. sulphur dioxide, particulate matter), is only necessary if there is a relevant short-term air quality management area (AQMA) for the pollutant of concern within 2km of the installation.

### 3.3 Acute Exposure

- 3.3.1 The operation of arrays of standby engines can lead to very high peak concentrations at sensitive human health receptors. You will need to provide an assessment against the US EPA Acute Exposure Guideline Levels (AEGLs) to determine if acute concentrations of  $\text{NO}_2$  may be high enough to cause health effects and associated risks to members of the public.
- 3.3.2 AEGLs provide scientifically derived thresholds for various exposure durations, including very short periods such as 10 minutes, which are particularly relevant

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when evaluating peak emissions from back-up engine operation. Although AEGLs are not a regulatory requirement in England, they are widely recognised as indicative benchmarks for assessing short-term health impacts during emergency or incident response.

- 3.3.3 Your acute exposure risk assessment should compare the 100th percentile predicted environmental concentrations (PECs) of NO<sub>2</sub> against the AEGLs. See Table 1 and [Air emissions risk assessment for your environmental permit - GOV.UK](#).

### 3.4 Ecological receptor assessments

- 3.4.1 You must assess against the relevant long- and short-term critical levels and the nutrient nitrogen and acid deposition critical loads for any relevant ecological designation, for both routine testing and emergency. For reference, critical levels are presented in Table 1 (and [Air emissions risk assessment for your environmental permit - GOV.UK](#)). Critical loads are habitat-specific; refer to [www.apis.ac.uk](http://www.apis.ac.uk) for relevant values.
- 3.4.2 If you are proposing to use your own critical loads or levels, you must provide sufficient evidence to support this.
- 3.4.3 The greatest ecological risks from back-up engines typically relate to the 24-hour NO<sub>x</sub> critical level. You should apply the critical level of 75 ug/m<sup>3</sup>, recommended in Chapter 11 of the WHO Air Quality Guidelines for Europe<sup>1</sup>, in the first instance for all detailed modelling assessments.
- 3.4.4 If you predict exceedances of the critical level of 75 µg/m<sup>3</sup>, you can then assess against the higher daily NO<sub>x</sub> critical level of 200 ug/m<sup>3</sup>, provided ozone (O<sub>3</sub>) is below the AOT40 (accumulated ozone exposure above a threshold concentration of 40 ppb) of 6,000 ug/m<sup>3</sup>, calculated from 1-hour concentrations over the defined growing season, and SO<sub>2</sub> is below the lower critical level of 10 ug/m<sup>3</sup> at the ecological receptor of relevance.

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<sup>1</sup> World Health Organisation (WHO). 2000. Air Quality Guidelines for Europe. <https://iris.who.int/handle/10665/107335>

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<b>Table 1: Averaging periods and relevant standards for Data Centres</b>								
<b>Pollutant</b>	<b>Averaging period</b>	<b>Relevant standards (<math>\mu\text{g}/\text{m}^3</math>)</b>						
		<b>10 min</b>	<b>30 min</b>	<b>1-hr</b>	<b>4-hr</b>	<b>8-hr</b>	<b>24-hr</b>	<b>Annual</b>
<b>Human health</b>								
<b>NO<sub>2</sub></b>	Annual							40
	1-hour (99.79 <sup>th</sup> percentile)			200				
	AEGL-1 <sup>Note 1</sup>	940	940	940	940	940		
	AEGL-2 <sup>Note 1</sup>	38,000	28,000	23,000	15,000	13,000		
	AEGL-3 <sup>Note 1</sup>	64,000	47,000	38,000	38,000	21,000		
<b>NO</b>	Annual							310
	1-hour (100 <sup>th</sup> percentile)			4,400				
<b>NH<sub>3</sub></b>	Annual							180
	1-hour (100 <sup>th</sup> percentile)			2,500				
<b>Ecological</b>								
<b>NO<sub>x</sub></b>	Annual							30
	24-hour (100 <sup>th</sup> percentile)						75 or 200 <sup>Note 2</sup>	
<b>NH<sub>3</sub></b>	Annual							1 or 3 <sup>Note 3</sup>
<b>Nutrient nitrogen deposition</b>	Annual							Note 4
<b>Acid deposition</b>	Annual							Note 4
<p>Note 1: some calculations may convert ppm to <math>\mu\text{g}/\text{m}^3</math> under different temperature assumptions so published AEGL values may differ. The values in this table are used by the Environment Agency.</p> <p>Note 2: see paragraph 3.4.4 above.</p> <p>Note 3: 1 <math>\mu\text{g}/\text{m}^3</math> should be selected when lichens and bryophytes are present. In other cases, use 3 <math>\mu\text{g}/\text{m}^3</math>. Refer to <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> for relevant critical levels.</p> <p>Note 4: Nutrient nitrogen and acid deposition critical loads are habitat-specific; refer to <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> for relevant values.</p>								

#### 4. Alternative fuels

4.1.1 HVO is an increasingly common alternative fuel to gas oil. If you propose to operate on HVO, you should use gas oil as the basis for your risk assessment. This will provide a reasonable worst-case, as HVO is expected to produce lower NO<sub>x</sub> emissions. Your permit will not prohibit the use of gas oil and there is no guarantee of availability of supply of HVO in the event of an outage, therefore this approach also maintains operational fuel flexibility.

4.1.2 Other substitute or 'drop-in' fuels for gas oil will generally be treated in the same way as HVO for modelling and risk assessment purposes. Agreement for the use of alternative fuels must be sought, on a case-by-case basis, from the

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Environment Agency in writing. To avoid delays with determining your application, this should ideally be done via enhanced pre-application advice.

### 5. Best Available Techniques (BAT)

#### 5.1 Build Standards – emissions optimisation

5.1.1 For installations subject to IED Chapter II (aggregated capacity >50 MWth), new Medium Combustion Plant (MCP) engines without abatement must be emissions-optimised to TA Luft 2g or Tier II US EPA or equivalent standards or better.

Indicative emission concentrations are:

- NO<sub>x</sub>: 2,000 mg/Nm<sup>3</sup> at 5% O<sub>2</sub> (equivalent to 750 mg/Nm<sup>3</sup> at 15% O<sub>2</sub>) at a typical emergency load (usually greater than 67% of standby power rating).

See [Emergency backup diesel engines on installations: best available techniques \(BAT\) - GOV.UK](#)

5.1.2 You must send copies of your engine specification sheets when you apply for your permit or variation, as these will provide evidence of these requirements and proof of BAT.

5.1.3 Please note, installing more polluting engines (e.g. 3g or 4g equivalent) and installing SCR to abate emissions is not BAT and will not be accepted.

#### 5.2 Build standards - stacks

5.2.1 The BAT guidance also specifies that stack design should ensure effective flue gas dispersion. Stacks should be vertical and unobstructed by caps or cowls.

5.2.2 Existing engines may have horizontal stacks, which limit effective dispersion and can result in higher ground-level pollutant concentrations. Where this is the case, the assessment must clearly explain how these have been accounted for in the modelling.

#### 5.3 Operational controls

5.3.1 When using back-up engines, you must manage the impacts on air quality to minimise harm to human health and the environment. BAT is to minimise how much you test the engines and to only test one engine at a time; see [Emergency backup diesel engines on installations: best available techniques \(BAT\) - GOV.UK](#)

5.3.2 You must fully justify any deviation from BAT, including any operational requirements to test engines concurrently.

#### 5.4 Selective Catalytic Reduction (SCR)

5.4.1 Where SCR is proposed, the NO<sub>x</sub> emission concentrations from the back-up engines will be lower. You must set out the achievable ELV in your application. Although there is no fixed ELV, an indicative benchmark of 190 mg/Nm<sup>3</sup> (at 15%

O<sub>2</sub>) is often applied; concentrations as low as 35 mg/Nm<sup>3</sup> may be achievable in some cases.

- 5.4.2 Where catalysts are not pre-warmed, the SCR ‘cold-start’ period must be accounted for in your emission assumptions. This typically lasts 5–10 minutes at the start of operation, during which NO<sub>x</sub> emissions will be higher.

## 6. Post-processing modelling outputs

- 6.1.1 All assumptions and calculations used in post-processing should be clearly documented and justified.
- 6.1.2 If you have run your model for a full year of continuous operation, when processing your 24-hour process contributions you should:
- Avoid factoring your 24-hour 100<sup>th</sup> percentile process contributions (PCs) by the number of hours of operation in a 24-hour period, as this may underpredict concentrations.
  - Where the daily operation is confirmed to be 10 hours or fewer, the 1-hour 100<sup>th</sup> percentile can be used as a proxy and factored by the number of hours of operation in 24 hours.

### 6.2 Time-varying emissions file use

- 6.2.1 Where operation is known to occur only during specific hours, time-varying emission factors can be applied to restrict the modelled hours of operation, potentially limiting the hours of exceedance.
- 6.2.2 A time-varying emissions file can account for operational variability throughout the year, but this approach relies on the emissions profile being representative of reality and reflecting a realistic worst-case assumption. Any use of a time-varying file must be fully evidenced and justified in your report.

### 6.3 Statistical Analysis

- 6.3.1 If your initial modelling indicates that short-term NO<sub>2</sub> concentrations may exceed the air quality standard, you should use a suitable statistical analysis method to estimate the probability of exceedances.
- 6.3.2 Statistical analysis should only be applied where there are a maximum number of permissible exceedance hours (i.e. the NO<sub>2</sub> short-term air quality standard, with 18 permissible exceedance hours (99.79<sup>th</sup> percentile)) and should not be applied to the NO<sub>2</sub> AEGL or 24-hour NO<sub>x</sub> assessments.
- 6.3.3 Statistical methods such as Hypergeometric Probability Distribution Analysis or a Monte Carlo Simulation may be used to calculate the probability of the NO<sub>2</sub> short-term air quality standard being exceeded, accounting for the number of operating hours and permissible hours of exceedance.

## Appendix A to the Supplementary Combustion Sector (Part A Installations) Basic Pre-Application Advice Document

- 6.3.4 The web guidance [Specified generators: dispersion modelling assessment - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/specified-generators-dispersion-modelling-assessment) provides a methodology to assess the operating envelope and operational hours using hypergeometric probability distribution analysis to support assessment of compliance, particularly where engine operation is limited to a small number of hours each year. The guidance highlights that, in such cases, it is appropriate to use statistical methods to assess the likelihood of exceeding the permitted number of exceedance hours and provides advice on selecting and applying these techniques.
- 6.3.5 The short-term Environmental Standard for NO<sub>2</sub> permits up to 18 hours of exceedance per year (99.79th percentile). If all testing occurs for a total of 18 hours or less annually, it is not possible to breach this standard, so no statistical analysis is needed. Be aware that some tests may not exceed this threshold when modelled in isolation but may exceed when multiple tests are considered (e.g. 22 hours of exceedance with 9 hours of exceedance from Test 1 and 13 hours of exceedance from Test 2). All test scenarios must be included when calculating the total number of potential exceedance hours in your modelling.

### 6.4 Probability outcomes

- 6.4.1 Statistical analysis results should be interpreted as follows:
- 1% or less: Exceedances are considered highly unlikely.
  - Less than 5%: Exceedances are unlikely, assuming plant operational lifetime of no more than 20 years.
  - More than or equal to 5%: There is potential for exceedances, and the Environment Agency will consider the acceptability of this risk on a case-by-case basis.

## 7. Modelling outcome

- 7.1.1 If you predict short-term exceedances of the 1- hour NO<sub>2</sub> (99.79<sup>th</sup> percentile) air quality standard, you should undertake statistical analysis (Section 6.3).

### 7.2 Routine testing

- 7.2.1 Routine testing scenarios will not be permitted if modelling and statistical analysis (where required) indicates an exceedance of the environmental standards. Exceedances of the AEGLs may be acceptable; however, substantial exceedances are unlikely to be allowed where the Environment Agency considers that reasonable additional measures could be applied to reduce impacts.
- 7.2.2 If your modelling, or our subsequent audit, predicts that exceedances are likely for testing, you will need to propose additional measures to reduce emissions. This may include, but not be limited to:

## Appendix A to the Supplementary Combustion Sector (Part A Installations) Basic Pre-Application Advice Document

- Revising testing regimes to align with BAT (reducing the number of engines operating in groups, and/or their operating duration - see Section 5).
- Increasing stack heights.
- Replacing any horizontal stacks with vertical stacks.
- Including SCR (of limited effectiveness for short-term tests unless catalysts are pre-warmed).

7.2.3 You will need to resubmit your air quality modelling assessment to demonstrate that exceedances no longer occur.

### 7.3 Emergency

7.3.1 Some exceedances of the environmental standards may be permissible for the emergency scenario. Substantial exceedances will not be acceptable, however, particularly where the Environment Agency considers that reasonable additional measures could be applied to reduce impacts.

7.3.2 If modelling predicts exceedances for emergency use, the grid reliability likelihood assessment in section 2.3.4 should be followed.

7.3.3 All Data Centre installations are required, via an improvement condition, to develop a site-specific Air Quality Management Plan (AQMP) that identifies the emergency operating conditions under which local air quality may be adversely affected and the measures that will be taken to minimise impacts at sensitive receptors.

## 8. Ecological receptors

8.1.1 You must consider the impact of your site on protected conservation areas in your assessment. These include European designated sites (Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Ramsar sites), Sites of Special Scientific Interest (SSSI), and local nature sites (ancient woodland, local wildlife sites, and national or local nature reserves).

8.1.2 See [Air emissions risk assessment for your environmental permit - GOV.UK](#) for the relevant screening distance for air emissions on protected conservation areas.

8.1.3 The Environment Agency can provide free basic advice before you apply for an environmental permit, this includes information on whether your activity may have an impact on nature conservation sites, or protected species and habitats. We can also give you enhanced advice for more complex requests – this is a service you pay for. [Get advice before you apply for an environmental permit - GOV.UK](#).

### Annex 1 - Testing regime template tables

You must complete a separate table for **each** test scenario and submit these with your application.

<b>Name of test:</b> <i>[e.g. Building 1 test]</i>							
<b>Number and location of engines:</b> <i>[e.g. 8 engines located at Data Hall 1 (DH1), emission points A1-A8]</i>							
Frequency	Duration	Engine loading	Tested concurrently or consecutively?	Maximum number of engines operated in any:		Where Selective Catalytic Reduction (SCR) is installed/proposed:	
				1hr	24hr	SCR operational during test?	SCR warm-up time
<i>[e.g. monthly – first Wednesday of the month]</i>	<i>[e.g. 10 minutes per engine]</i>	<i>[e.g. 50% load]</i>	<i>[e.g. each engine tested individually (consecutive operation)]</i>	<i>[e.g. 6 engines]</i>	<i>[e.g. 8 engines]</i>	<i>[e.g. No – SCR installed but not utilised for this test due to warm-up times]</i>	<i>[e.g. N/A – SCR installed but not utilised for this test]</i>

<b>Name of test:</b> <i>[e.g. Annual Black Building Test]</i>							
<b>Number and location of engines:</b> <i>[e.g. all 32 standby engines, across 4 data halls (DH1–DH4), emission points A1-A32]</i>							
Frequency	Duration	Engine loading	Tested concurrently or consecutively?	Maximum number of engines operated in any:		Where Selective Catalytic Reduction (SCR) is installed/proposed:	
				1hr	24hr	SCR operational during test?	SCR warm-up time
<i>[e.g. Annual – during 1st week of June – no more than two data halls per day.]</i>	<i>[e.g. 30 minutes per data hall]</i>	<i>[e.g. 100% load]</i>	<i>[e.g. All engines run concurrently for 30 minutes. Limited to two data halls per day. Data halls not tested simultaneously.]</i>	<i>[e.g. 8 engines]</i>	<i>[e.g. 16 engines]</i>	<i>[e.g. Yes – SCR operational where installed (data halls 1, 2, and 3 only, emission points A1-A24)]</i>	<i>[e.g. 10 minutes]</i>

## SDC M40 Campus

### Issue

The mandatory EPR permitting for natural gas Energy Centre (clearly >50MWth) is not detailed and hence the full implications on plant design and abatement requirement are not present in the scoping report (attached guides for information):

- Regulatory Framework for Embedded Generation at Data Centres - March 2026
- Combustion (Part A) pre-app basic advice

### Impact

The absence of detail on the installed plant energy centre design and configuration risks that final implementation might not be permissible under EPR and IED BAT without modifications or additional controls.

### Suggested solution

Pre-application or twin-tracking for EPR >50MWth IED permit. Review/update the current baseline scoping with the additional information regarding the Energy Centre operations BAT in detail and specifically energy efficiency.

<b>Document Reference(s):</b> Environmental Impact Assessment Scoping Report April26 4.2.16 National Policy Statement for Natural Gas Electricity Generating Infrastructure (EN-2) 3.6. Decarbonisation Readiness including 5.10. and 6.2.64, 6.5.50 etc 3.8. Waste Heat Recovery – efficiency of combustion plant	
<b>Issue</b>	EPR for Energy Centre Aggregated >50MWth
<b>Impact</b>	Emission to air of NOx and dust/particulate Energy efficiency of power plant Decarbonisation and carbon capture options <a href="#">Decarbonisation readiness in environmental permit applications - GOV.UK</a>
<b>Solution</b>	LCP BAT and additional abatement (SCR and DPF) need to be more detailed. Clear target for energy efficiency meeting BAT needs to be outlined. Heat recovery, only mentioned in the context of the Data Centre, should also potentially include the power plant operations (e.g. CCGT mode or Combined Heat and Power (CHP))

Scoping should ideally consider both decarbonisation routes. Outline detail of decarbonisation readiness if hydrogen fuel availability is limited i.e. carbon capture plant readiness

**Additional narrative/ explanation (if necessary)**

Review/update the current baseline scoping with the additional information regarding the Energy Centre operations BAT in detail and specifically energy efficiency. BAT for emission to air and abatement is also needed. Outline of detail of Decarbonisation readiness including carbon capture plant readiness (or provide space to retrofit).

The report does not specify the scale or technology of the proposed >50MWth energy centre (e.g. OCGT, CCGT, or engines). As a result, it is unclear how Best Available Techniques (BAT) may influence the output of the Air Quality assessment, beyond general references in planning policy and brief mentions on air quality impacts.

Combustion plant >50MWth falls under Part A(1) of the Environmental Permitting Regulations. Installations of 20MWth or more must also assess opportunities for high-efficiency cogeneration under the Energy Efficiency Directive.

If the scheme comprises either multiple units >15MWth totalling over 50MWth (into a common stack), or a single OCGT/CCGT >50MWth, it would be classed as a Large Combustion Plant under IED Chapter III. Applicable emission limits depend on annual operating hours, with stricter requirements above 1,500 hours/yr.

The Environment Agency must base permit conditions on published BAT conclusions. Current BAT does not support baseload OCGT operation or CCGT in open-cycle mode due to poor efficiency, typically around 20% lower than combined-cycle operation (45%–55%).

The data centre is expected to reach up to 300MWe IT load. The associated gas-fired energy centre could supply up to 350MWe, and it is uncertain whether hydrogen supply via the gas network is feasible. A technical and economic assessment of CO<sub>2</sub> capture, transport, and storage is therefore likely required (previous CCS and readiness threshold was >300MWelec).

The following issues will be considered as part of the permitting process for aggregated plant as an energy centre:

1. OCGT/CCGT as IED Chapter III LCP – LCP Bref directly applicable for 24/7 baseload power plant (>1500hours)
  - i. LCP BAT and BAT AELs
  - ii. IED LCP ELVs
  - iii. Different BAT criteria may apply for when the power plant moves to peaking <1500hours and exports to the grid i.e. the data centre goes fully on electricity grid (if/when grid capacity is available)

2. Or reciprocating engines typically each <15MWth under IED Chapter II >50MWth aggregated.
  - a. Environment Agency minimum the selection of emissions optimised ignition engines meeting 95mg/m<sup>3</sup> as new plant MCP (covering legal minimum as specified generator under SG regs).
  - b. BAT under EPR permitting may require Selective Catalytic Reduction (SCR) to reduce NO<sub>x</sub> emissions to tighter than 95mg/m<sup>3</sup>; typically, 40mg/m<sup>3</sup> – target LCP equivalent
    - i. the scale of the energy centre
    - ii. proximity to M40 motorway
    - iii. proximity of NO<sub>x</sub> source landfill gas plant (24/7 operation)
    - iv. proximity to proposed standby engines and their engine test and maintenance emissions
    - v. proximity of downwind sensitive receptors (e.g. Beaconsfield) & SSSI (Burham Beeches, Hodgemoor Wood)
    - vi. Reliability and maintenance of the energy centre power plant (being a substitute for the UK Grid) may require the standby engines to run more often in support and hence affect standby AQ modelling impacts and potentially standby permitting.
    - vii. Possible applicability of NO<sub>x</sub> and Dust/particulate damage costs emissions to air as policy like (e.g. [Air Quality SPD](#)) (being a local authority remit)
3. Efficiency BAT and waste heat (LCP Chapter III or Chapter II)
  - a. Heat recovery is mentioned only in the context of the Data Centre not as part of efficient power plant operations (e.g. CCGT mode or Combined Heat and Power (CHP))
  - b. Embedded generation at data centres should use combined cycle generation or increase the efficiency of open cycle generation to an equivalent energy efficiency of LCP BATc
4. Decarbonisation readiness is proposed through hydrogen conversion only; it is not clear if this is limiting the scope of appropriate plant OCGT/CCGT, gas engines for the prior period running on natural gas and thus compromising other BAT generally i.e. the plant BAT for energy efficiency may not be readily convertible to hydrogen (or readily convertible to hydrogen may not be very energy efficient) and hence item 5 below
5. Risks that provision of decarbonisation readiness through hydrogen conversion only, without any detailed justification or assessment, precludes the option for Carbon Capture readiness in plant design and layout [Carbon Capture Readiness \(CCR\): a guide on consent applications - GOV.UK](#) ([Post-combustion carbon dioxide capture: emerging techniques -](#))
6. Stacks for the exhaust of baseload 24/7 emissions are of sufficient height for acceptable dispersion reducing impacts to sensitive receptors.
7. Noise and vibration levels are acceptable and to BAT for EPR permitting.  
<https://www.gov.uk/government/publications/noise-and-vibration-risk-assessment-using-the-noise-advisory-tool/noise-and-vibration-environmental-permit-application-guidance#:~:text=5.2%20Power%20generation%20or%20back%20up%20and%20peaking%C2%A0>

The mandatory EPR permitting for Standby Generators is not detailed and hence the full implications on plant design and abatement requirement is not present in the scoping report (attached guides):

- Regulatory Framework for Embedded Generation at Data Centres - March 2026
- Combustion (Part A) pre-app basic advice 2
- Data Centre Air Quality Appendix to Combustion Pre App v1.1\_external circulation

**Impact**

The absence of detail on the proposed standby plant design and configuration risks that final implementation might not be permissible under IED and BAT.

**Suggested solution**

Pre-application or twin-tracking for EPR >50MWth IED permit aggregated standby. Review/update the current baseline scoping with the additional information regarding the standby engine BAT in detail and AQ impacts (testing, maintenance and major outages of the energy centre).

Incorporate EA Pre-application guidance on modelling air impacts of data centres into Air Quality Assessment

<b>Document Reference(s):</b> Environmental Impact Assessment Scoping Report April26 6.2. AIR QUALITY specifically 6.2.58 page 84. Also 3.2.12 for >50MWth	
<b>Issue</b>	EPR for Standby Aggregated >50MWth for the data centre
<b>Impact</b>	Emission to air of NOx and Dust/particulate for the standby engines.  Fuel storage and potential spills
<b>Solution</b>	Standby BAT including fuel type, additional abatement (SCR and DPF), noise, stacks, minimised test regime.  BAT for fuel and SCR reagent storage and protection of ground and surface water  Review/update the current baseline scoping with the additional information regarding the Standby operations BAT in detail.  Whether the applicant will need to go beyond BAT and install and optimise Selective Catalytic Reduction (SCR) to reduce emissions further. This is likely where air quality is poor, multiple sites using aggregated back-up engine co-locate, or engine test regimes include testing multiple engines at once.

### **Additional narrative/ explanation (if necessary)**

Review/update the current baseline scoping with the additional information regarding the Standby operations BAT in detail.

The report does not indicate the actual scale of the MWelec installation of standby emergency diesel plant and hence the number and size of engines. Combustion activities above 50MWth net rated input are Part A(1) activities under the Environmental Permitting Regulations. The applicant has not discussed Best Available Techniques (BAT) in detail *{but under Scoping document: Policy and Guidance 4.1.14(k) Pollution Control and Regulatory Regimes (4.12) makes some reference to BAT; also standby gensets Air Quality 6.2.59 "Selective Catalytic Reduction (SCR) Maintenance"}*

The data centre is understood to be up to 300MWelec IT load (3x100MW blocks) in total; depending on Power Usage Effectiveness (PUE) (1.2-1.3) and n+1 resilience this might equate to 150-200 2MWelec rated standby gensets.

The natural gas energy centre powering the site may be up to 350MWelec (for 2x100MW IT) but this would not substitute the diesel standby requirement, as both are needed; and could well share the load demand and operate in parallel under certain power outage conditions.

The following issues will be considered as part of the permitting process for aggregated diesel generators:

Impacts from air emissions from both (a) the testing and maintenance regime and (b) the worst-case emergency scenario of all engines running continuously for 72 hours. Air Dispersion modelling will assess impact to both air quality standards and Acute Exposure Guideline Levels for Oxides of Nitrogen.

The applicant has not discussed Best Available Techniques (BAT) namely;

1. Environment Agency minimum the selection of emissions optimised ignition engines that are compliant with USA EPA Tier II / TA Luft standards '2g'. The physical configuration should be 'SCR-ready' for retrofit of additional abatement if needed. Further guidance on BAT for engine design standards is published here <https://www.gov.uk/guidance/emergency-backup-diesel-engines-on-installations-best-available-techniques-bat>;
2. However EPR permitting engagement and BAT review there may be a need for **Standby diesel beyond-BAT and Selective Catalytic Reduction (SCR) to reduce NOx emissions (<190mg/m<sup>3</sup>) and diesel particulate filter (DPF)**. This is because *{operator is mentioning SCR in the scoping for additional emission abatement but not specifically stated as being fitted as standard}*
  - a. the scale of the installed standby (possibly equivalent to exceeding 150+ 2MWelec gensets)
  - b. proximity to M40 motorway
  - c. proximity of NOx source landfill gas plant (24/7 operation)

- d. proximity to proposed continuous >50MWth energy centre as a NOx source
  - e. proximity of downwind sensitive receptors (e.g. Beaconsfield) & SSSI (Burham Beeches, Hodgemoor Wood)
  - f. Possible applicability of NOx and Dust/particulate damage costs (engine testing and one-off electrical outage) emissions to air as policy like [Air Quality SPD](#) (being a local authority remit)
  - g. Reliability and maintenance of the energy centre power plant (being a substitute for the UK Grid) may require the standby to run more often in support including electively for energy centre maintenance and overhaul works. This could potentially impact on standby AQ impacts and permitting.
3. Maintenance and testing regime that minimises the impact to air quality by minimising and sequencing of testing.
  4. Fuel storage (COMAH quantities?) and, where applicable, SCR reagent (urea) storage standards for ground and surface water protection.
  5. Stacks for the exhaust of emissions for back-up diesel generation are vertical and of sufficient height above nearby buildings and flow is unimpeded.
  6. Use of an Air Quality Manage Plan (AQMP) to manage and monitor air quality risks during site standby maintenance, testing and outage operations. Potential inclusion of ambient AQ monitoring stations.
  7. Choice of fuel as BAT: diesel or Hydrotreated vegetable oil (HVO)

**Issue**

**COMAH.** The scoping document does not assess the likely total standby fuel storage quantities as potentially elevating the site to a lower tier COMAH.

**Impact**

May require a Major Accident Prevention Policy - MAPP and meet the other Core Lower Tier Requirements.

**Suggested solution**

Review/update the current baseline scoping with the additional information regarding the total fuel stored on site for standby operations and handling under COMAH.

<b>Document Reference(s):</b> Environmental Impact Assessment Scoping Report April26. 6.8.14 PROJECT VULNERABILITY (MAJOR ACCIDENTS AND DISASTERS)	
<b>Issue</b>	COMAH
<b>Impact</b>	Is potential a lower Teir COMAH for the total quantity of standby diesel fuel stored
<b>Solution</b>	May require a Major Accident Prevention Policy - MAPP and meet the other Core Lower Tier Requirements.  Link <a href="#">understanding-comah-new-entrants.pdf</a>
<b>Additional narrative/ explanation (if necessary)</b>	
<p>The site needs to address directly COMAH in relation to the total quantity of fuel stored on site used primarily for the standby engines.</p> <p>Lower Tier: 2,500 tonnes diesel. This may equate to roughly 150 gensets with standard 20,000litre belly tanks. We think the site may be at a scale reaching lower tier COMAH but the detail is not clear.</p> <p>Hazardous Substances and Major Accidents (4.14): Developments involving hazardous materials or presenting major accident risks must comply with the Control of Major Accident Hazards (COMAH) Regulations. Applicants should demonstrate robust containment, safety management, and emergency response measures proportionate to identified risks. Is reference in the report overall.</p>	



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26<sup>th</sup> May 2026

**Your ref: EN0110030**

Dear Sir/Madam,

Re: M40 SDC Data Centre Campus – EIA Scoping Consultation Response

Gerrards Cross Town Council submits this response in its capacity as a statutory consultee in respect of the Environmental Impact Assessment (EIA) Scoping Report for the proposed M40 SDC Data Centre Campus (“the Proposed Development”).

This submission is intentionally concise. It is supported by, and should be read together with, an independent Expert Report commissioned by the Town Council and prepared by Mr Andrew White M.Eng., C.Eng., MBA, FIET of Harberry Limited, dated 26 May 2026.

**Purpose of this Submission**

The purpose of this letter is threefold:

1. To summarise the principal concerns of the Town Council;

2. To highlight critical issues that, in our view, require careful consideration at the scoping stage; and
3. To formally introduce and direct the Examining Authority to the accompanying Expert Report, which contains the detailed technical assessment underpinning this response.

Given the complexity and scale of the Proposed Development, the Town Council considers that the Expert Report is essential reading to inform a robust and proportionate Scoping Opinion.

### **Introduction to the Expert Report**

The Town Council has commissioned an independent expert with over 40 years' experience in telecommunications infrastructure and data centre systems to provide a professional assessment of the proposal from an ICT, infrastructure, and energy systems perspective.

The Expert Report has been prepared specifically to assist the decision-maker in understanding whether:

- the proposed site represents an appropriate and strategically justified location for infrastructure of this scale;
- the proposed energy and cooling strategies reflect optimal design or are driven by underlying constraints; and
- the scope of the EIA adequately captures the likely significant environmental effects arising from the Development.

The report is independent, evidence-based, and confined to matters within the expert's professional competence. It does not seek to duplicate planning or legal argument, nor does it repeat the content of the Applicant's Scoping Report. Instead, it provides a structured technical critique of key assumptions and omissions.

### **Why the Expert Report Merits Close Consideration**

The Town Council respectfully emphasises that the Expert Report should be read in full. In particular, it:

- Identifies structural characteristics of the scheme that are not immediately apparent from the Applicant’s documentation, including the extent to which the Development is enabled by mitigation of site constraints rather than inherent site suitability;
- Examines interdependencies between energy generation, cooling strategy, site topography, and environmental effects, which are critical to understanding the true operational impacts of the Development;
- Highlights areas of material uncertainty—notably in relation to long-term energy strategy, cooling feasibility, and environmental performance—that are not adequately reflected in the proposed EIA scope; and
- Provides a clear technical basis for why several topics proposed to be scoped out should instead be assessed in detail.

These considerations go directly to the purpose of scoping under the EIA Regulations: to ensure that all likely significant effects are properly identified at an early stage.

### **Key Matters for the Scoping Opinion**

Without repeating the detailed analysis set out in the Expert Report, the Town Council draws attention to the following overarching themes:

#### **1. Constraint-led Development**

The proposal appears to rely on compensatory measures—particularly in relation to power supply and cooling—arising from constraints at the site, rather than demonstrating inherent suitability for hyperscale infrastructure.

#### **2. Energy Strategy and Grid Constraints**

The reliance on a large-scale gas-fired onsite energy centre is presented as a solution to constrained grid capacity, rather than an optimised or future-aligned design approach. This has implications for:

- long-term sustainability and policy alignment;
- environmental impacts; and
- appropriate scoping of related effects.

### **3. Thermal Output and Cooling Dependencies**

The Development will produce a substantial and continuous thermal output, requiring large-scale heat rejection to the local environment. The proposed reliance on air cooling introduces dependencies on local atmospheric conditions and site configuration that are not yet demonstrated.

### **4. Interrelated Environmental Effects**

The Town Council is particularly concerned that the current scoping approach treats environmental topics in isolation, whereas the evidence suggests a strongly interdependent system involving:

- energy generation;
- cooling performance;
- waste heat dispersion; and
- local environmental conditions.

### **5. Scope of the Environmental Assessment**

The Town Council supports the Expert's conclusion that the following topics should be scoped into the EIA, contrary to the Applicant's proposal:

- Water Resources and Flood Risk;
- Waste and Materials (including thermal outputs);
- Population and Human Health; and
- Odour effects.

The Applicant's Scoping Report proposes that several of these topics be excluded from detailed assessment.

In the Council's view, and as supported by the Expert Report, this risks under-scoping the environmental effects of a development of this scale.

The Council also draws attention to important heritage sites nearby including Bulstrode Park and Bulstrode Camp which are of archaeological interest. Therefore archaeology should be within the scope of the EIA and not excluded.

## **Conclusion**

The Town Council recognises that the Proposed Development is of substantial scale and may contribute to national data centre capacity. However, this does not, in itself, determine that the site or configuration is appropriate.

The central issue raised by this submission—and examined in detail in the Expert Report—is whether the Development represents:

- a strategically suitable and future-aligned piece of national infrastructure; or
- a scheme that is deliverable only through the mitigation of significant site constraints, with associated environmental implications that are not yet fully understood.

The Town Council respectfully submits that a robust Scoping Opinion should ensure that these matters are properly examined within the Environmental Statement.

Accordingly, we strongly encourage the Examining Authority to consider the enclosed Expert Report in full when forming its view.

Yours faithfully,  
Pravina Patel



Town Clerk  
On behalf of Gerrards Cross Town Council

# **In the matter of M40 SDC DATA CENTRE PROPOSAL**

**On behalf of:**

**Gerrards Cross Town Council**

**Expert Report of Mr. Andrew White** M.Eng. C.Eng. MBA FIET

**Report status: FINAL**

**26<sup>th</sup> May 2026**

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## ABBREVIATIONS

Below you can find a further description of the terms and abbreviations that are used in this report

<b>Term</b>	<b>Description</b>
ACC	Air Cooled Condenser
CNI	Critical national infrastructure
DC	Data Centre
DCO	Development consent order
EIA	Environmental Impact Assessment, Scoping Report, produced by Slough Holdings UK Limited, dated April 2026.
GW	1,000MW
GWe	Giga watts of electricity
GWt	Giga watts of thermal energy
ICT	Information and Communications Technology
IET	Institution of Engineering and Technology
MW	1,000,000 Watts
MWe	Mega watts of electrical energy
MWt	Mega watts of thermal energy
Project	M40 SDC
S35	Section 35 Direction - qualifying request document for SDC M40 campus. Dated: 21 January 2026 (as supplemented on 27 February 2026)
TCCA	The Critical Communications Association

# 1 INTRODUCTION, EXPERIENCE, INSTRUCTIONS AND DECLARATION

## 1.1 Introduction

I, Andrew White, am Managing Director of Harberry Limited, a UK based company that provides my services as a telecommunications and business expert to clients internationally, predominantly in Europe and the Middle East.

## 1.2 Experience

I have over 40 years of professional experience in the global Information and Communications Technology (ICT) industry. My experience spans telecommunications infrastructure, including data centres, and associated strategic, commercial and technical considerations.

I have previously served as a Corporate Officer of a publicly listed telecommunications company with annual revenues of approximately US\$2 billion, which operated multiple data centres as an essential component of its business activities.

I also have extensive experience in the subsea (submarine) telecommunications sector, including serving as a director of a Bermuda registered company active in this field.

My professional work has included detailed consideration of the strategic and technical challenges associated with the siting and powering of data centres. This has encompassed analysis of both conventional and alternative energy sources, including hydrogen, nuclear, and large scale solar generation, as well as the broader constraints associated with infrastructure availability and resilience.

I have significant experience in the application of ICT in both commercial environments and critical national infrastructure (CNI). I am a director and major shareholder of Wray Castle Limited, a well established telecommunications consultancy and training organisation. Wray Castle is a member of the TCCA (The Critical Communications Association) and TechUK, and its principal client is Vodafone Group. In this capacity, I have been involved in work supporting Vodafone, including matters relating to data centre orchestration.

I am a Chartered Engineer, and was elected a Fellow of the Institution of Engineering and Technology (IET) in 2012.

I hold a Master's degree in Electrical and Electronic Engineering from the University of Surrey and a Master of Business Administration (MBA) from London Business School.

### 1.3 Instruction

I have been instructed by Gerrards Cross Town Council to provide an independent professional opinion from an Information and Communications Technology (ICT) perspective, together with any related matters concerning data centres for which I possess relevant expertise and experience.

Specifically, I have been asked to address the following matters:

1. To explain the importance of data centres and their integral role within the modern digital ecosystem, with particular focus on:
  - a. geographic location,
  - b. power infrastructure and availability, and
  - c. telecommunications connectivity.
2. Within this context, to assess the suitability of the proposed M40 SDC data centre development with reference to the Section 35 Direction ("S35"), and Environmental Impact Assessment, Scoping Report, produced by Slough Holdings UK Ltd, April 2026 ("EIA"). Including producing opinion relating to the 'scoped out' proposals of the Applicant.

My assessment is limited to ICT, data centre operations, associated infrastructure considerations and economics, including energy supply as it relates directly to data centre functionality. I do not provide planning, environmental or legal opinion.

Where I refer to the Environmental Impact Assessment (EIA), I rely on the EIA Scoping Report as a statement of the Applicant's intended approach, rather than as a definitive assessment of impacts.

### 1.4 Declaration

I understand that my duty in providing written reports and giving evidence is to help, in this case the Secretary of State, on matters within my expertise, and that this duty overrides any obligation to the party from whom I have received instructions or by whom I am paid.

I confirm that I have complied and will continue to comply with that duty.

I confirm that I have set out in this report what I understand from those instructing me to be the questions in respect of which my opinion as an expert is required.

I confirm that I have made clear which facts and matters referred to in this report are within my own knowledge and which are not. Those matters that are within my own knowledge I confirm to be true. The opinions I have expressed represent my true and complete professional opinions on the matters to which they refer.

I confirm that I have not omitted to consider material facts which might alter or detract from the opinions expressed.

I confirm that I have indicated the sources of all information I have used.

I confirm that I have not included anything in this report which has been suggested to me by anyone, including those instructing me, without forming my own independent view of the matters concerned.

I confirm that, where there is a range of opinion on the matters dealt with in this report, I have summarised the range of opinion and given reasons for my own conclusions.

I will advise those instructing me immediately if, for any reason, my existing report requires any correction or qualification.

I hereby confirm that Harberry's remuneration is not in any way dependent on the conclusions resulting from our work or on the outcome of this report.

## **1.5 Restrictions & Limitations**

We have relied on the information provided to us at the date of this document and have not carried out any investigation to verify this information. No representation is made as to the accuracy or completeness of such information and nothing in this report is or shall be relied upon as a representation of the future.

We reserve the right, but have no obligation, to revise our assessment and the analysis presented in our report and, if we deem necessary, to modify our conclusions in response to any additional information subsequently brought to our attention.

Harberry will not be responsible for any kind of financial loss or other loss arising from this report, or as a result of undertaking this activity.

The prospective user of this report is encouraged to make additional research and collect any information needed to make a well informed decision, including obtaining professional advice before making any decision to act based on the information available.

Our report is not destined for any general distribution or publication. It must not be used for any other purpose than that already described (i.e. in relation to the M40 SDC). The entire content of this report is considered confidential and reproduction of information is not permitted in any possible sense, or distribution to other persons or entities without the prior written consent of Harberry. We can accept no liability for any loss incurred by any party as a result of any distribution, reproduction, mention or other use of this report contrary to the stipulations of the present paragraph.

## 2 OVERVIEW OF MODERN DATA CENTRES

Data centres (DCs) are a fundamental component of the modern digital economy, underpinning communications, commerce, public services, and information exchange. Their role has expanded significantly over recent decades, and the sector is now undergoing a further period of rapid transformation, driven in large part by the growth of Artificial Intelligence (AI) and data intensive computing.

In recent years, power availability and delivery timelines have become the primary determinants of data centre site selection, often outweighing traditional considerations such as proximity.

### 2.1 Energy Requirements and Scale

A defining characteristic of this transformation is the significant increase in energy demand associated with modern data centre infrastructure.

By way of context, data centres constructed in or around the year 2000 typically operated at capacities below 5MW. Contemporary developments are materially larger. Some recent proposals internationally are reported at multi-gigawatt (GW) scale. For comparison, a conventional nuclear reactor typically produces approximately 1GW of electricity, and the proposed Sizewell C nuclear power station in the United Kingdom is expected to have a capacity of approximately 3.2GW.

While such very large developments remain relatively uncommon, the general trend toward higher capacity facilities is well established and reflects the increasing computational intensity associated with AI workloads, including large scale model training and inference.

Goldman Sachs<sup>1</sup> forecast that US data centre power demand will double by 2027, from 31GW in 2025 to 66GW in 2027.

These characteristics are directly relevant to assessing whether a given site and energy configuration are compatible with modern hyperscale deployment requirements.

### 2.2 Global Orchestration and Hyperscale Infrastructure

A further development within the sector is the increasing use of orchestration technologies. In broad terms, orchestration refers to the ability to distribute and manage computing workloads across multiple data centres, wherever they are located around the globe.

The technical capability to do so is well established and continues to develop, with increasing use of automation and optimisation techniques, including AI driven workload management. Key optimisation factors include cost, performance, resilience, and energy availability.

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<sup>1</sup> <https://www.goldmansachs.com/insights/articles/us-data-center-power-demand-projected-to-double-by-2027> retrieved 24th May 2026.

This capability is supported by substantial investment in global telecommunications infrastructure, including high capacity subsea fibre networks. A notable feature of recent market development is that such infrastructure is frequently deployed and controlled by large scale data centre operators.

These trends have contributed to the emergence of “Hyperscale” operators, such as Amazon (AWS), Microsoft, and Google, which design and operate data centre infrastructure at a global scale.

### **2.3 Latency and Locational Considerations**

Historically, proximity to end users has been an important factor in determining data centre location, primarily in order to minimise latency (i.e. the time required for data transmission). This remains relevant for certain applications, such as real-time communications, financial trading, and interactive services.

However, it is also the case that not all workloads are equally sensitive to latency. In particular, some forms of large scale compute—such as AI training and batch processing—may be less dependent on proximity, particularly where supported by high capacity network infrastructure and orchestration technologies.

Accordingly, while latency remains an important consideration in specific contexts, it is one of several factors influencing modern data centre siting, alongside others such as energy availability, cost, and infrastructure resilience.

### **2.4 Energy Transition and Emerging Technologies**

There is increasing focus within the sector on the development of low carbon energy solutions, reflecting both regulatory requirements and commercial objectives.

Hydrogen has been identified as a potential future energy source in this context, particularly due to its ability to provide low carbon power when used in fuel cell systems. However, large scale deployment in data centre applications remains at a relatively early stage of development, and its long term role will depend on technological, economic, and infrastructure factors.

### **2.5 Summary**

In summary, modern data centres are characterised by:

- increasing scale and massive energy demand;
- integration within globally distributed computing architectures;
- growing use of automated orchestration technologies; and
- evolving energy requirements, with increasing emphasis on sustainability and reliability.

These factors collectively influence both the design of data centre infrastructure and the selection of suitable locations for new development.

## 3 ASSESSMENT OF THE PROPOSED M40 SDC DEVELOPMENT

Expert Review of the Section 35 Direction Request, 21 January 2026 (as supplemented on 27 February 2026), including reference to the Environmental Impact Assessment Scoping Report produced by Slough Holdings UK Limited, April 2026.

### 3.1 Executive Summary (S35 Paragraphs 1.1-1.4)

The Applicant identifies the Project as being of national significance primarily by reference to its scale, economic value, and contribution to forecast demand for data centre capacity.

#### Professional Opinion

I accept that the Applicant has demonstrated that the Project is of substantial scale and would contribute meaningfully to national data centre capacity. However, national significance also requires consideration of the quality, resilience and long-term suitability of the proposed development and are not, in themselves, sufficient indicators that the scheme represents **appropriate or strategically optimal infrastructure for a nationally significant development**.

While the Project would contribute materially to national capacity, the assessment of national significance should also take into account:

- the quality and resilience of the infrastructure being delivered;
- the long term suitability of the site; and
- the extent to which the design aligns with emerging industry and energy system trends.

These factors are not fully addressed in the Applicant's summary justification.

In my opinion, the Applicant's case demonstrates that the Project can be delivered, but does not demonstrate that this location represents an optimal or strategically justified site for infrastructure of this scale.

**With respect to the scope of the EIA, it is my professional opinion, and I shall explain the reasons why in this report, that the following should also be scoped in:**

- **Human Health;**
- **Odours;**
- **Waste and Materials; and**
- **Water Resources and Flood Risk.**

### 3.2 Project Description and Energy Strategy (S35 Paragraphs 1.2, 2.2, 4.10-4.15)

The Applicant describes the provision of an onsite energy centre (approximately 270–350MWe), based on gas fired generation, as enabling a “*resilient and reliable*”<sup>2</sup> power supply.

#### Professional Opinion

Based on the information provided, it is my view that the reliance on onsite gas fired generation primarily reflects **limitations in local grid capacity** rather than an **optimised or future-aligned energy strategy**.

The following observations are relevant:

- The need for onsite generation indicates that the **site does not** currently have sufficient access to high capacity grid infrastructure. In this context, the energy strategy should be understood as **constraint-driven**, rather than the outcome of deliberate optimisation in relation to cost, resilience, or long-term sustainability.
- The proposed energy solution is therefore compensatory in nature.
- The Applicant’s reference to “*decarbonisation-ready*”<sup>3</sup> plant does not provide sufficient clarity regarding the technical or commercial feasibility of future transition (e.g. to hydrogen), particularly at the scale proposed.

In my opinion, the reliance on gas fired generation introduces a number of material risks, including:

- exposure to long-term fuel cost volatility;
- potential misalignment with UK decarbonisation policy and net zero commitments;
- increased regulatory uncertainty over the operational life of the asset; and
- the risk of future stranded or sub-optimal infrastructure.

Government policy and industry practice both indicate that power availability is now the primary driver of Hyperscaler site selection. **In this case, the absence of grid capacity necessitates the use of onsite generation, which indicates that the site does not appear to meet this primary criterion in its current form, and instead relies on compensatory measures.**

This compensatory approach is also reflected in other aspects of the Proposed Development, including the reliance on air cooled thermal rejection (see Section 3.6), which similarly depends on site conditions that are not demonstrated to be inherently favourable.

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<sup>2</sup> Sections 1.2, 2.2 (2) and 4.10 (2).

<sup>3</sup> Sections 2.2 (2), 4,10 (2), 4.14

The 100+ data centre operators committed to the *Climate Neutral Data Centre Pact*<sup>4</sup> have agreed to ensure climate neutrality by 2030, with 100% hourly carbon-free energy by December 31, 2030.

The EIA (Executive Summary and Section 3.4) confirms that the Energy Centre is an integral and functionally interdependent component of the Proposed Development, providing c.300MWe of gas fired generation specifically to overcome local grid constraints.

This is explicitly justified as enabling early delivery of the scheme due to the absence of grid capacity until at least 2030. This reinforces the conclusion that the energy strategy is constraint led rather than optimised, raising questions regarding the inherent suitability of the site for hyperscale infrastructure.

While the EIA references '*decarbonisation readiness*' via hydrogen conversion, it acknowledges that this remains dependent on future infrastructure (e.g. hydrogen pipelines and supply chains), and, is therefore uncertain in both timing and feasibility at scale. The EIA confirms this is to be assessed as a future scenario rather than a firm delivery pathway, reinforcing the **speculative nature of the decarbonisation strategy**.

The applicant acknowledges<sup>5</sup> that a connection to National Gas' Project Union initiative to build a UK hydrogen backbone is required to supply hydrogen to the site. As of July 2025, the Government reports<sup>6</sup> that a mere £500M has been confirmed in the Spending Review to support hydrogen infrastructure, with the first projects becoming operational in 2031<sup>7</sup>.

Decarbonisation of the Energy Centre is proposed via hydrogen conversion; however, the EIA confirms that this depends on future infrastructure, including pipeline conversion or new hydrogen supply networks<sup>8</sup>. This demonstrates that the decarbonisation pathway is contingent on external factors and is not secured within the current proposal.

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<sup>4</sup> <https://www.climateutraldatacentre.net/working-groups/#clean-energy> retrieved 24<sup>th</sup> May 2026.

<sup>5</sup> EIA, §7.2.22

<sup>6</sup> Hydrogen Update, Department for Energy Security & Net Zero, July 2025. Page 5.

<sup>7</sup> Ibid, page 6.

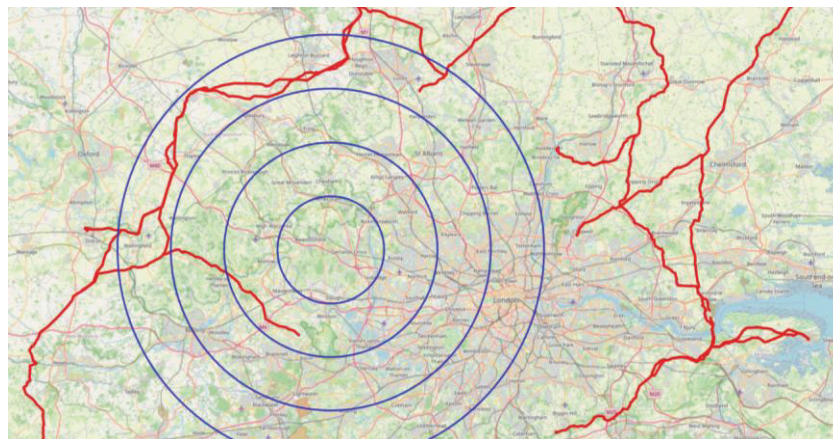
<sup>8</sup> EIA, §3.6.2 §3.6.4

The map below shows the proposed route of Project Union pipelines, note, there is no committed budget for this development. As is clear from the map, there is no current proposal, even if unfunded to extend the Project Union pipeline to the site.



**Figure 1 National Gas, Project Union proposed hydrogen national transmission backbone.**

Zooming in on the site, Project Union’s proposed hydrogen backbone is between 30-40km distance from the site. The red lines on the map below represent the gas transmission network, the blue circles are 10, 20, 30 & 40km from the site.



**Figure 2 10, 20, 30, 40km distant from the site.**

Given the evidence, it is my opinion that it is speculative to consider that Project Union and

hydrogen is a viable route to decarbonisation because of uncertain timing and dependency on external infrastructure which is not currently committed.

The Government's definition of its "Clean Power" target is "... *that by 2030, Great Britain will generate enough clean power to meet our total annual electricity demand, backed up by unabated gas supply to be used only when essential.*"<sup>9</sup> I accept that the use of gas is essential for this site, however I support the Government's view that there are other, much more suitable sites, these having been identified as AI Growth Zones (which will be discussed in the next section).

The EIA confirms that, once a grid connection becomes available, the Energy Centre is intended to continue operating as a reserve or peaking plant<sup>10</sup>. Accordingly, reliance on gas fired generation forms an enduring component of the proposed infrastructure rather than a temporary enabling measure.

### **3.3 Grid Constraints and Timing (S35 Paragraphs 7.53-7.55)**

The Applicant states that grid connection delays (potentially up to 15 years) necessitate the use of onsite generation in order to deliver capacity within required timescales.

#### **Professional Opinion**

It is accepted that constraints in the electricity grid represent a significant issue at national level. Globally, "*Site selection criteria have changed dramatically with a more prominent focus on power availability and delivery timelines.*"<sup>11</sup>

However, in my opinion, it is important to distinguish between:

- System wide constraints, and
- the suitability of a specific development site.

The absence of a viable grid connection at the proposed location is a material consideration in assessing site suitability. While onsite generation may allow earlier deployment, it does not address the underlying limitation and instead **addresses it through an alternative approach which may be less efficient and/or a less sustainable solution.**

A similar pattern is observed in the proposed cooling strategy, where reliance on air cooling introduces a dependence on site specific atmospheric conditions, rather than demonstrating that the location itself provides naturally suitable operating characteristics (see Section 3.6).

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<sup>9</sup> Clean Power 2030 Action Plan: A new era of clean electricity.

<sup>10</sup> EIA §3.4.8, page 28.

<sup>11</sup> Data Centers, 2024 Global Outlook. Jones Lang Lasalle IP, Inc.

**It is important to distinguish between a national shortage of grid capacity and the suitability of a specific site.** The use of onsite generation addresses the former only by compensating for the latter.

Accordingly, the approach adopted should be viewed as:

- enabling delivery despite constraints, rather than
- demonstrating that the site is inherently well suited to this form of development.

The EIA states that the Energy Centre is necessary due to constrained grid capacity in West London, with upgrades not expected until at least 2030<sup>12</sup>. This confirms that the need for onsite generation arises from locational limitation, not system design optimisation. In planning terms, this is a strong indicator that the site is not aligned with the emerging policy emphasis on power-led site selection.

OFGEM's recent Demand Connection Reform<sup>13</sup> consultation clearly recognises the importance of connecting data centres, dovetailing with the Government's "*Delivering AI Growth Zones*"<sup>14</sup> policy paper. Government recognises that, "*Timely connections to the electricity grid ... single biggest blocker*"<sup>15</sup>. Further Government has identified that "*There are sometimes mismatches between the amount of electricity generated in a certain region and the electricity grid's ability to transmit that electricity ..... <for example> the amount of wind generation in Scotland may be more than the grid is currently capable of handling...*"<sup>16</sup>, to coordinate the build-out of the UK's AI capability, **Government policy explicitly links the delivery of future data centre capacity to locations with available or prioritised power infrastructure.** Government proposes that, "*AI Growth Zones will be pivotal in achieving that vision and accelerating the buildout of our domestic AI data centres.*"<sup>17</sup> This site is not aligned with locations currently identified by Government as priorities for large-scale AI infrastructure. Government has announced AI Growth Zones in Scotland, South Wales, North Wales, the North East and Oxfordshire<sup>18</sup>, but **NOT in Buckinghamshire.**

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<sup>12</sup> EIA §3.4.1, page 28.

<sup>13</sup> OFGEM, Call for input, Demand Connections Reform/ 13<sup>th</sup> February 2026.

<sup>14</sup> Department for Science, Innovation & Technology, Policy paper, Delivering AI Growth Zones. Published 13 November 2025. <https://www.gov.uk/government/publications/delivering-ai-growth-zones/delivering-ai-growth-zones>

<sup>15</sup> Ibid section 2.

<sup>16</sup> Ibid section 3.

<sup>17</sup> Ibid section 1.

<sup>18</sup> AI Growth Zones, <https://www.gov.uk/government/collections/ai-growth-zones>

### 3.4 Resilience and Reliability (S35 Paragraphs 3.10, 3.12, 3.18, 4.10, 7.55)

The Applicant places significant emphasis on resilience, including references to redundancy and continuity of operation.

#### Professional Opinion

In my view, the resilience of the proposed configuration requires **careful consideration**.

The information provided indicates that the development would rely substantially on:

- a single onsite energy centre;
- a continuous gas supply; and
- associated local infrastructure.

While redundancy may be incorporated within the energy centre itself, the overall configuration appears to introduce a **relatively high degree of dependence on a single class of energy supply**, i.e. a relatively concentrated dependency on a single class of energy infrastructure. Major NCI sites are often equipped with "*diverse feeds of mains supply*" (i.e. connectivity from independent grid sources), with standby power supplies, "*of sufficient capacity to fully support the operational power load in the period between power failure*"<sup>19</sup>.

By comparison, grid connected facilities benefit from:

- a diversified generation portfolio;
- multiple generation sources; and
- geographical distribution of supply risk.

In my opinion, the proposed arrangement may therefore:

- provide operational resilience at a local level;
- but offer less systemic resilience than a diversified grid connected model.

#### **This distinction is very important for infrastructure of this scale.**

By contrast, grid connected infrastructure typically benefits from **diversified and geographically distributed generation sources**, which materially reduces exposure to single category supply risks. In my opinion, the proposed configuration therefore represents a model of **local operational resilience, but reduced systemic resilience**, which is a significant consideration for infrastructure classified as Critical National Infrastructure.

OFCOM's resilience requirements for the core network include "*... fuel-powered electricity generators. These sites are expected to be able to survive power loss for a minimum of 5 days,*

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<sup>19</sup> Electronic Communications Resilience and Response Group (EC-RRG) Resilience Guidelines for **Providers of Critical National Telecommunications Infrastructure**, V0.7 March 2008.

*with permanent electricity generators on site which can be refuelled while in operation...*<sup>20</sup> The Applicant makes only tangential reference to fuel storage facilities, without detailing their capacity and whether or not there will be sufficient capacity to store five or more days of gas fuel.

The EIA describes the DC Campus and Energy Centre as functionally interdependent and part of a single integrated project<sup>21</sup>. Electricity is generated and supplied onsite via a single Energy Centre, rather than through a diversified grid supply<sup>22</sup>. In my opinion, this represents a concentrated system configuration. I do not suggest that the system cannot achieve high operational reliability; rather, my observation relates to the concentration of energy dependency when compared to the diversified nature of grid based supply.

### **3.5 Availability Zone and Locational Requirement (S35 Paragraphs 3.18-3.20, 3.21-3.26)**

The Applicant states that proximity within the Slough Availability Zone, including a 7-10 km fibre distance, is necessary to support low latency and failover requirements.

#### **Professional Opinion**

It is accepted that Availability Zones are an established architectural model for cloud infrastructure, particularly for latency sensitive applications requiring real time synchronisation. I accept that proximity within an Availability Zone remains important for certain latency-critical applications, and that while Availability Zones remain relevant, the relative importance of proximity has reduced for many workloads, particularly AI and large-scale compute.

However, in my opinion, this position should be considered alongside developments in the wider sector:

- A substantial and growing proportion of workloads (particularly AI training and large scale compute) are not materially latency dependent.
- Advances in orchestration and global connectivity increasingly allow workloads to be distributed across wider geographic areas.

Accordingly, while locational proximity remains important for certain use cases, it is not the sole determinant of optimal data centre siting and is increasingly being superseded by power availability, cost, and sustainability considerations.

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<sup>20</sup> Network and Service Resilience Guidance for Communications Providers. Guidance for communications providers on resilience related security duties under the Communications Act 2003. Published 6<sup>th</sup> Sept. 2024. Section 4.2.3

<sup>21</sup> EIA, Executive Summary (iv) and §1.3.2

<sup>22</sup> EIA, §1.1.3 and §3.4

In practice, other factors, particularly energy availability, cost, and sustainability, which are becoming increasingly significant in site selection.

In my opinion, the justification places greater emphasis on latency than is consistent with emerging industry priorities, particularly the increasing importance of power availability.

## 3.6 Thermal Performance, Environmental Effects and EIA Scope

### 3.6.1 Overview

The Proposed Development comprises a large scale, high energy density system with an electrical load of approximately 300MWe for the Data Centre Campus, supported by an onsite Energy Centre, totalling c.450-500MWt. The thermodynamic consequence of such systems used in DCs is that a very substantial proportion of the energy input is dissipated as heat.

When considered in aggregate, the Development will require the continuous rejection of a very large thermal load to the local environment, c.450-500MW. This section addresses the implications of that thermal output in relation to:

- operational performance (cooling feasibility);
- environmental effects (including localised climate impacts); and
- the appropriate scope of Environmental Impact Assessment (EIA).

In my opinion, these issues are interrelated and should be assessed as a single system, rather than as discrete or isolated considerations.

### 3.6.2 Magnitude of Thermal Output

The Energy Centre is expected to operate at an efficiency broadly comparable to modern combined cycle gas turbine plant. At approximately 60-65%<sup>23</sup> electrical efficiency, a 300MWe generating plant will produce in the order of **c.170-200MW of thermal waste heat**.

In addition, the electrical energy consumed by the Data Centre Campus (c.300MW IT load) is, in practical terms, fully converted to heat as part of normal operation.

Accordingly, the Development will require the **continuous dissipation of c.450-500MW of thermal energy**.

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<sup>23</sup> Europe's most efficient gas fired power station SSE Keadby 2 (Humber) is only 63% efficient. <https://www.ssethermal.com/news-and-views/2023/03/europe-s-most-efficient-power-station-enters-commercial-operation-in-the-humber/> retrieved 24<sup>th</sup> May 2025.

This represents:

- a **continuous and material physical output** of the Development;
- of a magnitude comparable to large-scale industrial thermal discharge; and
- one that will interact directly with the local atmospheric environment.

### 3.6.3 Cooling Strategy and Atmospheric Dependence

The Applicant proposes the use of air-cooled systems for both the Data Centre Campus<sup>24</sup> and the Energy Centre<sup>25</sup>, and on this basis seeks to scope out Water Resources and Flood Risk from the EIA.

In my opinion, this position does not fully reflect the engineering realities of air-cooled thermal rejection at this scale.

Air is a relatively poor heat transfer medium due to its low density and heat capacity. As a consequence:

- cooling performance is **highly dependent on ambient atmospheric conditions**;
- system efficiency reduces as **ambient temperature increases**; and
- performance is sensitive to **wind speed, wind direction, and airflow distribution**.

Published evidence<sup>26</sup> demonstrates that air-cooled condenser systems can experience:

- degraded performance under **high temperature and low wind conditions**;
- **imbalance and reduced efficiency** where airflow is uneven; and
- sensitivity to **crosswinds and site-specific aerodynamic effects**.

These factors are particularly relevant at a site of this scale, where:

- the feasibility of the cooling strategy is not solely a matter of design specification, but of whether **site-specific atmospheric conditions can reliably support the required heat rejection over time**.

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<sup>24</sup> EIA, §3.3.3

<sup>25</sup> EIA, §3.3.4

<sup>26</sup> Investigation of air-cooled condenser's (ACC) operating parameters in modern thermal power plant. ŠKUNDRIĆ. et al, Thermal Science: Year 2023, Vol. 27, No. 3B, pp. 2477-2487, **HBV-01**

### 3.6.4 Site Configuration and Airflow Constraints

The proposed site comprises a former quarry void that has been infilled and reprofiled, resulting in a **basin-like landform bounded by raised edges and bunding**<sup>27</sup>.

This configuration is likely to:

- **reduce effective wind penetration** across the site;
- create areas of **air stagnation or recirculation**; and
- diminish the efficiency of **convective heat transfer to the atmosphere**.

There is therefore a direct interaction between:

- **site geometry**, and
- **cooling system performance**.

In my opinion, this interaction is material and has not been adequately addressed in the Applicant's scoping justification.

### 3.6.5 Operational Implications and Water Dependence

Where air-cooled systems are unable to maintain sufficient thermal performance under adverse conditions, it is common industry practice to deploy:

- hybrid cooling systems; or
- supplementary evaporative (water-assisted) cooling.

The reliance on air cooling at the scoping stage does not therefore eliminate the potential for water demand over the operational life of the Development; rather, it introduces a **credible pathway to future water-dependent cooling**.

Accordingly:

- the exclusion of **Water Resources and Flood Risk** from the EIA is not supported by a sufficiently robust technical basis; and
- the current assessment risks deferring, rather than addressing, a material environmental consideration.

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<sup>27</sup> EIA, §2.1.0, §3.2.15 (c), §3.12.2, §4.2.19 (b), §6.2.48 Earthworks,

### 3.6.6 Waste Heat as a Material Output

The continuous rejection of c.450-500MW of heat constitutes:

- a **material by-product of the Development**, analogous in functional terms to other emissions or residual outputs;
- a **physical transfer of energy into the local environment**; and
- a driver of secondary environmental effects, including localised temperature change.

In my opinion, it is therefore inconsistent to:

- recognise the presence of large-scale thermal discharge, while
- **scoping out "Waste and Materials"** from the EIA.

Thermal output should be considered within the EIA as a **residual output stream**, requiring assessment of:

- magnitude;
- pathways of dispersion; and
- cumulative environmental effects.

### 3.6.7 Local Climate Effects ("Data Centre Heat Island")

Recent research<sup>28</sup> has identified a measurable phenomenon described as the "**data centre heat island effect**", whereby large-scale hyperscale data centre developments result in statistically significant increases in local land surface temperature.

Evidence indicates:

- average local temperature increases of approximately **2°C**;
- maxima exceeding **9°C** under certain conditions; and
- spatial effects extending up to **10 km from the source**, with persistent increases of approximately **1°C within several kilometres**.

Applying these findings to a Development of comparable scale:

- literature suggests receptors within approximately c.5 km may reasonably experience **measurable increases in local ambient temperature**;

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<sup>28</sup> The data heat island effect: quantifying the impact of AI data centers in a warming world, Marinoni et al, 21 March 2026 **HBV-02**

- peak effects may occur during **periods of high load, high ambient temperature, and low wind speed**; and
- the magnitude of change would represent a **material alteration to the local microclimate**.

Given the proximity of multiple settlements within this range, there is a clear pathway for environmental impact. Thorough site modelling is required.

The following settlements are located within approximately 7.5km of the Site and therefore fall within the potential zone of influence: Gerrards Cross, Beaconsfield, Chalfont St Peter, Chalfont St Giles, Denham, Chalfont, Seer Green, Jordans, Coleshill, Winchmore Hill, Loudwater, Wooburn Green, Bourne End, Burnham, Farnham Royal, Stoke Poges and Maple Cross.

**A number of these receptors are located within c.5km of the Site, including Gerrards Cross, Beaconsfield, Chalfont St. Peter, Seer Green, Jordans, Farnham Common, Fulmer, Hedgerley and Chalfont St. Giles.**

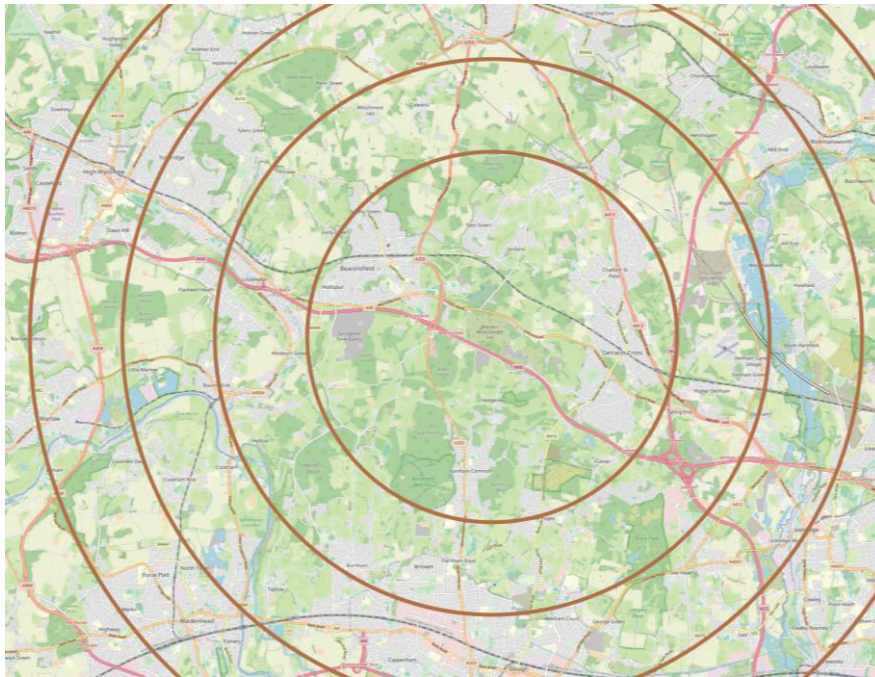


Figure 3 5km, 7.5km & 10km from the site.

### 3.6.8 Human Health and Energy System Effects

Elevated ambient temperatures are directly associated with:

- increased incidence of **heat stress, cardiovascular impacts, and mortality during heat events**; and
- greater reliance on **mechanical cooling (air conditioning)**.

Accordingly, the thermal output of the Development introduces:

- a **direct pathway to human health effects**, particularly during heat events; and
- an **indirect effect on the electricity system**, through increased cooling demand in surrounding communities.

This latter effect is notable in that:

- additional demand may arise **concurrently with peak load from the Development itself**,
- thereby contributing to **cumulative system stress**.

### 3.6.9 Implications for EIA Scope

Taken together, the evidence indicates that:

- the Development will produce a **large-scale, continuous thermal output**;
- the performance of the proposed cooling strategy is **contingent on variable atmospheric conditions**;
- the **site configuration may constrain airflow**, affecting cooling efficiency;
- there is a **credible pathway to water-dependent cooling**; and
- there are **measurable environmental and health pathways** associated with thermal discharge.

In my professional opinion, this provides a clear and coherent basis for concluding that the following topics should be included within the scope of the Environmental Impact Assessment (EIA):

- **Water Resources and Flood Risk** (due to potential cooling water demand);
- **Waste and Materials** (including heat as a residual output);
- **Climate / Microclimate Effects** (including the data heat island effect); and
- **Population and Human Health** (due to temperature-related impacts).

Furthermore, these topics should not be treated in isolation, but as **interrelated aspects of a single thermal-environmental system**, driven by the scale and operational characteristics of the Development.

### 3.6.10 Thermal EIA Scoping Summary

In summary, the proposed reliance on air-cooled thermal rejection, in combination with:

- the magnitude of heat output;
- the specific characteristics of the site; and
- the absence of demonstrated long-term cooling feasibility under variable conditions

gives rise to a **set of interdependent operational and environmental risks that are not fully addressed in the current EIA scoping approach.**

In my opinion, the exclusion of the above topics from the EIA is not supported by a sufficiently robust technical basis, and results in a material under-scoping of the environmental effects of the Development.

### 3.7 Contribution to National Need (S35 Paragraphs 7.36-7.52)

The Applicant states that the Project would contribute approximately 5% of national need and a larger proportion of regional demand.

#### Professional Opinion

I accept that the Project would make a material contribution to national and regional data centre capacity. However, meeting demand does not in itself establish that a particular site or configuration represents the most appropriate or efficient solution.

In my opinion, meeting demand should not be considered in isolation from:

- the efficiency and sustainability of the solution;
- the long term resilience of the infrastructure;
- the global economic competitiveness of the site and its power source; and
- the opportunity cost of alternative site selection.

Infrastructure delivered under constrained conditions may satisfy short term capacity requirements but may not represent optimal long term provision.

Accordingly, the existence of demand should not be taken to imply that any particular development, in any location, represents an appropriate or efficient response to that demand.

### **3.8 Economic Considerations (S35 Paragraphs 1.4, 7.65-7.75)**

The Applicant highlights a capital investment in the order of £2 billion (or higher when including associated infrastructure), together with employment and economic benefits.

#### **Professional Opinion**

I agree that the proposed investment is significant and that the development would generate economic benefits. However, energy cost and availability are primary determinants of long term competitiveness for data centres.

This level of investment reinforces the importance of ensuring that the infrastructure delivered is:

- robust over its operational lifespan;
- adaptable to future energy systems; and
- competitive within an increasingly global market.

In my opinion, there is a risk that infrastructure delivered in response to local constraints may, over time, prove comparatively less resilient or less efficient than alternatives located in areas with stronger underlying energy and infrastructure characteristics.

Given that this development constitutes a major investment in UK Critical National Infrastructure, it is reasonable to expect that it should meet the highest standards of long term resilience and strategic alignment.

This is particularly relevant in the context of global competition for data centre investment, where energy cost, availability, and long term stability are key determinants of competitiveness.

The EIA indicates that construction of the Proposed Development is expected to take approximately 11 years<sup>29</sup>. In my opinion, this extended construction period is indicative of the complexity of developing the site.

### **3.9 Employment Effects (S35 Paragraphs 3.81, 7.75, 8.5)**

#### **3.9.1 Overview**

The Applicant identifies employment generation as a key benefit of the Proposed Development.

#### **3.9.2 Nature of Employment**

Data centres are characterised by:

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<sup>29</sup> EIA, §3.18.1

- High capital investment and **low operational employment density** relative to comparable commercial or industrial uses.

Employment is largely limited to:

- Specialist technical and maintenance roles, with a relatively small permanent workforce.

### 3.9.3 Assessment of Significance

The scale of employment generation is:

- **Limited in absolute terms**, and
- **Not proportionate to the scale of environmental change** associated with the Proposed Development.

As such:

- Employment benefits **should not be relied upon as a determining factor** in offsetting potential adverse environmental effects.

### 3.9.4 Local Benefit Consideration

A significant proportion of construction and operational expenditure:

- Is likely to be directed to **national or international supply chains**, rather than local economies.

Consequently:

- The **direct benefit to local communities is expected to be limited**.

### 3.9.5 Scoping Implications

The limited magnitude of employment benefit, in my opinion, reinforces the need for **robust assessment of environmental harms**, including:

- **Human Health**
- **Waste and Materials**
- **Odours**

## 3.10 Odours

### 3.10.1 Baseline Context

The Site is located within a former landfill area, with ongoing management under an Environmental Permit. Local residents report:

- Existing instances of **noxious odours** associated with landfill operations.

### 3.10.2 Data Centre Odour Sources

Emerging evidence suggests that data centres may generate odours from:

- Cooling systems;
- Electrical equipment;
- Back-up generation and associated emissions;
- And potentially, interaction with existing landfill gases.

### 3.10.3 Potential Effects

The Proposed Development introduces:

- New industrial processes adjacent to existing landfill sources.

There is therefore potential for:

- **Cumulative and synergistic odour effects.**

### 3.10.4 Public Perception and Amenity

Odour is a key determinant of:

- **Residential amenity and quality of life.**

Given existing sensitivities:

- Even low or intermittent odour effects may be perceived as significant.

### 3.10.5 Scoping Implications

Notwithstanding uncertainty in magnitude:

- There is a **clear pathway to likely effects on receptors.**

In my opinion, at a minimum:

- Odour should be **scoped into the EIA to provide assessment and public reassurance.**

### **3.11 Consenting Approach (S35 Paragraphs 7.76-7.85)**

The Applicant argues that a single DCO route would provide a more efficient consenting process.

#### **Professional Opinion**

While a unified consenting process may provide procedural efficiencies, this has limited relevance to the fundamental question of:

- **whether the site and proposed infrastructure configuration are appropriate for development of this scale and significance.**

While procedural efficiency is desirable, it does not address the underlying question of whether the proposed infrastructure configuration is appropriate for development of this scale.

### **3.12 EIA Out of Scope Topics**

The EIA proposes that certain topics, including human health, traffic and movement, water resources and flood risk, and waste and materials, are to be scoped out of detailed assessment<sup>30</sup>.

#### **Professional Opinion**

Given the scale and nature of the Proposed Development, the exclusion of these topics is notable and warrants careful scrutiny.

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<sup>30</sup> EIA, Executive Summary §vii

### 3.13 Overall Assessment

Based on my review of the Applicant's submission, I consider that:

- The Project is clearly of substantial scale and would contribute to national data centre capacity.
- The need for additional capacity is well established.

However:

- The reliance on onsite gas fired generation indicates a **fundamental constraint in site infrastructure, particularly in relation to grid access.**
- The proposed site is **not located** within a Government designated AI Growth Zone<sup>31</sup>.
- The proposed energy solution introduces **long term uncertainties and potential disadvantages** in terms of cost, sustainability, and policy alignment.
- The reliance on air cooling is presented as a design assumption rather than being supported by evidence of operational performance under site specific conditions, and therefore cannot, in itself, justify the exclusion of related environmental effects from assessment.
- The evidence relating to 'heat islands around hyperscale DCs' is material, requiring careful and thorough investigation at the EIA stage,
- The knock-on impact of local temperature rises will likely stress the local electricity grid further due to extra air conditioning and chiller power requirements. This requires careful scrutiny, as it is possible that the waste heat could actually cause a very significant extra load upon the grid,
- The resilience of the scheme appears **more locally concentrated** than would typically be expected of infrastructure of this scale.
- The locational justification relies heavily on Availability Zone considerations, without fully addressing broader industry trends toward **power-led siting strategies.**
- the scale of local economic benefit appears limited relative to the scale of environmental and infrastructure considerations identified,
- Taken together, these factors indicate that the proposed development is **constraint-led rather than location-led**, which is not typical of optimal Hyperscale infrastructure deployment.

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<sup>31</sup> AI Growth Zones, <https://www.gov.uk/government/collections/ai-growth-zones>

The EIA confirms that the Proposed Development depends on a dedicated onsite Energy Centre using gas fired generation, supplied via pipeline infrastructure and forming an essential component of the scheme without which it would not be viable<sup>32</sup>. The Energy Centre is required due to local grid constraints<sup>33</sup>, will continue operating beyond grid connection<sup>34</sup>, and relies on a decarbonisation pathway that is contingent on future infrastructure<sup>35</sup>. In my opinion, these factors demonstrate that the Proposed Development is only deliverable through the application of **compensatory measures** addressing **fundamental site constraints**, rather than representing an optimally located or inherently suitable site for nationally significant infrastructure.

I recognise that there may be differing professional opinions on these matters, particularly in relation to the balance between timely delivery and optimal siting.

**In my opinion, the defining characteristic of the Proposed Development is that it is enabled by mitigation of constraints, rather than aligned with optimal siting conditions.**

**Taken in aggregate, the Proposed Development relies on the systematic mitigation of site constraints across energy supply, cooling, and environmental performance, rather than demonstrating that the site is inherently suitable for infrastructure of this scale.**

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<sup>32</sup> EIA, §3.4.2 and §3.2.12

<sup>33</sup> EIA, §3.4.1

<sup>34</sup> EIA, §3.4.8

<sup>35</sup> EIA, §3.6.2 §3.6.4

## 4 REALISTIC ALTERNATIVES

While it is not necessary for the purposes of this report to identify specific alternative sites, Government policy and industry practice clearly demonstrate that suitable locations with superior energy and infrastructure characteristics exist. In January 2026, the Prime Minister stated, *"We have designated five AI Growth Zones, unlocking investment and accelerating data centre buildout."*<sup>36</sup>

I note the government press releases relating to AI Growth Zones in Scotland, South Wales, Bristol, North Wales, the North East, Oxford, Northumberland, etc, etc<sup>37</sup>.

I note that the first phase of Project Union<sup>38</sup>, the national hydrogen network, where funds have been committed is located broadly around the Humber, stretching from Bishop Auckland through to Theddlethorpe.

I also note the difference between highly economically valuable jobs arising from creating AI applications ('programming', etc) that can be performed at any location worldwide, verse jobs actually at the DC itself, which post construction are relatively limited in number.

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<sup>36</sup> AI Opportunities Action Plan: One Year On, Department of Science, Innovation and Technology, January 2026. [https://assets.publishing.service.gov.uk/media/697a36873c71d838df6bd400/ai\\_opportunities\\_action\\_plan\\_one\\_year\\_on.pdf](https://assets.publishing.service.gov.uk/media/697a36873c71d838df6bd400/ai_opportunities_action_plan_one_year_on.pdf) retrieved 25<sup>th</sup> May 2026.

<sup>37</sup> <https://www.gov.uk/government/collections/ai-growth-zones>

<sup>38</sup> <https://www.nationalgas.com/future-energy/project-union-east-coast>

## 5 CONCLUSION

In conclusion, it is my professional opinion that:

- The proposed development represents a **viable means of delivering data centre capacity in the short term**;
- However, it **does not represent an optimal or future-aligned model** for nationally significant digital infrastructure.

The defining characteristic of the Proposed Development, as set out in Section 3, is that it is **enabled through the mitigation of constraints**, rather than being located where those constraints do not arise.

In particular:

- The reliance on onsite gas fired generation reflects **structural limitations in grid availability** at the proposed site;
- The decarbonisation strategy remains **dependent on uncertain future infrastructure**;
- The proposed cooling approach is **dependent on atmospheric conditions**, without demonstrating that the site can reliably support the continuous rejection of **c.450 - 500MW of thermal load**; and
- The site's **basin-like landform introduces further constraints on airflow**, directly affecting the viability of the proposed cooling strategy; and
- The 'heat island effect' evidences that many tens of thousands residents may suffer impact from material rises in temperature, with associated knock-on quality of life issues,

Taken together, these factors indicate that the Proposed Development is:

### **constraint-led rather than location-led**

This distinction is material. Modern Hyperscaler infrastructure is typically located where:

- high-capacity power is available,
- environmental constraints are minimised, and
- long-term operational efficiency can be achieved without reliance on compensatory measures.

By contrast, the Proposed Development relies on:

- substitute energy generation,
- uncertain future decarbonisation pathways, and
- environmental assumptions which have not been demonstrated at the scale required.

The table below summarises limitations of the proposed site, these characteristics reflect established industry trends in hyperscale site selection, as outlined in Section 2 and Government policy on AI Growth Zones.

Criterion	M40 Site	Typical Hyperscaler Site
Grid availability	constrained	available / prioritised
Cooling conditions	basin / airflow risk	open / favourable
Energy strategy	gas-led	grid/renewables-led
Policy alignment	not AI zone	AI Growth Zone

In addition, the interaction between energy generation, thermal rejection, site topography, and cooling strategy represents a **cumulative effect** which is not addressed in the proposed scope of the EIA.

I accept that the development would make a material contribution to national data centre capacity. However, **meeting demand does not, in itself, establish that a particular site or configuration represents the most appropriate or efficient solution.**

In particular, the Applicant's reliance on air cooling, when considered alongside:

- the **site geometry**, and
- the **scale of heat rejection required**,

does not provide a robust basis for excluding *Water Resources and Flood Risk* from the EIA, nor does the application demonstrate how the environmental implications of continuous large-scale heat rejection are to be assessed.

Given the scale of investment and the classification of data centres as Critical National Infrastructure, it is reasonable to expect that such developments should be:

- **aligned with power availability**,
- **resilient over their full operational life**, and
- **consistent with long-term energy policy and environmental constraints.**

**In my opinion, the Proposed Development does not fully satisfy these criteria.**

The characteristics identified are not merely indicative of suboptimal design, but represent structural limitations that directly affect the long-term operational efficiency, resilience and environmental performance of the Development.

**In my professional opinion, these factors materially undermine the case that this site represents an appropriate location for infrastructure of this scale and classification.**

Accordingly, while the Project may deliver capacity in the short term, it raises **material concerns regarding long-term suitability, resilience, and strategic alignment**, and requires careful scrutiny in the context of whether it represents the most appropriate location for infrastructure of this scale and significance.

Where there is material uncertainty in relation to system performance, this does not provide a basis for scoping impacts out of the EIA, but rather reinforces the need for their detailed assessment.

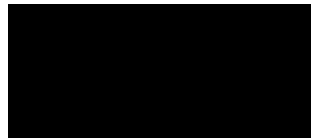
The purpose of the scoping process is to ensure that all likely significant environmental effects of the Proposed Development are properly identified and assessed. In this case, the Applicant's approach relies on design assumptions; particularly in relation to energy supply and air cooled thermal rejection, that are contingent onsite conditions which have not been demonstrated to be inherently suitable. Given the scale of the development, including the continuous rejection of c.450-500MW of thermal energy, and the dependence of air cooled systems on variable atmospheric conditions within a basin like landform, there is a clear and credible basis for potential environmental effects that has not been adequately addressed. In these circumstances, the proposed exclusion of Water Resources and related cooling impacts from the scope of the Environmental Impact Assessment is not supported by sufficient technical evidence, and these matters should be included within the Environmental Statement to enable a robust and informed assessment by the decision-maker.

**Excluding these matters at the scoping stage risks limiting the ability of the Environmental Statement to provide a complete understanding of the operational and environmental characteristics of the Proposed Development.**

### 5.1 Statement of Truth

I confirm that I have made clear which facts and matters referred to in this report are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. The opinions I have expressed represent my true and complete professional opinions.

I understand that proceedings for contempt of court may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief in its truth.



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**Chartered Engineer Andrew White**

**M.Eng C.Eng MBA FIET (2101 9997)**

Harberry Limited. UK.

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## ANNEX A : LIST OF EXHIBITS

Document reference	Description
HBY-01	Investigation of air-cooled condenser's (ACC) operating parameters in modern thermal power plant. ŠKUNDRIĆ. et al, Thermal Science: Year 2023, Vol. 27, No. 3B, pp. 2477-2487
HBY-02	The data heat island effect: quantifying the impact of AI data centers in a warming world, Andrea Marinoni, Pietro Lio, Erik Cambria, Luca Dal Zilio, Weisi Lin, Mauro Dalla Mura, Jocelyn Chanussot, Edoardo Ragusa, Gianmarco Mengaldo, Chi Yan Tso, Yihao Zhu, Benjamin Horton 21 March 2026

## ANNEX B : LIST OF DOCUMENTS ON WHICH I HAVE RELIED UPON

Document reference	Description
1	Section 35 Direction - Qualifying request. SDC M40 Campus 21 January 2026 (as supplemented on 27 February 2026). <a href="https://assets.publishing.service.gov.uk/media/69b7ece3ba47c264e6c8cfba/Request_Document_-_SDC_M40_Campus_-_Section_35_Direction.pdf">https://assets.publishing.service.gov.uk/media/69b7ece3ba47c264e6c8cfba/Request_Document_-_SDC_M40_Campus_-_Section_35_Direction.pdf</a>
2	SDC M40 Campus, Consultation booklet <a href="https://www.datocms-assets.com/177752/1762862866-stage-one-consultation-consultation-booklet.pdf">https://www.datocms-assets.com/177752/1762862866-stage-one-consultation-consultation-booklet.pdf</a>
3	Environmental Impact Assessment Scoping Report. Slough Holdings UK Limited. April 2026
4	National Gas, Network route map. Geospatial data files. Gas_Pipe_23042026
5	Investigation of air-cooled condenser's (ACC) operating parameters in modern thermal power plant. ŠKUNDRIĆ. et al, Thermal Science: Year 2023, Vol. 27, No. 3B, pp. 2477-2487
6	The data heat island effect: quantifying the impact of AI data centers in a warming world, Andrea Marinoni, Pietro Lio, Erik Cambria, Luca Dal Zilio, Weisi Lin, Mauro Dalla Mura, Jocelyn Chanussot, Edoardo Ragusa, Gianmarco Mengaldo, Chi Yan Tso, Yihao Zhu, Benjamin Horton 21 March 2026



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## INVESTIGATION OF AIR-COOLED CONDENSER'S OPERATING PARAMETERS IN MODERN THERMAL POWER PLANT

by

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Original scientific paper

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*Air-cooled condensers in thermal power plants have recently become increasingly popular. Besides all the advantages they have, like no demands for water supply on the plant site and no need for taking care of environmental regulations, they also have some serious disadvantages. One of the biggest disadvantages air-cooled condensers do have is precisely the nature of the Earth's atmosphere being their low temperature reservoir. Low density and low heat capacity of the air as the cooling medium combined with extremely stochastic behavior of the atmosphere itself put some serious challenges in front of the air-cooled condenser's proper and steady functioning. In this paper, the operating parameters of the air-cooled condenser in the chosen thermal power plant were investigated to gain a clearer insight into the influence of the atmospheric changes on its entropy generation and consequently on its efficiency. Also, the acquired results were further proposed as a starting point for potential optimization of the process inside the device.*

Key words: *air-cooled condenser, thermal power plant, entropy, efficiency*

### Introduction

Until recently, especially in large thermal power plants, condensers were, as a rule, exclusively designed as a water-cooled. The main reason for that was the fact that degree of efficiency of the cycle by which older power plants operated was relatively low, leaving no room for additional reduction, which the use of the air-cooled condenser would certainly cause. Water-cooled condensers, obviously have some significant advantages over the air-cooled systems, primarily in terms of higher specific heat and higher density of the coolant, and, as a rule, lower coolant temperatures. But, on the other hand, they also have a significant disadvantage since, regardless of the construction, they require the existence of sufficient amount of water on-site, whether it is a river, lake, or possibly the sea. Another lack of water-cooled condensing systems refers to their negative impact to the environment especially when it comes to large plants, which was investigated by various authors, [1-4].

Air-cooled condensers become applicable in large thermal power plants only after the technology of materials used for the construction of boiler and turbine elements reached a

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level that allowed significant increases in fresh steam parameters, and thus allowed significant increasing of such plant's efficiency. A more detailed insight into the impact of modern materials on the plant's efficiency can be obtained through the recently published studies, [5-7]. Such modern and far more efficient plants finally leave room to implement an air-cooled steam condensing system, as their overall efficiency, even with slightly less efficient condensation, will remain within more than satisfactory limits. This further enables the building of plants at the coal mine location, even if there is not enough water on-site for the application of water-cooled condensers. Such location can still be used to construct the plant, without the additional cost for fuel or energy transport.

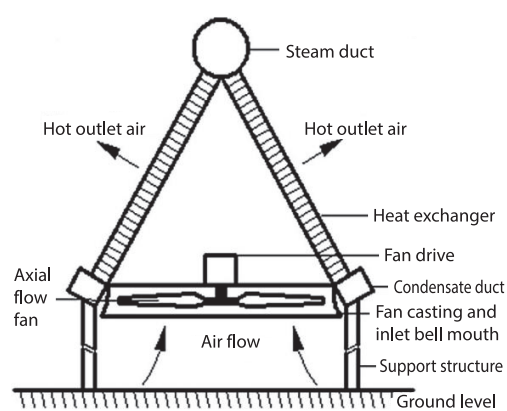
However, low values of air density and specific heat are not the only problem when it comes to the operation of air-cooled condensers. One of the biggest problems of such condensing systems lies in the extremely stochastic nature of the environment into which the heat from the condensing steam is dissipated. The mentioned stochastics of the environment is primarily reflected in the difficulty of wind parameters prediction, the insolation intensities during the day, as well as the deviation of ambient air temperatures from the design values. Particularly for these reasons, a number of researches have been conducted with a goal to find an optimal direction for further improvement of the air-cooled condenser design, [8-12]. Also, the complex phenomena governing the function of air-cooled condensing devices have also been the field of interest of numerous authors, [13-16].

Considering before mentioned, for a quality insight into possible operational problems of such a system, as well as to find ways to eliminate them, it is necessary to perform continuous and detailed measurements of the condenser operational parameters simultaneously with meteorological parameters on-site of the plant. One possible approach to this challenge is given in this paper on the example of thermal power plant in Stanari, Republic of Srpska.

**The air-cooled condenser in thermal power plant Stanari**

Thermal power plant *Stanari* is the 300 [MW] lignite-fired power plant. Since no water resources exist on the plant's site, the condenser for the plant was chosen to be the air-cooled, fig. 1. The air-cooled condenser within the plant is designed as the *A*-type external multicell device with forced draft.

The condenser itself is mounted on the steel structure, which is supported by concrete columns, and consists of modules with packages of aluminum finned steel pipes mounted on steel frames with electric motor driven axial fans that provide the flow of ambient air as a cooling medium.



**Figure 1. The *A*-type cell of air-cooled condenser**

The condenser consists of two types of panels (packages of finned pipes) and those are primary and secondary panels. The primary, parallel-flow or direct-flow panels are designed in a way that both the steam and the condensate flow in same direction, while the secondary or counter-flow panels are designed so the steam and the condensate flow in mutually opposite directions. Part of the condenser which involves only secondary panels is also called dephlegmator.

The steam discharged from the turbine is being supplied to the condenser through the duct mounted onp of the each module and

flows while condensing through the finned tubes within primary and secondary panels and finally is being collected as completely condensed in collectors positioned on the bottom of the mounting frame. Part of the duct on the top of secondary panels is connected to the group of elements for removing of non-condensable gases from the condenser. Finally, the condensate from primary and secondary sections of the condenser is further stored in the condensate tank placed beneath the low pressure turbine.

Regarding the layout and actual dimensions, the condenser consists in total of 30 cells arranged in six lanes with five cells in each lane, fig. 2. The first, the third and the fifth cell in each lane are of primary type, while the second and the fourth are of secondary (counter-flow) type. There are 300 panels in total, whereby 252 of them are of the primary type and 48 of the secondary type. Overall heat exchanging surface of the condenser is approximately 877495 m<sup>2</sup>, while the whole condenser is 70 m long and 59 m wide.

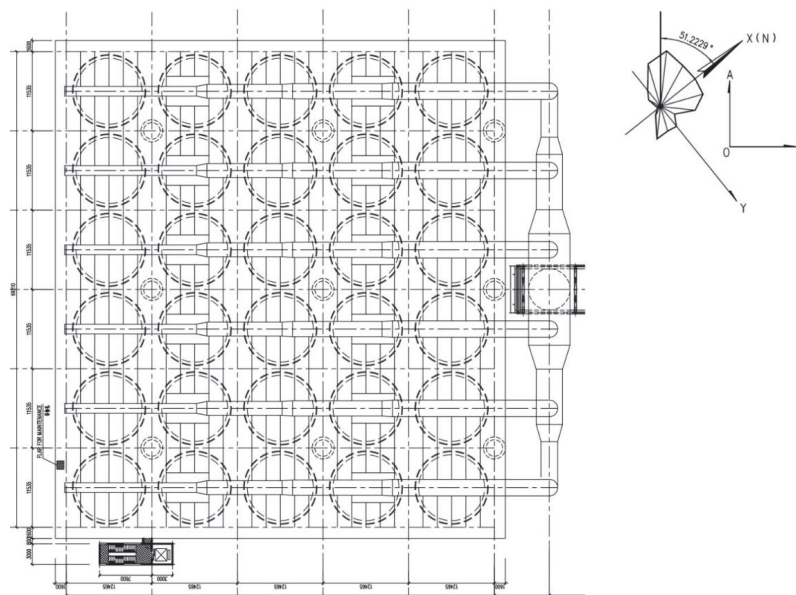


Figure 2. The air-cooled condenser disposition and orientation

**Method**

The main goal of the paper was to get the insight into the scale of the steam flow imbalance inside the condenser that is caused by the current meteorological conditions. The reason for this direction in investigating condenser's operating parameters was the suspicion that the side wind not only causes decreasing of convective heat transfer coefficient on certain cells due to compromised air velocity on the fan's outlet, but also causes steam flow imbalance inside the condenser. Possible imbalance would certainly cause increasing of both thermal and fluid-flow irreversibilities of the process. If so, this would mean that the side wind could also be the cause for increasing of overall generated entropy of the condenser, compromising its efficiency in the same time. For this purpose, the entropy generation minimization algorithm, given by Bejan [17] was used. By the algorithm, the generated entropy on the steam side is given:

$$\dot{S}_{gen} = \dot{Q} \frac{\Delta T}{T_0 T_{in}} + \frac{\dot{m} v_{out}}{T_{in}} \Delta p \tag{1}$$

where  $\dot{Q}$  is the heat flux removed from the steam,  $\dot{m}$  – the mass-flow of the steam,  $v_{out}$  – the specific volume on the condenser outlet ( $\sim$  specific volume of the condensate),  $T_{in}$  – the temperature on the condenser's inlet ( $\sim$  temperature of condensation),  $T_0$  – the ambient temperature,  $\Delta T = T_{in} - T_0$  – the difference between those two temperatures, and  $\Delta p$  – the pressure drop on the steam side.

Obviously, the first term in the eq. (1) represents the heat transfer irreversibility and the second term represents the fluid-flow irreversibility. Since the calculation was performed using the actual data and since the condenser's design is such that it pretty much is a *black box* with almost no sensors mounted on the device, the technical aspect of the analysis was a pretty challenging task. The only available readings were the process data from the power plant monitoring system which gives only parameters on the inlet and the outlet of the condenser with absolutely no information what is going on in individual cells of the condenser. Those readings were sufficient for determining  $T_{in}$  and  $v_{out}$ , but for the heat fluxes and the pressure drops in particular sections of the heat exchanging modules the proper approach still had to be found.

For that purpose, certain assumptions and simplifications of the actual physical model had been made:

- The steam was assumed to be fully condensed by the lower end of the panel (tube).
- All the panels were assumed to be of direct-flow type.
- The condensate was assumed to be in the saturated liquid state.
- The two-phase flow inside the tubes was assumed to be stratified.
- The condenser was assumed to operate in quasi steady-state.

To find the unknown magnitudes, temperatures of outer walls of the heat-exchanging surface were measured with the ScanTemp 490 Infrared thermometer, manufactured by Dostmann electronic GmbH. The ScanTemp 490 has declared accuracy of  $\pm 2\%$  in the temperature range of  $-60$  °C to  $+1000$  °C. The temperatures were measured in a way to obtain readings at the mid-sections of 4 panels inside each cell (left and right panel on each side of the cell).

The steam side convective heat transfer coefficient was calculated according to Shah's improved correlation, [18]. The correlation is based on the procedure for determining one of the three given regimes the actual physical model applies to and then to calculate the convection coefficient according to the equation which obeys the actual regime. To determine the regime, two variables must be calculated:

$$J_g = \frac{xG}{\left[ gD_{int}\rho_g(\rho_\ell - \rho_g) \right]^{0.5}} \quad (2)$$

$$Z = \left( \frac{1}{x} - 1 \right)^{0.8} p_r^{0.4} \quad (3)$$

where  $J_g$  is the dimensionless steam velocity and  $Z$  – the so-called Shah's correlating parameter. Other variables in the eq. (2) and (3) are:  $x$  – the steam quality (mean value between the turbine exhaust state and the saturated liquid state was taken),  $G$  – the total mass flux,  $D_{int}$  – the internal diameter of the tube (the hydraulic diameter was taken),  $\rho_g$  – the density of the vapor phase and  $\rho_\ell$  – the density of the liquid phase,  $p_r$  – the dimensionless reduced pressure. Since the calculated values for  $J_g$  and  $Z$  correspond to the Regime III, [18] the steam-side convection coefficient was further calculated according to Nusselt's equation for laminar film condensation in vertical tubes:

$$\alpha = 1.32 \text{Re}_\ell^{-1/3} \left[ \frac{\rho_\ell(\rho_\ell - \rho_g)gk_\ell^3}{\mu_g^2} \right]^{1/3} \quad (4)$$

where  $k_\ell$  is the thermal conductivity of the liquid phase,  $\mu_g$  – the is the dynamic viscosity of the vapor phase, while  $Re_\ell$  is the Reynolds number for liquid phase, calculated as:

$$Re_\ell = \frac{4\dot{m}(1-x)}{\pi\mu_\ell D_{int}} \quad (5)$$

where  $\dot{m}$  is total mass-flow of the steam and  $\mu_\ell$  – the dynamic viscosity of the liquid phase. It is also important to say that according to Shah, [18], for tubes inclined downwards at 15° or more the recommended approach is to treat them as they were vertical.

The heat fluxes were calculated according to the eq. (6) as combined convective and conductive heat transfer from the liquid film of the condensate inside the tube to the outer wall of the tube, where the temperatures were measured. Also, the resistance to the heat flow through the tube's wall was calculated according to the numerically obtained conduction shape factor:

$$\dot{Q} = \frac{Fk}{1 + \frac{Fk}{A_{int}\alpha}} (T_k - T_w) \quad (6)$$

Mass-flows of the steam were further calculated according to the known heat fluxes and the enthalpy differences for the fully condensed steam. The pressure drops on the steam side were calculated according to the equation [19]:

$$\Delta p = \lambda \rho_g \frac{w_g^2}{2d_{free}} L \quad (7)$$

where  $\lambda$  is the friction factor on the surface of the liquid film,  $\rho_g$  – the density of the steam,  $w_g$  – the velocity of the steam,  $L$  – the length of the tube,  $d_{free}$  – and the equivalent free diameter of the tube corresponding to the free cross-section of the tube (the hydraulic diameter of the tube was taken). The velocity of the steam was calculated as the average velocity of gaseous phase with the assumption that the steam fully condenses by the end of the panel.

The friction factor on the surface of the liquid film was calculated according to the correlation, [19]:

$$\lambda = 8 \left[ \left( \frac{8}{Re} \right)^{12} + \frac{1}{(A+B)^{1.5}} \right]^{1/12} \quad (8)$$

where  $A$  and  $B$  are constants dependent on the Reynolds number and evaluated according to [20]:

$$A = \left[ 2.457 \ln \frac{1}{\left( \frac{7}{Re} \right)^{0.9} + 0.27 \frac{\varepsilon}{D}} \right]^{16} \quad (9)$$

$$B = \left( \frac{37530}{Re} \right)^{16} \quad (10)$$

where  $\varepsilon/D$  in the eq. (9) is the relative roughness of the inside of the tubes.

Meteorological parameters at the plant location were measured in the meteorological station located within the plant itself, while the process data were obtained directly from the power plant monitoring system.

The given mathematical approach was later applied to the measured temperatures and obtained process data and was also applied for the hypothetical case of ideally balanced condenser's operation. For ideally balanced state of the condenser's operation the state where heat fluxes and steam mass-flows are equal for each tube was considered and was assumed to be the state with minimum entropy generation. So finally, the corresponding entropy generation numbers were calculated for each set of measured temperatures:

$$N_s = \frac{\dot{S}_{gen}}{\dot{S}_{min}} \tag{11}$$

**Results and discussion**

Two sets of measurements have been performed. One on a relatively calm day with an average wind speed of 1.30 m/s and another on a relatively windy day, with an average wind speed of 3.40 m/s. The results of the measurements are shown in tab. 1 and tab. 2. As in the method description part of the paper was already mentioned, the temperatures of the outer walls (inside the cells) of heat-exchanging panels front sections were measured with the IR-thermometer at 120 points, so four different measurements were performed for each cell.

**Table 1. Temperatures measured at 1.30 m/s wind speed, condensing temperature 62.03 °C**

°C		CELL										
		#1		#2		#3		#4		#5		
LANE	#1	L	56.1	56.4	56.8	56.1	57.1	57.6	57.1	59.6	57.7	57.1
		R	56.9	56.8	57.6	56.8	57.1	57.3	55.6	59.4	58.7	58.6
	#2	L	57.6	58.3	58.6	57.7	56.5	57.4	56.3	57.5	56.8	56.4
		R	57.9	58.1	58.8	57.9	58.2	57.2	56.7	58.5	57.6	56.8
	#3	L	56.7	56.8	58.3	57.5	56.8	57.7	57.0	58.7	57.6	57.8
		R	57.1	56.2	58.5	56.8	57.6	57.9	57.4	58.5	57.9	59.7
	#4	L	56.8	56.7	57.4	57.6	56.3	56.2	56.5	57.8	57.0	57.3
		R	56.6	55.6	58.5	57.4	57.6	56.5	56.8	58.3	57.0	57.6
	#5	L	55.6	55.1	57.0	57.8	57.9	57.7	56.8	58.6	56.6	57.8
		R	56.1	56.1	57.7	57.3	57.9	56.9	55.6	55.8	58.6	58.8
	#6	L	58.4	56.9	57.2	57.7	57.4	56.9	56.6	58.8	55.7	56.5
		R	58.1	57.4	57.3	57.9	56.6	57.7	56.3	57.4	56.5	56.6

Measurements at each cell were performed in a way that the temperatures for left and right section on each side of the cell were measured. Each of those sections includes approximately 76.5 tubes according to the specified dimensions of the cells and the specified dimensions of each tube given by the manufacturer's specification. It should be noted that for certain cells from the second data set, some of the measured temperatures appeared to be slightly higher than the actual condensation temperature. Those values were considered equal to the actual condensation temperature and the differences in readings were attributed to the declared error of the IR-thermometer. It was also assumed that cells where the measured temperatures were equal to the condensation temperature were out of the function at the time and that no heat flux was being distributed through those heat exchanging surface sections.

**Table 2. Temperatures measured at 3.40 m/s wind speed, condensing temperature 59.76 °C**

°C		CELL										
		#1		#2		#3		#4		#5		
LANE	#1	L	49.5	50.1	50.1	51	50.6	51.4	52.1	54.1	52.7	52.8
		R	52.6	51.6	49.6	51.4	51.6	51.6	49.8	53.8	52	55.8
	#2	L	52.6	53.4	54.4	52.1	54.4	53.4	53.8	53.8	56.4	56.1
		R	52.7	52.4	52.6	52.9	55.9	54.1	54.6	54.5	55.5	55.1
	#3	L	54.9	55.1	56	55.1	55	55	55.1	55.7	55.8	55.9
		R	53.1	53	55.7	55.4	55.1	55.2	55.7	55.1	55.4	55.8
	#4	L	55	54.4	55.7	55.6	56.1	56	56.7	58.3	58.3	61
		R	53.9	54.2	54.8	54.1	55.1	55.2	55.1	55.4	58.3	60.5
	#5	L	57.1	56.7	57.1	54.6	56.8	56.1	55.8	57.5	58.7	60.1
		R	58.9	56.9	56.8	54.2	56.4	54.9	56.9	59.4	59.6	58.5
	#6	L	57.4	59.8	60.4	55.4	55.4	55.5	55.4	60.7	57.9	60.3
		R	58.3	59.6	59.1	59	57.9	56.8	56.4	56.8	60.4	59.5

For the first set of measurements, the overall heat flux calculated according to the measured temperatures differed from the heat flux calculated according to the process data (readings from the power plant's monitoring system) by 3.7% while for the other set of measurements the difference was 5.2%. The same deviation from the process data was also present in calculated steam mass-flows. These differences originate in the method the convection coefficients were calculated. The convection coefficients were calculated for both sets of the data for an ideally balanced condenser (equal mass-flows through each panel calculated according to the process data), which means that the rest of the calculation was performed according to the average values of the coefficient. Since the actual operating states at the time of the measurements were certainly not ideally balanced, the scale of the imbalance directly influenced the deviation of local convection coefficients from the average value, increasing the overall deviation of the results.

On the figs. 3-10 the calculated data are presented. For easier presentation, at the diagram's horizontal axis, Numbers 1 and 2 refer to the first cell, Numbers 3 and 4 to the second and so on. Each point on diagrams refers to a package of 76.5 tubes or one quarter of one cell.

At the first glance, the considerably higher dissipation of the results can be seen on diagrams that refer to the second data set. As expected, the operating condition of the condenser during the windier day was much more out of the balance than the calm day operating condition, which also explains the higher obtained error for that set of the data. The dash-dotted line on each diagram refers to the average value of the calculated results. The average values of the heat flux and the mass-flow of the steam refer to the ideally balanced condenser for the actual condensation pressure for each data set.

One can notice that the obtained friction coefficients were in a good compliance with the available data, for the average Reynolds number values within  $3.65 \cdot 10^4$  to  $3.84 \cdot 10^4$  and the relative roughness of the tube of  $1.48 \cdot 10^{-3}$  for the flow over the liquid film. For the first data set, friction coefficient was in average  $2.69 \cdot 10^{-2}$  with standard deviation of  $3.502 \cdot 10^{-3}$  and for the other set  $2.23 \cdot 10^{-2}$  in average with standard deviation of  $1.335 \cdot 10^{-2}$ . The calculated pressure drops were in average 232.5 Pa for the first data set and 350.7 Pa for the second and both cal-

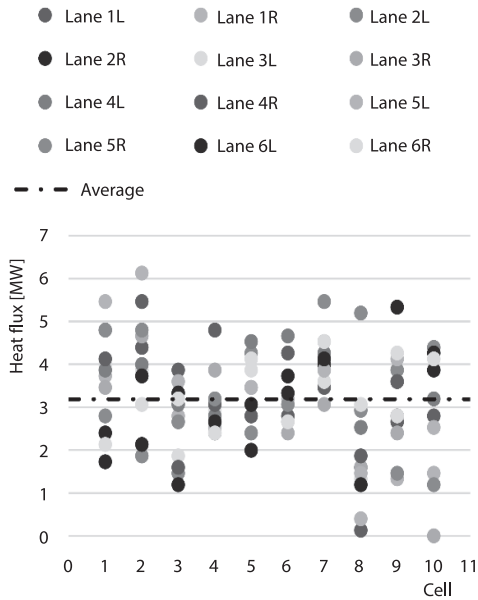


Figure 3. Heat flux for 1.30 m/s wind speed

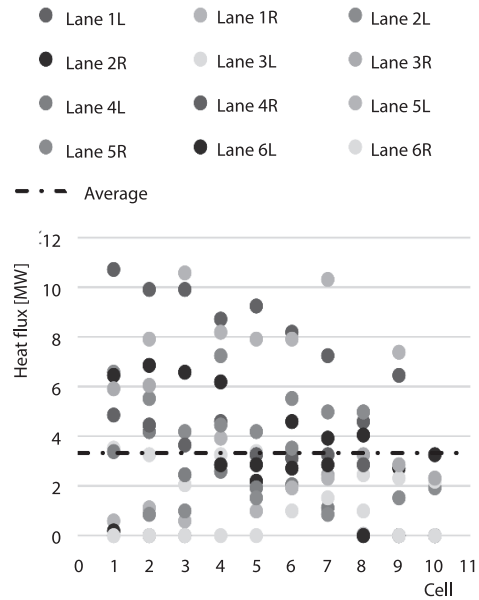


Figure 4. Heat flux for 3.40 m/s wind speed

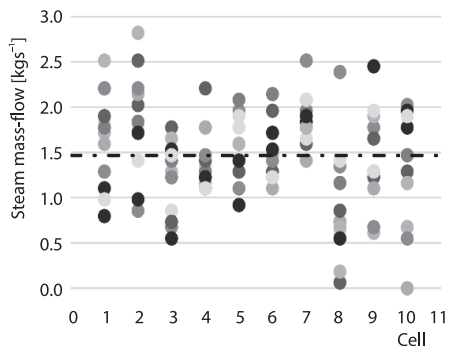


Figure 5. Mass-flow for 1.30 m/s wind speed

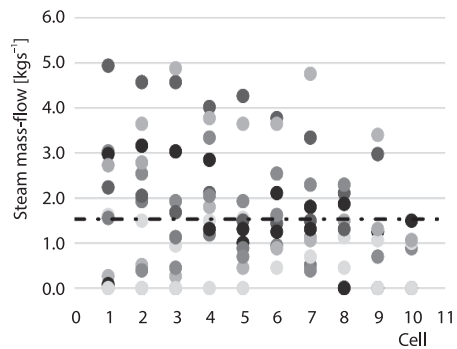


Figure 6. Mass-flow for 3.40 m/s wind speed

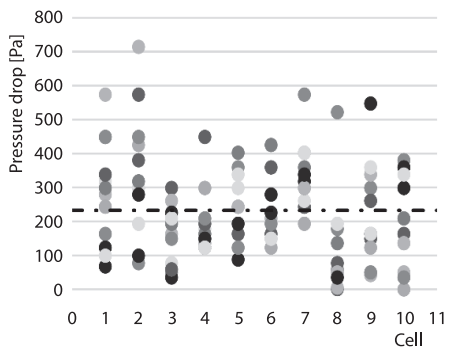


Figure 7. Pressure drop for 1.30 m/s wind speed

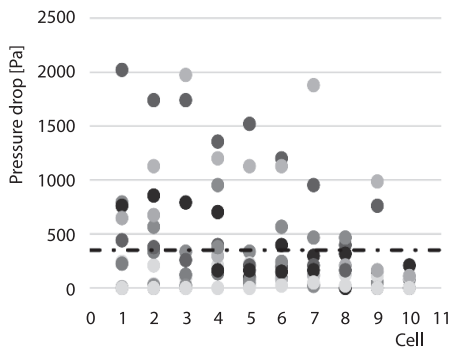
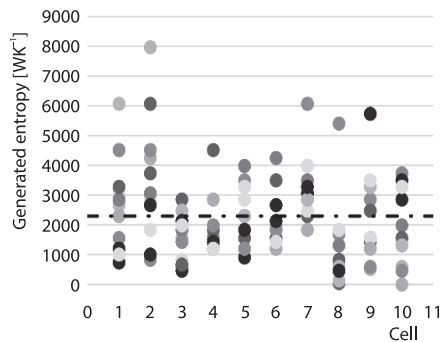
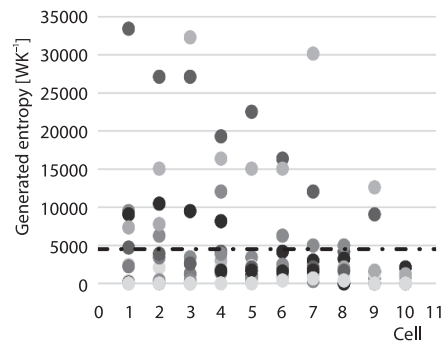


Figure 8. Pressure drop for 3.40 m/s wind speed



**Figure 9. Generated entropy for 1.30 m/s wind**



**Figure 10. Generated entropy for 3.40 m/s wind**

culated values were in reasonably good compliance with the pressure drop that corresponds to the temperature differences between condenser's inlet and the outlet.

Finally, the average entropy generated per cell for the first measurement set was 2300 W/K with standard deviation of 1483 W/K and for the other set was 4504 W/K with standard deviation of 7047 W/K. At the same time, the generated entropies which correspond to the ideally balanced operating states were 1970 W/K and 2038 W/K, respectively.

This shows that average corresponding entropy generation numbers were 1.17 for the first data set and 2.21 for the other. Also, the overall generated entropies, calculated according to the average pressure drops were  $2.53 \cdot 10^5$  W/K and  $3.27 \cdot 10^5$  W/K, respectively for the first and for the second data set, while the corresponding generated entropies for the ideal cases were  $2.36 \cdot 10^5$  W/K and  $2.45 \cdot 10^5$  W/K, respectively. So, the overall entropy generation numbers were 1.07 for the first set and 1.34 for the other.

By observing the generated entropies presented on the figs. 9 and 10 the very interesting occurrence can be noticed. If we consider panels which generate more entropy than 3000 W/K as those with high entropy generation, and panels which generate less entropy than 1000 W/K as those with low entropy generation. As presented, exactly the panels with low generated entropies are also the ones with the lowest mass-flows and with the lowest distributed heat fluxes while the ones with the highest generated entropies seem to perform most of the process. Obviously, the problematic panels are not the ones which generate entropy above the average but exactly the ones with entropy generation below the average and especially the ones with generated entropy close to zero. Moreover, it seems that sub-functioning panels with consequently below average entropy generation cause overloading of the rest of the panels increasing their irreversibility and disrupting the overall condenser efficiency.

**Conclusion**

It is presented that the most challenging part of the air-cooled condenser performance and application in modern thermal power plants is exactly the Earth's atmosphere being the low temperature reservoir for the process. Sudden and often hard to predict changes in the atmosphere could lead to serious disruptions of the air-cooled plant functioning. The most dramatic scenario arises during hot summer days when the condenser operates on the top nominal parameters of the atmosphere. During those periods even a slight additional disturbance can cause severe operating problems. Those disturbances can be caused either by additional temperature rise or by the sudden gust of the side wind or, for the worst-case scenario, by both.

In such cases, obviously an additional boost of condensing potential must be engaged in order to preserve the projected cooling capacity of the condenser. One of the possible solutions is a hybrid system which uses water-spray injected in the air-flow to increase the cooling potential of the system. The additional cooling water increases the operating costs and should be used in limited quantities and economically. The mathematical approach given in this paper could help in optimizing the quantities of the cooling water in a way to engage the hybrid system only for cells with the lowest entropy generation. Doing so, increasing the overall heat flux and improvement of the condenser's efficiency could be simultaneously achieved by keeping the condenser reasonably balanced.

### Nomenclature

$A_{\text{int}}$  – internal surface area of tube, [m<sup>2</sup>]  
 $D$  – diameter of tube, [m]  
 $d_{\text{free}}$  – equivalent free diameter of tube [m]  
 $F$  – conduction shape factor of tube, [m]  
 $G$  – mass flux, [kgm<sup>-2</sup>s<sup>-1</sup>]  
 $g$  – gravitational acceleration, [ms<sup>-2</sup>]  
 $J_g$  – dimensionless steam velocity, [–]  
 $k$  – thermal conductivity, [Wm<sup>-1</sup>K<sup>-1</sup>]  
 $L$  – length of tube [m]  
 $\dot{m}$  – mass-flow, [kgs<sup>-1</sup>]  
 $N_s$  – entropy generation number, [–]  
 $p$  – pressure, [Pa]  
 $p_r$  – reduced pressure, [–]  
 $\dot{Q}$  – heat flux, [W]  
 $Re$  – Reynolds number, [–]  
 $\dot{S}$  – generated entropy, [WK<sup>-1</sup>]  
 $T$  – temperature, [K]  
 $v$  – specific volume, [m<sup>3</sup>kg<sup>-1</sup>]  
 $w$  – velocity of steam, [ms<sup>-1</sup>]

$x$  – quality of steam, [–]  
 $Z$  – Shah's correlating parameter, [–]

### Greek symbols

$\alpha$  – convective heat transfer coeff., [Wm<sup>-2</sup>K<sup>-1</sup>]  
 $\varepsilon$  – absolute roughness of tube, [mm]  
 $\lambda$  – Darcy friction factor, [–]  
 $\mu$  – dynamic viscosity, [Pas]  
 $\rho$  – density, [kgm<sup>-3</sup>]

### Subscripts

gen – generated  
 0 – environment, low temperature reservoir  
 in – inlet  
 out – outlet  
 int – internal  
 g – gaseous phase  
 ℓ – liquid phase  
 min – minimum

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# The data heat island effect: quantifying the impact of AI data centers in a warming world

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## Abstract

The strong and continuous increase of AI-based services leads to the steady proliferation of AI data centres worldwide with the unavoidable escalation of their power consumption. It is unknown how this energy demand for computational purposes will impact the surrounding environment. Here, we focus our attention on the heat dissipation of AI hyperscalers. Taking advantage of land surface temperature measurements acquired by remote sensing platforms over the last decades, we are able to obtain a robust assessment of the temperature increase recorded in the areas surrounding AI data centres globally. We estimate that the land surface temperature increases by 2°C on average after the start of operations of an AI data centre, inducing local microclimate zones, which we call the *data heat island effect*. We assess the impact on the communities, quantifying that more than 340 million people could be affected by this temperature increase. Our results

show that the data heat island effect could have a remarkable influence on communities and regional welfare in the future, hence becoming part of the conversation around environmentally sustainable AI worldwide.

**Keywords:** Artificial intelligence sustainability, data centres, power consumption, heat dissipation, land surface temperature.

## 1 Introduction

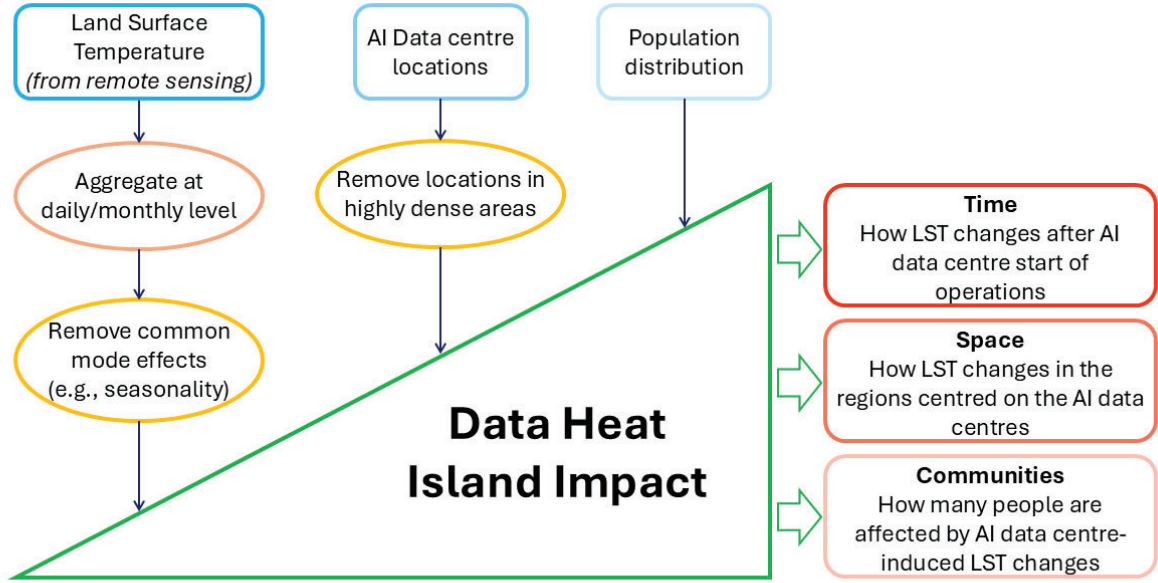
When considering the impact of anthropogenic activities on climate change and global warming in the last few decades, the urban heat island (UHI) effect plays a key role. UHI results from the concentration of industrial activities and heavy use of synthetic construction material, as well as solid increase in energy consumption in densely populated urban areas [1–6]. When discussing UHI effects, it is paramount to consider the impact they have on local communities and regional welfare. In this respect, it has been studied and demonstrated how UHI would affect healthcare, energy consumption, air quality, and water quality. It is therefore crucial to understand their causes [7].

Specifically, the main drivers for UHI are classified in terms of geometry of the anthropogenic spaces (e.g., urban canyons dictate the concentration of particulates); lack of vegetation and water bodies; generation of air pollutants and water vapour; heat retention and low albedo building [1, 3, 6, 8, 9]. On top of these categories, the type of human activities established and operating dramatically influence the impact of UHI on environment and communities. These anthropogenic activities are characterized by their spatial concentration, functional type (e.g., residential, industrial), cooling requirements, fuel sources, and thermal efficiency [1, 7, 8].

With global data volumes growing rapidly [10], data centres are expected to be one of the most power-hungry activity in the next decade [11–14]. In fact, it has been estimated that in 3 to 5 years the power consumption for data processing will exceed the amount budgeted for manufacturing [15–17]. As such, it is possible to expect that the impact of data centres and AI hyperscalers activities on climate might not be negligible [18–20], indeed being further exacerbated by the use of AI in the next decades [15, 16, 21].

In fact, AI data centres are in vast majority relying on fossil fuel use [15, 19–22]. Therefore, the steep growth of AI training and use for various applications would directly translate into high net impact on emissions. Also, the inefficiencies and nonidealities of AI hyperscalers operations would cause their emissions to rise even more under the expected projections of AI model scaling [19].

However, studying in detail the actual impact of AI hyperscalers environmental footprint would entail several uncertainties and unknowns [19]. Indeed, there are no credible indicators that can help determine and quantify the impact of existing AI applications. Moreover, predicting the characteristics of future AI applications, particularly their energy consumption and computing requirements, remains challenging. The fluctuations on forecast scenarios that could be drawn are further amplified by a lack of both consistency in methodologies and comprehensive data, even in historic estimates of environmental footprint from the ICT sector [19, 20, 23, 24]. In this paper, we aim to provide a novel perspective on the impact of AI hyperscalers on environment and sustainability under various climate scenarios for the next decades. By a multiscale multimodal analysis of records collected from various sources of information and sensors, we quantify the contribution of AI hyperscalers worldwide on land surface temperature increase (see Figure 1). Specifically, we integrate land surface temperature data from remote sensing platforms with the locations of AI hyperscalers that have been established in the last twenty years in order to assess the change in atmospheric heat induced by the data centres. To make our study less prone to uncertainties, we harmonise, arrange and filter the data from seasonality effects, influence from various nonidealities (e.g., missing data), and influence from factors (e.g., other types of anthropogenic activities in the surrounding of AI hyperscalers) which might contaminate our study. In this way, we are able to identify the impact of AI hyperscalers on environment as a



**Fig. 1** Graphical abstract of this work: the proposed multiscale multimodal architecture for data analysis integrates records of land surface temperature trends from year 2004 to 2024, gridded population maps, and AI data centres locations worldwide, to achieve a thorough understanding of the impact of *data heat islands* in time, space and over communities.

consistent gradient in temperature between the area of data centres and their surrounding regions, so much so that could form a “*data heat island effect*”. Our analysis moves in order to address three main objectives:

- Quantification of the land surface temperature increase connected to the establishment of an AI hyperscalers;
- Assessment of the region of influence of this increase;
- Estimation of the population affected by the temperature increase.

The paper is organised as follows. Section 2 introduces the datasets and the methodology used to extract information on the land surface temperature increase induced by the AI data centres in twenty years worldwide. Section 3 reports the results we achieved with respect to the aforementioned indicators. Section 4 provides a few best practice guidelines for software and hardware solutions that could help to reduce the impact of the data heat island effect. Finally, Section 5 draws the final remarks and conclusions.

## 2 Data and methods

Our analysis of the environmental footprint of AI hyperscalers relies primarily on land surface temperature (LST) measurements (see Figure 1). We used a reconstructed MODIS LST dataset (produced by NASA) acquired worldwide from 2004 to 2024 over an enhanced 500m resolution grid [25]. To address data limitations (e.g., missing acquisitions, cloud cover), we aggregated the results at daily and then monthly scale, and removed seasonality effects, as well as outliers. Then, we focused our attention on the locations of the main AI hyperscalers that have been built in the same time interval. For this purpose, we used the database provided by [19]. This database contains more than 11000 locations worldwide, of which 8472 have been detected to dwell outside of highly dense urban areas.

We thus used the latter locations to quantify the effect of the establishment of data centres on the environment in terms of the LST gradient that could be measured on the areas surrounding each data centre. In fact, LST profiles in urban and densely built-up areas can be affected by various activities, e.g., manufacturing, house heating, road networks. Considering only the AI data centres located outside of highly dense regions allows us to provide a solid connection between the LST trends that we can measure and the presence of AI data centres in the area. In particular, we assess mean LST trends over time within circular regions centered on each AI hyperscaler. In practice, our analysis counts over 6733 data points, when considering LST trends cleared out of problematic data points and outliers for AI data centres located outside of highly dense urban areas. Finally, to assess the impact of LST change on population, we downscale the 100m x 100m demographic maps from Worldpop Global Project [26] over the considered to 1km resolution, so to enable a robust statistical analysis of the population affected the temperature increase induced by AI data centres.

This study relies on the assumption that AI hyperscalers might have an impact on the LST of their locations because of the heat that they would release as a result of the high power demanding applications that they would be used for [27]. To assess this, we first quantify the normalised temperature increase that could be observed in the months right after the start of operations of the AI hyperscalers we considered. To assess this impact we draw inspiration from the quantification approach used to estimate the urban heat island effect [6, 8, 9]. Specifically, we compute the monthly average LST of the area centred on each AI hyperscaler, and we calculate the difference between the mean monthly LST and average LST that is recorded across a period of  $k$  months on that region. In other terms, let us define  $T_i^r$  as the mean LST for month  $i$  at a distance of  $r$  km from a given data centre. Then, for every AI data centre location, we can write the normalised temporal temperature increase centred over the data centre location as  $\Delta_i^{r=0}(k) = \Delta_i^0(k)$ , which is defined follows:

$$\Delta_i^0(k) = T_i^0 - \frac{1}{k} \sum_{j=1}^k T_{i-j}^0, \quad (1)$$

where  $T_i^0$  identifies the mean LST for month  $i$  for each AI data centre location. For completeness, this quantity is typically computed over 10 years, which translates into setting  $k = 120$  in (1).

To focus our attention on the impact of AI data centres on LST increase, we centre the origin of the  $i$ -axis on the date of start of operations of each data centre under exam. Therefore,  $\Delta_0(k)$  identifies the average LST increase that is measured over each AI data centre with respect to the mean of the LST that was recorded over the  $k$  months before their start of operations.

With this in mind, we assess the spatial influence of AI data centres on LST increase by focusing our attention on the LST distribution at  $r$  km from the given data centres over the  $k$  months prior to the start of operation of each data centre, that is:

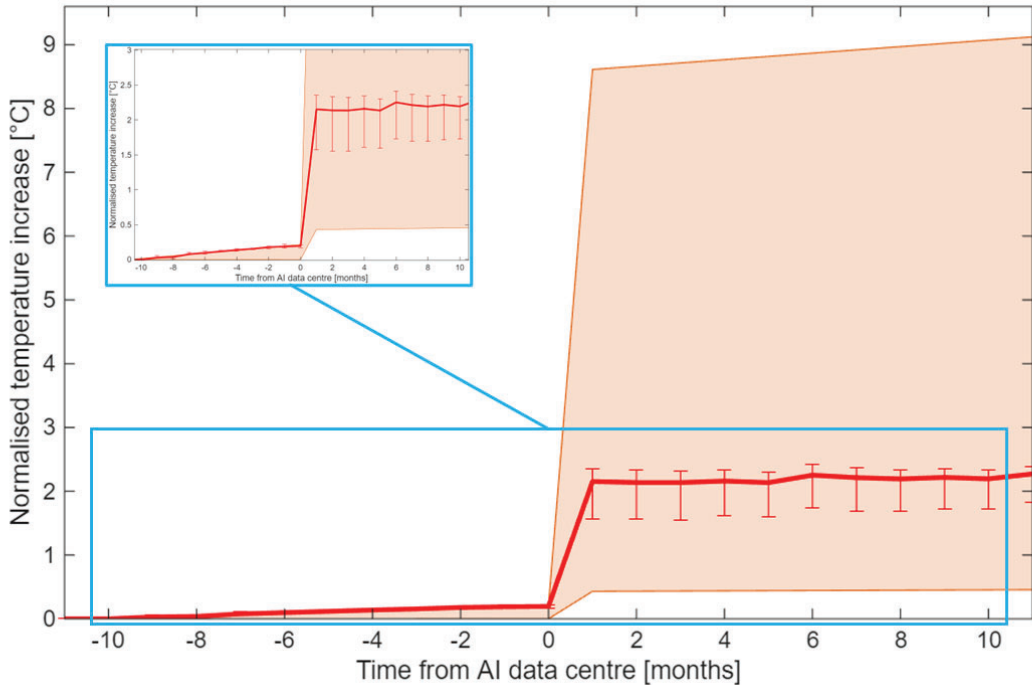
$$\Delta_0^r(k) = \bar{T}_0^r - \frac{1}{k} \sum_{j=1}^k \bar{T}_{0-j}^r, \quad (2)$$

where  $\bar{T}_0^r$  and  $\bar{T}_{-j}^r$  identify the average of the LST of all the points at  $r$  km from the given AI data centre on the month of start of operation and at  $j$  months prior, respectively. In other terms, assuming that  $R$  points are at  $r$  km from the given data centre, and that  $T_u^r|_l$  identifies the LST that we estimate for the  $l$ -th point at  $r$  km from the given data centre and  $u$  months from the start of operations, we can write  $\bar{T}_u^r = \sum_{l=1}^R T_u^r|_l / R$ .

As mentioned, we compute the quantities in (1) and (2) for each data centre under exam. The following Section reports the results we achieved building up on these metrics.

### 3 Results and discussion

The results we obtained conducting the analysis described Section 2 across all AI hyperscalers analysed during the 2004-2024 period are aggregated and displayed in Figure 2. Specifically, we focus our attention on the LST increase induced over the AI data centres under exam with respect to the average LST recorded over those regions for the 5 years prior to each AI data centre start of operations. For sake of visualisation, we concentrate 10 months before the start of operations of each data centre, and the 10 months after it. In other words, we compute  $\Delta_i^0(k)$  as in (1) with  $k = 5 \times 12 = 60$ , and for  $i \in \{-10, -9, \dots, -1, 0, 1, \dots, 9, 10\}$ . In particular, we align the temporal analysis results over the x-axis, where the trends are centred over the time of start of operations of each data centre. The aggregate average of the LST difference is shown in red solid line. The shaded areas show the interval between the maximum and minimum value of LST increase that has been recorded across the considered AI hyperscalers. Finally, the bar across the average line identifies the limit of the 95th percentile of the distribution we compute. Figure 2 shows a clear increase of LST coinciding with the start of



**Fig. 2** Temperature increase through time over the AI hyperscalers locations centred around the time of start of operations ( $i = 0$ ), according to the procedure described in Section 3 - equation (1). The aggregate average of the LST difference is shown in red solid line. The shaded areas show the interval between the maximum and minimum value of LST increase that has been recorded across the considered AI hyperscalers. The bar across the average line identifies the limit of the 95th percentile of the distribution we compute.

operations of the AI hyperscalers that have been monitored in this study. Indeed, the average LST increase across the data centres is  $2.07^\circ\text{C}$ , whilst its minimum and maximum can be found at  $0.3^\circ\text{C}$  and  $9.1^\circ\text{C}$ , respectively. The 95th percentile of the LST increase after the AI data centres start of operations is concentrated between  $1.5^\circ\text{C}$  and  $2.4^\circ\text{C}$ . These results are dramatically impressive, especially considering that the typical LST increase caused by the quintessential example of compound of anthropogenic activities – the urban heat island effect – has been estimated in the  $4$  and  $6^\circ\text{C}$  interval [1, 6, 8]. This apparent step function emphasize the clear effect of AI hyperscalers on their surrounding areas, so much that it can match the impact of “islands” of higher temperatures: therefore, we

call this the *data heat island* effect. This terminology is further supported when computing monthly LST differences as in Equation (1) over various time intervals (12 months to 10 years). Table 1 reports these results: across all the intervals that have been considered, the LST increase over the AI hyperscaler regions over the start of operations of the data centre seems consistent. The influence of

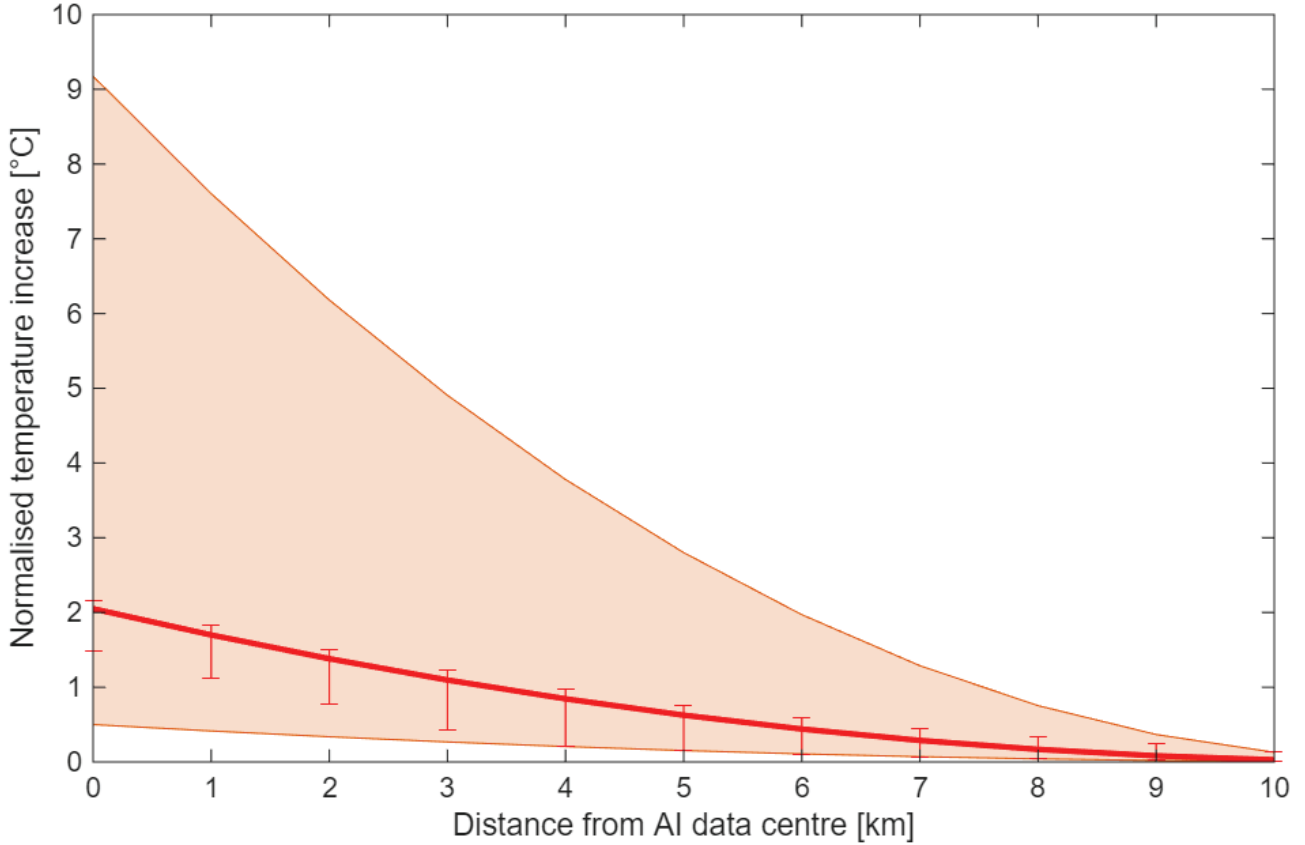
**Table 1** Temperature increase (in °C) as defined in Equation (1) at AI hyperscalers start of operation ( $i=0$ ) as a function of  $k$ .

$\Delta_0(k)$	<b>k=12</b>	<b>k=24</b>	<b>k=36</b>	<b>k=120</b>
average	2.03	2.05	2.06	2.12
minimum	0.30	0.31	0.32	0.37
maximum	9.02	9.09	9.14	9.24

AI hyperscalers apparently is not limited to the immediate proximity of their locations. In fact, we computed the temperature increase over wider regions circularly arranged around the data centres, following the same procedure that we previously described. Figure 3 displays the results of this analysis. Taking a look to these results, it is evident that the impact of LST increase reaches up to 10 km distance from the AI hyperscalers. The data heat island effect seems to reduce its intensity to 30% within 7 km around the data centres. In particular, an average monthly LST increase of 1 °C can be measured up to 4.5 km from the AI hyperscalers. This spatial extent is comparable to that observed in urban heat island effects [1, 6, 8]. The LST increase that is recorded in the area surrounding AI data centres seem consistent across various regions of the world, even if under diverse climatic conditions. As an example, we mention three situations that show the consistency of our study. In fact, in the following case studies, our LST increase assessment fit some anomalous trends of LST increase that have been recorded in the last decades, so that our approach could eventually be used to explain these non-typical temporal LST profiles:

- *Bajío region, Mexico*: the Bajío region in Mexico records a very high density of data centres managed by various providers that started operations approximately twenty years ago. The stable climate, low seismic activity, and proximity to North American markets made the Bajío region a great hub for AI data centres. Nevertheless, it has been recorded a serious LST increase trend (in the order of 2°C) in the last twenty years in the region, which was not identified in proximal areas [28];
- *Aragón province, Spain*: Aragón has emerged as a major European hub for hyperscale AI data centres. The region is becoming a critical node for AI, cloud computing, and, increasingly, specialized server manufacturing. At the same time, the region has recorded an anomalous increase of approximately 2°C, which stands out with respect to the trends of the neighboring provinces of Spain, as well as to the global temperature increase that has been monitored in Europe [29];
- *Ceara’ and Piauí states, Brazil*: The north east region of Brazil identifies one of the areas in the country (together with the greater urban areas of Rio de Janeiro and Sao Paulo) with a very high concentration of data centres. The surroundings of the city of Teresina, Piauí, are in particular dedicated for AI service hub. At the same time, the states of Ceara’ and Piauí have shown a peculiar LST increase trend centred in Teresina in the range of 2.8°C, projected to reach more than 3.5°C in the next five years, that is quite unusual with respect to other areas in the north Brazil and equatorial Brazil [30].

These results become more significant when considering the population exposed to data heat island effects. We report in Figure 4 the amount of people that were resident within 10 km radius from the AI hyperscalers with respect to the LST increase that they would have experienced after the start of operations of each data centre. Figure 4 displays the result of this analysis. Although the object of the analysis has been focused on data centres outside of densely populated areas (as mentioned in



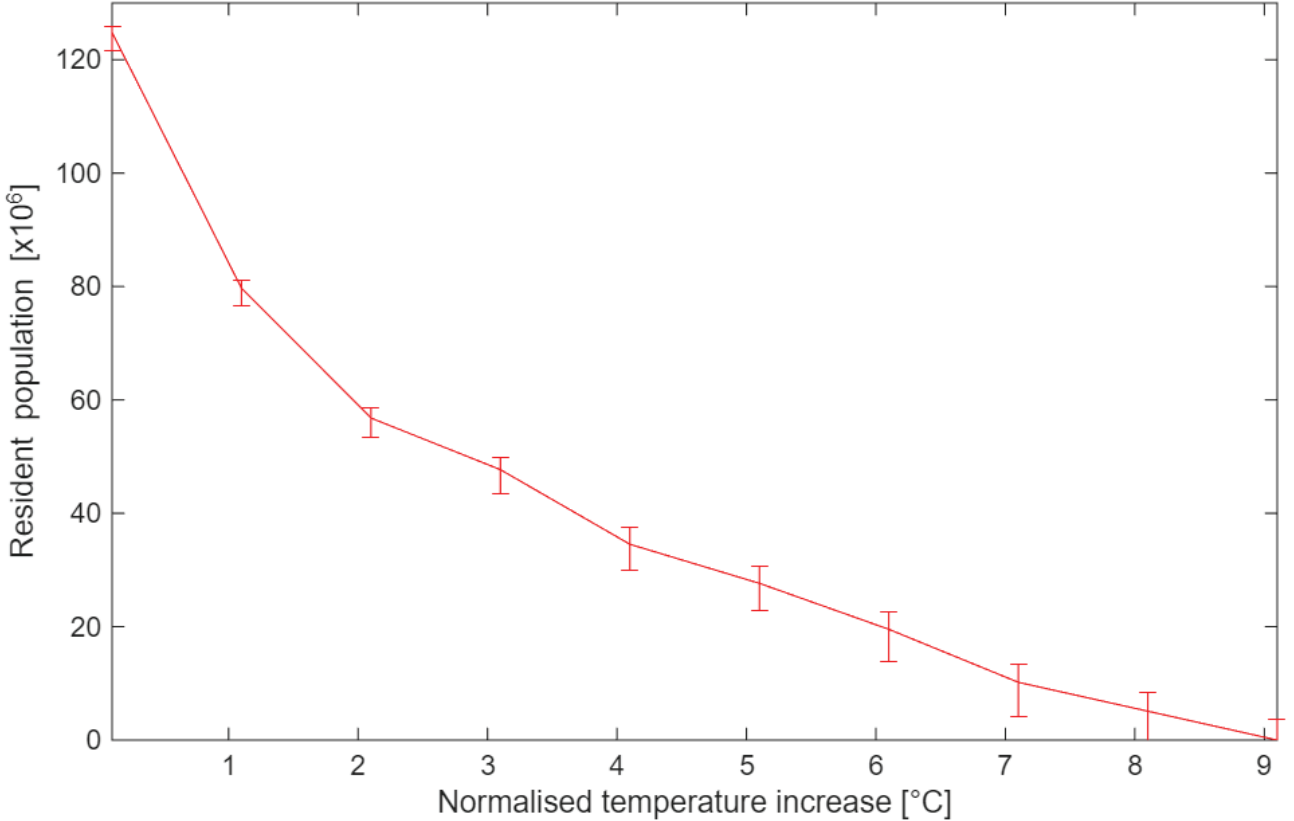
**Fig. 3** Temperature increase through space as a function of the distance from the AI hyperscalers locations, according to the procedure described in Section 2 - equation (2). The same color policy as in Figure 2 applies here.

Section 2), it is possible to appreciate how many people (up to 343 millions in total for a LST increase up to 9°C) could be affected by the data heat island effects worldwide. This makes the data heat island effect a phenomenon that is very hard to consider negligible, as it may lead (like the urban heat island effect) to dramatic impact on welfare, healthcare and energy systems [2, 6, 19, 24, 31].

Given these findings, mitigation measures for data heat island effects warrant urgent consideration: a set of strategies that can be implemented in this respect are introduced in the next Section.

## 4 A way forward

Although the impact of data heat islands can be intense (as it has been previously discussed), advances in technology in the semiconductor and energy material industries, as well as methodological developments in computer science and electrical engineering, can be used to mitigate their effects. We categorise these possible strategies in two main classes, software- and hardware-based. We report in the following examples of realistic approaches that can be employed to alleviate the data heat island effect (although in most cases these strategies have not been designed to address LST increase in the context of climate transformation). Beyond technological interventions, addressing the environmental impact of AI hyperscalers also highlights the need for a new theory of intelligence that explicitly incorporates energy, information, and physical constraints. Traditional AI theories often treat intelligence as abstract computation or symbolic manipulation, ignoring the thermodynamic costs of information processing. The Matryoshka model of intelligence [32], for instance, proposes a hierarchical, physically grounded framework in which cognitive, sensory, and motor processes are coupled with energy



**Fig. 4** Distribution of population as a function of the LST increase they are affected by within  $r = 10$  km radius from the AI hyperscalers considered in this study with respect to the LST trend of the 5 years prior to the start of operations of the data centres, i.e.,  $\Delta_0^{10}(60)$  in (2) in Section 2.

and material constraints across nested levels of complexity. By recognizing intelligence as a thermodynamically instantiated phenomenon, this framework not only provides deeper insight into natural and artificial cognition but also offers a principled foundation for designing more energy-efficient and sustainable AI systems, which could substantially reduce the heat and carbon footprint of large-scale data centers. Integrating such theory-driven principles into AI architecture and operations could complement hardware and software strategies, offering a holistic approach to mitigating the data heat island effect.

#### 4.1 Software-based solutions

The strategies in this category pertain to the design, development and implementation of computational methods that would make the data processing in AI hyperscalers more efficient, hence reducing their inherent power consumption. In order to provide a complete overview of the directions that could be explored for limiting the impact of data heat island effect in this respect, we divide the strategies in this category according to the main phases for data data analysis, i.e., preprocessing, processing, and usage for decision making:

- *how data are arranged*: the preprocessing operations in data analysis frameworks must not be underestimated. In the vast majority of operational scenarios, data analysis has to be performed onto records that show several nonidealities (e.g., missing, corrupted, unbalanced data, high variability in the records, low informativity of the data samples). This affects the quality of data analysis, as classic AI models would aim to reduce this uncertainty by implementing transformations (e.g., interpolation, smoothing) on the data, which could lead to artificial bias and hallucinations [24].

In this respect, considering the records as realizations of propagation and advection forces that can be used to model the properties of the data samples in the feature space can help [33]. In fact, this choice enables the identification of the actual relevance of the data samples and features, hence supporting efficient computational procedure by removing the negligible connections across samples and focusing the algorithms' attention on the significant and informative components of the datasets only. Core datasets can be selected from their original datasets to improve training efficiency in deep learning, without loss of performance accuracy [34].

- *how data are processed*: one of the greatest challenges of classic AI algorithms is convergence to unacceptably inferior local minima during the loss minimization or training process [23, 24, 35–37]. This leads to extreme difficulties for AI algorithms to guarantee any level of predictive accuracy without allowing AI models to use a large amount of energy, e.g., to identify all the possible solutions across the feature space [16, 18, 38, 39]. Seminal concepts such as the universality of deep, feed-forward neural networks and empirically encouraging results, although the degree of improvement in terms of power efficiency is most of the times very limited. Also, hierarchical learning based on functional learning (e.g., isogeometrical networks [40]) can be used to mitigate training and convergence issues, and can increase the accuracy of the classic AI strategies whilst guaranteeing a sustainable use of the computing resources. Also, pruning and compression of deep learning based models [41, 42] can benefit the definition and development of solution for hardware-aware AI models.
- *how data are used*: as other anthropogenic activities, data centers emissions can be quantified in terms of carbon footprint, i.e., the the amount of greenhouse gas emissions (gCO<sub>2</sub>) generated [1, 2, 7, 9]. In this respect, novel strategies for innovative carbon-aware generative language model inference framework have been designed to reduce carbon footprint: the primary method for this relies on the strategic use of token generation directives while maintaining high-quality outputs [20, 23, 43, 44]. To achieve these goals architectures proposed in technical literature employ numerical programming for system-level optimization, balancing carbon savings with generation quality.

## 4.2 Hardware-based solutions

In this category, we summarise some viable options to improve data centres efficiency (hence their heat release in the atmosphere) by enhancing their operational framework. As for the previous case, we list these novel approaches according to the stage of functional deployment in the AI hyperscalers, i.e., at signal processing, power management, and infrastructure level.

- *how data are translated into signals*: recent progresses in integrated circuitry have enabled the development of technologies able to reduce the power consumption of AI accelerators and indeed recover the energy used for computing [23, 24, 45]. Adiabatic circuitry plays a key role in this respect [46]. This class of low-power integrated circuits rely on reversible logic and energy recovery, so that reduction of energy loss during computation can be achieved. This directly leads to reduction in heat dissipation, therefore potentially reducing the data heat island effect. Indeed, in adiabatic circuitry, power is recycled mainly through transistor switching. Although very promising, this technology show consistent limits for speed and scaling to AI models, hence requiring very complex systems (e.g., sinusoidal/trapezoidal clocks) to be implemented.
- *how signals are translated into power*: AI workloads are characterized by high computational intensity over long timeframes; high degree of variability, unpredictability, and nonlinear scalability of computational power usage; sensitivity to algorithmic design and implementation [11–13, 15, 16, 18]. This leads to major problems for demand and supply of AI hyperscalers within the energy grids that they are embedded in, e.g., affecting the grid stability and the accuracy of the AI models that are run onto their structures. These issues are a direct byproduct of the inability of AI hyperscalers power infrastructures to track the high variability of AI models usage. However, when power resources are set up to provide dynamic power response [47] (e.g., by intelligent battery energy support systems paired with power-load-temperature optimisation systems for resource and job

allocation), the efficiency of data centres could dramatically improve, e.g., showing solid reduction of data centre downtime; protection of the infrastructure by power fluctuations, drops and spikes; and higher resilience towards irregular and unstructured AI platform usage.

- *how power is managed in infrastructure* The electronic components in AI hyperscalers are characterised by extremely high-power densities, often reaching magnitudes on the order of  $107 \text{ W/m}^2$  [48]. These extreme thermal loads, exacerbated by non-uniform workload distributions and the emergence of localized hotspots across chips, demand sophisticated thermal management strategies [49]. One key approach involves multiscale coordinated cooling schemes that combine localised liquid cooling at the chip level with system-wide air cooling across the facility. This hybrid method targeted heat extraction from critical hotspots while maintaining overall thermal balance throughout the infrastructure [50]. In addition to active cooling methods, passive cooling technologies offer complementary benefits by alleviating structural thermal load without increasing operational energy demand. Among these, passive radiative cooling has garnered particular interest. This technique engineers the optical properties of outdoor-exposed surfaces, such as building envelopes, by incorporating high solar reflectivity to suppress solar heat gain and strong thermal emissivity in long-wave infrared spectrum to enable radiative heat dissipation, thereby reducing the overall thermal load on infrastructure [51–53]. Recent advancements have translated this passive cooling technology into practical applications. In particular, passive radiative cooling coating based on polymer–nanoparticle composite has been applied across various real-world scenarios, including residential structures, urban infrastructure, and agricultural storage facilities [54]. Reported results indicate cooling load reductions ranging from 10% to 40% after applying the coating, contingent on site-specific factors such as surface albedo, orientation, and geographic climate conditions. In the context of AI hyperscalers, where thermal loads are not only intense, but spatially heterogeneous, such passive approaches can play a structural role in limiting the baseline thermal burden imposed on active cooling systems.

## 5 Conclusions

The increasing demand for AI-based services, processes and operations led to the proliferation of data centres worldwide that are extremely power hungry. In this paper, we provide the first assessment of the environmental impact of AI hyperscalers. We focus our attention on the heat dissipation of data centres, which is directly connected to the energy consumption required for the operations of the AI hyperscalers. We investigate, by means of a multimodal multiscale architecture, the land surface temperature change occurred as a consequence of the start of operations of the data centres. Our analysis spans over the last decades (from 2004 to 2024), taking advantage of the plethora of remotely sensed temperature measurements acquired by satellites worldwide. Our study shows a non negligible and rather remarkable impact of the AI data centres on their local regions, which is consistent across the data centres worldwide and extends for several kilometers around the AI hyperscalers. The consistency, scale and extent of these effects lead to think that the creation of local climate zones induced by data centres - that we call the *data heat island effect* - is real and significant, especially in the context of global warming and climate transformation.

Consequently, the data heat island effect could affect the welfare, healthcare, energy, and demographic systems. Since the trends of data centre energy consumption are expected to show a steep growth in the foreseeable future, the data heat island effect could solidly become an additional factor for environmental and industrial sustainability in the changing climate, hence having a robust impact on communities at local, regional, and international level, thus demanding to be studied in complex multi-hazard systems. To this aim, in this paper we provide an overview of potential solutions to alleviate the data heat island effect, which could be further expanded into mitigation policies for future climate and socioeconomic scenarios.

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## Harberry Report. Addendum #0001

**Dear Secretary of State,**

I write further to my report submitted on behalf of Gerrards Cross Town Council in relation to the *M40 SDC Data Centre Proposal*, dated 26 May 2026.

I am under an obligation to advise those instructing me immediately if, for any reason, my report requires correction or qualification. In an abundance of caution, I wish to bring to your attention a further matter relating to potential noise impacts, which I respectfully submit by way of this addendum for your consideration.

Recent research<sup>1</sup> has highlighted the potential relevance of **low-frequency infrasound** in environments associated with mechanical and infrastructure systems. Infrasound—defined as sound at frequencies below 20 Hz—can arise from sources such as ventilation systems, air conditioning, traffic, and building mechanical services, all of which are features commonly associated with large-scale data centre developments.

Emerging evidence indicates that such infrasound may have measurable effects on humans. This study found that infrasound exposure can be associated with **increased irritability, negative affective responses, and elevated stress markers (including cortisol)**, even where individuals are not consciously aware of the sound. The study concluded that infrasound may act as an environmental irritant with aversive properties.

In addition, a recent review of the scientific literature<sup>2</sup> notes that infrasound can **travel long distances with minimal attenuation and penetrate biological tissues**, with experimental evidence suggesting potential physiological and neurological effects depending on exposure characteristics such as intensity and duration.

I emphasise that I am not an expert in acoustics, infrasound, or medicine. However, given the emerging nature of this evidence and the characteristics of the proposed development, I consider it reasonable and appropriate to draw this matter to your attention. I attached both research papers.

Accordingly, I respectfully suggest that the Environmental Impact Assessment (EIA), and in particular the noise assessment, should explicitly consider the potential presence and effects of low-frequency and infrasonic sound, including appropriate measurement methodologies and assessment criteria.

Yours faithfully,

Andrew White. 26<sup>th</sup> May 2026.

**Andrew  
White** Digitally signed  
by Andrew White  
Date: 2026.05.26  
12:49:33 +01'00'

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<sup>1</sup> Infrasound exposure is linked to aversive responding, negative appraisal, and elevated salivary cortisol in humans. Scatterty, et al. *Frontiers in Behavioral Neuroscience*, 27 April 2026.

<sup>2</sup> Infrasound and Human Health: Mechanisms, Effects, and Applications. Dastan, et al. *Applied Sciences*, 3 Feb. 2026.



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# Infrasound exposure is linked to aversive responding, negative appraisal, and elevated salivary cortisol in humans

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**Introduction:** Infrasound describes sound wave frequencies below 20 Hz, which are typically imperceptible to humans. Some animals perceive and demonstrate aversion to infrasound, raising concerns about its potential adverse effects as an anthropogenic pollutant. Recent research suggests humans may also respond to infrasound, despite being below the conventional limit of human hearing. This study explored the non-auditory impact of infrasound on human mood and stress responding.

**Methods:** Participants ( $n = 36$ ) were exposed to calming or unsettling music with infrasound (~18 Hz) present or absent in a  $2 \times 2$  between-subjects design (*calming vs. unsettling, infrasound on vs. off*). Self-report measures were collected immediately post-exposure, and saliva was collected immediately pre-exposure and 20 min post-onset for cortisol assay.

**Results:** Participants did not detect infrasound above chance ( $p = 0.241$ ). Infrasound was associated with elevated salivary cortisol ( $p = 0.022$ ,  $r_{tb} = 0.390$ ) and higher self-reported irritability ( $p = 0.049$ ,  $\eta^2 = 0.096$ ), disinterest ( $p = 0.044$ ,  $\eta^2 = 0.121$ ;  $p = 0.047$ ,  $\eta^2 = 0.118$ ), and sadness appraisal ( $p = 0.002$ ,  $\eta^2 = 0.253$ ) across both music conditions, with no expectancy effects. Interest, irritability, sadness appraisal, and cortisol were also identified as important predictors of infrasound exposure via random-forest modeling.

**Discussion:** Without auditory detection nor expectancy effects, infrasound exposure was linked to elevated cortisol and more negative affective self-reporting. These findings align with previous animal studies and suggest infrasound may be aversive to humans, acting as a potential environmental irritant and contributing to more negative subjective experience.

KEYWORDS

aversion, behaviour, cortisol, ELISA, infrasound, perception, psychoacoustics, stress

## 1 Introduction

Infrasound can be defined acoustically as soundwaves with an upper frequency limit below 20 Hz (Bedard and Georges, 2000). Infrasound has been postulated to cause aversion and feelings of fear in supposedly haunted locations and to contribute to anxiety, distress, and reduced well-being in the vicinity of energy infrastructures such as wind turbines (Boczar et al., 2022; Scatterty et al., 2023; Salt and Hullar, 2010; Persinger, 2013; Burt, 1996; Chaban et al., 2021; Leventhall, 2007; Friedrich et al., 2023; Tandy and Lawrence, 1998). Infrasound also occurs naturally, generated, for example, by tectonic or volcanic activity (Hamama and Yamamoto, 2021; Watson et al., 2022; Marchetti et al., 2019), convective storms (Sindelarova et al., 2015), and air-water interactions such as during upstream water discharges (Che et al., 2023). Infrasound is also, however, prevalent in urban areas near ventilation systems, air conditioning, low-rumbling pipes, traffic and building power, heating, mechanical systems (Persinger, 2013; Burt, 1996; Butkus and Vasiliauskas, 2013; Grafkina et al., 2019; McComas et al., 2019; Wynn and Dugick, 2023; Nowicki et al., 2014). Exploratory field recordings also detected low-frequency acoustic energy in the infrasound range from similar urban sources in Edmonton (AB, Canada) as well as during musical performances (see [Supplemental materials](#)).

Animal models suggest that infrasound may alter affective state and stress responses (Scatterty et al., 2023; Salt and Hullar, 2010; Karlsen, 1992a; Karlsen, 1992b; Enger et al., 1993; Sand and Karlsen, 1986; Sand and Karlsen, 2000; Bui et al., 2013; Karlsen et al., 2004; Sand et al., 2001), however, it is unknown whether this also applies to humans, as direct behavioral, physiological, and anatomical comparisons in the context of infrasound exposure are limited and cannot yet be reliably made. Some studies indicate that infrasound can negatively affect human sleep and potentially induce feelings of fatigue, nausea, or anxiety (Persinger, 2013) as well as elevated feelings of annoyance and discomfort (Møller, 1984). However, research on the impact of infrasound on humans has been conflicting (Leventhall, 2007; Majjala et al., 2021; Mühlhans, 2017). While some investigations report little significant effect of infrasound exposure on human physiological or psychological measures (Leventhall, 2007) others have documented adverse reactions, including discomfort, anxiety, and sleep disturbances (Persinger, 2013; Møller, 1984). A likely contributor to these mixed findings is that studies tend to rely heavily on observational designs and self-report outcomes, with limited experimental control over infrasonic exposure and inconsistent reporting or validation of stimulus characteristics. Additionally, relatively few controlled studies pair verified infrasound exposure and its effects on self-reporting with established physiological markers of affective or stress-related change. Currently these factors make it difficult to determine whether infrasound can *causally* modulate affect and stress at both psychological and physiological levels under controlled conditions.

Experimental paradigms that pair verified infrasonic exposure with both self-report and physiological measures provide a direct way to test whether infrasound influences affect and stress responses in humans. In the present study, we paired the presence or absence of infrasound (~18 Hz, 75–78 dB) with music stimuli designed to be calming or unsettling and examined both self-reported affect and pre-post salivary cortisol as convergent indicators of affective and stress-related response. We hypothesized that infrasound exposure would shift self-reported affect negatively and increase cortisol relative to no-infrasound conditions, independent of music type. We further

expected that any effects would be detectable independently of participant awareness of the presence of infrasound in the room. Accordingly, we tested whether infrasound exposure heightens negative affective responses and increases salivary cortisol relative to infrasound-off controls, and whether any such effects depend on music context within the 2 × 2 factorial design. By combining verified infrasound exposure with convergent self-report and physiological outcomes, this study provides a controlled investigation of whether infrasound can modulate human affect and stress physiology under experimentally controlled conditions.

## 2 Methods and materials

### 2.1 Participants

A convenience sample of undergraduate MacEwan University students ( $n_{\text{target}} = 40$ ,  $n_{\text{total}} = 36$ ; 9 males, 27 females;  $\mu_{\text{Age}} = 23.471$ ,  $SEM = 1.231$ ,  $min = 18$ ,  $max = 36$ ; Edmonton, AB, Canada) was recruited from second and third-year psychology classes and granted 1% bonus credit toward their final class grade for participating in the study. Participants were randomly assigned to one of four groups: (i) *infrasound on + calming music*, (ii) *infrasound off + calming music*, (iii) *infrasound on + unsettling music*, and (iv) *infrasound off + unsettling music*, resulting in a 2×2 grouping structure. Participants were considered eligible for the study if they were adults (≥18 years) able to provide informed consent and complete the protocol and reported no health concerns that might reasonably confound auditory perception (e.g., hearing impairment). Participants who failed to follow pre-testing instructions upon enrollment (e.g., refraining from food, beverages other than water, and marijuana or tobacco products for at least 1 hour prior to testing) were also to be excluded. Since the sample size was small, effect sizes were also calculated and reported as they are independent of sample size limitations. Given the sample's limited size and heavy skewedness toward female participants, unbiased analyses of predictive variable importance (discussed ahead) were employed to descriptively complement significance findings. This study received ethical approval from the MacEwan University Research Ethics Board. All research was performed in accordance with relevant guidelines and regulations.

All participants provided experimental informed consent after an introduction and explanation of the study. Participants were informed that they could withdraw consent at any point and none withdrew during the study period. Testing of participants took place over 10 days (July 24, 2023—August 3, 2023) during which students were allowed to sign up for a 1-h time slot between 9 a.m. and 5 p.m. each day via the online participant recruitment system. Participants were instructed to refrain from consuming food, beverages other than water, and marijuana or tobacco products for at least 1 hour prior to the testing period. No participants reported health concerns outside of psychiatric medication, such as history of hearing impairment. Each participant was only able to participate in the study once, and credit was only granted to the student after completion of the study. A script was used for welcoming, informing, and instructing participants to ensure that each participant received the same communications, language, and contact with the attending researchers (see [Supplementary materials](#)). Condition assignment was randomized in Qualtrics and configured to maintain balanced allocation across the

available testing time slots (9 a.m.–5 p.m.) and testing days, reducing the likelihood that any single condition disproportionately occurred at a particular time of day.

### 2.2 Infrasound administration

Infrasound was generated via two out-of-sight subwoofer speakers: A 12" Pyle subwoofer oriented toward the participants from the hallway outside of the testing rooms, and a 16" Pyle subwoofer oriented toward the ceiling located in a room between the two testing rooms (Figure 1a). This two-speaker configuration was identified during initial setup and in-room validation after testing multiple configurations, as it provided stable frequency and amplitude measurements at the participant location in both testing rooms while minimizing potential non-acoustic cues (e.g., audible room resonance, mechanical artifacts) that could unblind the condition.

The testing rooms were 3.04 m apart with the 12" speaker positioned adjacent to the left testing room, and the 16" speaker

positioned 0.61 m from the left testing room and 1.52 m from the right testing room. Calming and unsettling music was played to participants via separate consumer-grade computer speakers connected to the survey computers. The infrasound speakers were each connected to PI-9598 signal generators (Pasco Scientific, Roseville, CA, United States) and participants were exposed to infrasound frequencies centered ~18 Hz collectively between the two sources. 18 Hz was selected as the infrasound stimulus based on prior animal findings showing aversive responses ~15 Hz with similar trends toward 20 Hz (Scatterty et al., 2023) in combination with testing room optimization to achieve stable, validated stimulus delivery at the participant location.

The infrasound generator was optimized so that the sine wave amplitudes and frequencies used were stable with little fluctuation and did not cause readily observable mechanical disturbances due to room resonance. Infrasound frequencies were validated in each testing room using a Spider –20 microphone with Spider EDM 6.0 software (Crystal Instruments, Santa Clara, CA, United States) and were

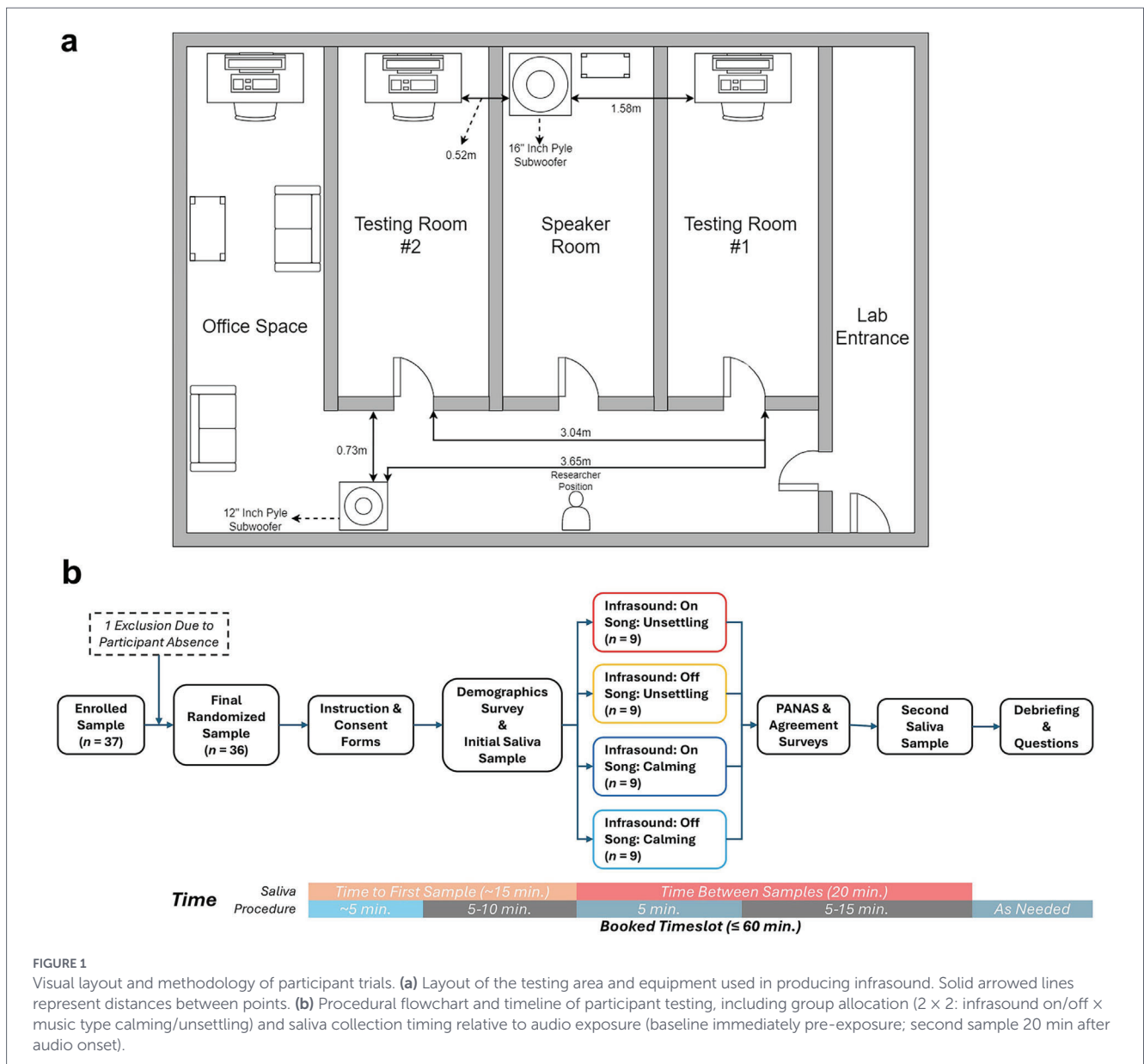


FIGURE 1

Visual layout and methodology of participant trials. (a) Layout of the testing area and equipment used in producing infrasound. Solid arrowed lines represent distances between points. (b) Procedural flowchart and timeline of participant testing, including group allocation (2 × 2: infrasound on/off × music type calming/unsettling) and saliva collection timing relative to audio exposure (baseline immediately pre-exposure; second sample 20 min after audio onset).

consistently present at an amplitude between 75–78 dB in both rooms. This amplitude range was considered safe for human exposure for the duration of the testing period<sup>1</sup>. The achieved amplitude range was also within the range of those commonly generated by mechanical energy, ventilation, and heating technologies that often lie between 70–80 dB within a distance of 100 m from the source (Salt and Hullar, 2010; Persinger, 2013; Chaban et al., 2021; Butkus and Vasiliauskas, 2013). With the infrasound generator off, a stable baseline of existing background low-frequency noise was established across both testing rooms. Turning the generator on consistently produced a distinct peak around 18 Hz that was ~35–40 dB above baseline. Corresponding FFT/spectral power visualizations comparing OFF versus ON conditions are provided in the [Supplementary materials](#) (see “Infrasound Testing Room Validation Notes”).

Ambient light and temperature conditions in each testing room were consistently maintained across days, and participants, as well as their assigned groups, were randomly distributed between rooms to control for potential undetected confounding differences.

### 2.3 Music stimuli

Participants were exposed to one of two audio clips, designed to be either *calming* or *unsettling*. These types were selected by the researchers to represent contrasting affective valence; *calming* expected to elicit typically positive responses, *unsettling* expected to elicit negative. The calming clip was instrumental and intended for meditation, whereas the unsettling clip consisted of horror-themed ambient audio intended to elicit discomfort. Clips were presented *via* consumer-grade computer speakers connected to the survey computers and were approximately 5 min in duration. Participants were randomly assigned to each music condition (*calm* vs. *unsettling*) and to concurrent infrasound exposure (*on* vs. *off*), resulting in a 2 × 2 design. The audio clips used in this study are provided in the [Supplementary materials](#).

Music was selected as an audible stimulus known to evoke affective responses in humans, providing a sensitive context for testing whether infrasound alters affective experience and evaluation of auditory stimuli, while explicitly modeling music valence in the factorial design. Choosing music types that contrasted in positive and negative valence also allowed for evaluation of whether the cortisol measure was sensitive to affective responding, should each music type elicit the expected response (increase for *unsettling*, decrease for *calming*). Music files were high-pass filtered to remove unintended low-frequency content in the infrasonic range. Similarly, the computer speakers used for music playback were not expected to produce sub-20 Hz output.

### 2.4 Self-report measures

A survey was designed and administered using the online survey platform Qualtrics (Qualtrics, 2023, Provo, Utah, United States, <https://www.qualtrics.com/>) including timed questions to ensure participants completed the testing period within the same time frame. In addition to written consent forms, participant consent was also collected within the survey. The survey included demographic and

medication status items, followed by affect and stimulus-evaluation measures described below.

#### 2.4.1 Positive and negative affect schedule (PANAS)

Participants completed a 20-item Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988) immediately following the music clip, using the standard 5-point intensity scale (“*very slightly*” to “*extremely*”) to rate how they felt at that moment. The PANAS was selected for its strong psychometric properties, including extensive validation as a measure of both baseline and experimentally altered positive and negative affect (Watson et al., 1988; de Carvalho et al., 2013; Crawford and Henry, 2004; Díaz-García et al., 2020). In addition to the standard PANAS, participants completed two brief sets of custom items designed to capture (i) affective evaluation of the music clip (14 descriptors) and (ii) self-reported description of affect during the clip (12 descriptors), each rated on a 9-point agreement scale (“*strongly disagree*” to “*strongly agree*”). The full item wording and response formats are provided in the [Supplementary materials](#).

### 2.5 ELISA cortisol assay

Cortisol is an established hormonal biomarker for stress (James et al., 2023) and is suggested to also play a role in negative affective states (Qin et al., 2016). Four Invitrogen Cortisol Competitive Human ELISA Kits were purchased from Fisher Scientific (Fisher Scientific Company, 112 Colonnade Road, Ottawa, ON) and stored in a –20 °C freezer prior to use, as per supplier recommendation. ELISA assays are commonly used to detect cortisol levels in urine, blood, feces, and saliva and have been well validated both internally by the supplier and externally by third-party studies (Invitrogen, 2018; Gholib et al., 2019; Thomsson et al., 2014; Gatti et al., 2009). All cortisol testing took place in a biological sciences laboratory at MacEwan University and analyses of samples were conducted using a Beckman Coulter DTX880 Multimode Detector (Beckman Coulter Inc., Indianapolis, IN, United States) and Multimode System Software (Version 3.3; Beckman Coulter Inc., Indianapolis, IN, USA).

All ELISA testing was carried out as outlined by the manufacturer protocol. All samples were run in duplicate; thus, two ELISA plates were required to determine the optical density of each sample. Plate 1 consisted of the “before” and “after” samples of participants 1 to 19 and Plate 2 consisted of the “before” and “after” samples of participants 20 to 36. Plates were run at an optimized dilution ratio of 1:2 and only one sample was deemed to be unfit and excluded from statistical testing due to an anomalously low cortisol concentration and markedly low viscosity consistent with water dilution (suspected to be rinse water rather than saliva). All duplicate values were checked for anomalous discrepancies and averaged when none were found.

### 2.6 Saliva collection

Participants were welcomed individually into the lab and assigned to one of two isolated testing rooms (Figure 1a). Following the consent procedure and an overview of the study, participants followed computerized instructions as the researcher relocated to an adjacent room containing the infrasound generator. At this point, the researcher learned of the infrasound condition *via* a face-down, randomized notepad and either activated the infrasound at an

<sup>1</sup> [www.cdc.gov](http://www.cdc.gov)

amplitude between 75–78 dB in both rooms or left it inactive. No further researcher-participant interaction occurred until data collection was complete. The researcher was blind to both song and infrasound condition in all interactions with the participants prior to data collection.

Each participant was exposed to a single musical stimulus. For participants in the infrasound condition, infrasound exposure lasted for a duration of 4 min and 40 s, giving the researcher time to subtly turn the infrasound on and off at the beginning and end of each ~5-min music clip. Immediately following, participants completed the modified PANAS. This assessed their current affective state, evaluation of the music, and affective experience during the music. Following the completion of the PANAS, participants were asked to indicate whether they thought the infrasound was on during the music clip. All post-exposure surveys were completed immediately after the audio clip, and participants were instructed to provide their second saliva sample 20 min after audio onset, regardless of whether the survey had been completed yet. Participants who gave their second sample mid-survey were then instructed to continue the survey until completion. A visual summary of the protocol sequence and key timing anchors, including saliva collection relative to audio onset, can be found in [Figure 1b](#).

### 2.6.1 Saliva collection

On each desk in the testing rooms, two 5 mL Eppendorf tubes were placed open and with a marked line at the 1 mL point within fields on a sheet of paper labelled “before” and “after.” Eppendorf tubes have been used in previous studies collecting saliva samples and were considered appropriate for this study ([Mohanani et al., 2019](#); [Bellagambi et al., 2020](#); [Mohamed et al., 2012](#)). Beside the tubes were two ~3-inch lengths of plastic straw, sterilized prior to testing. Small plastic cups were filled half-way with clean drinking water and placed at each desk for mouth rinsing. A point-form instruction sheet, as seen in the [Supplementary materials](#), was provided to remind participants of the collection steps and when to give samples. Prior to the survey and music clips, participants were given a demonstration of each step of the saliva collection. Participants were instructed to rinse their mouths prior to giving their samples by swishing their mouths with water and swallowing. The rinsing procedure was to be done 3 times before collection to standardize sampling and minimize potential contamination from residual food, beverages, or oral hygiene products present earlier in the day. Participants were then to spit through the straw into the Eppendorf tube and aim to fill it approximately to the marked 1 mL line. After sample collection, participants were instructed to close the Eppendorf tube securely and place it back on the desk in the corresponding “after” field. A new length of straw was used for each sample. The researcher present was to ensure that the pre-stimulus samples were given immediately prior to audio exposure and post-stimulus samples were 20 min after audio exposure. 20 min post-stimulus was determined to be an optimal time to detect changes in salivary cortisol levels ([Robert-Mercier et al., 2014](#); [Qi et al., 2016](#); [Iqbal et al., 2023](#)).

All collection tubes were pre-labelled with an anonymous participant identification number, with the letter “A” representing their first sample, and “B” representing their second sample (e.g., “12B”). Participants were informed that these numbers were only for data processing and could not be traced back to their personal information. After sample collection, the participant numbers were entered into the end of the survey by the researcher to pair self-report scores to

corresponding saliva sample. Following testing and collection, all participants were anonymous from the data.

Upon completion, all sample collection materials (cups, straws, etc.) were discarded and the testing area was sanitized with 70% ethanol. Samples were stored in a tray and transported at the end of each testing day to a –20 °C freezer for storage and later testing. Each sample was only thawed once when used for ELISA. All procedures involving the samples after initial freezing took place in the same laboratory space as the freezer in which they were stored to avoid transport-related thaw events. Researchers wore full-length laboratory coats and nitrile gloves for the duration of each testing period. Gloves were changed between each testing period to ensure sterility and avoid cross-contamination.

## 2.7 Statistical analysis

All data were analyzed using GraphPad Prism (v9.1.2; GraphPad, San Diego, CA, United States), JASP (v0.17.1; JASP Team, 2023), and R Statistical Software (v4.4.1; R Core Team, 2024). Statistical significance was set at  $\alpha = 0.05$  (95% confidence). Effect sizes and test values were reported alongside *p*-values to support transparent interpretation. Data are presented as means  $\pm$  standard error of the mean (SEM). Potential outliers were screened using ROUT (robust regression and outlier removal), which flags observations with unusually large residuals while controlling the false discovery rate. A Q value of 1 ( $Q = 1$ ) was selected, corresponding to a 1% maximum false discovery rate for outlier identification, and no outliers were detected. Normality and variance equality were verified using the D’Agostino–Pearson and Bartlett’s tests, respectively. Given the small group sizes, formal assumption tests were treated as supplementary and interpreted alongside residual diagnostics (e.g., Q–Q and residual-versus-fitted plots). Univariate and small subset analyses of variance (ANOVAs) were conducted across all independent variables. Given that final sample size could not be predetermined, *post hoc* sensitivity analyses were used (G\*Power;  $\alpha = 0.05$ ) to estimate the effect sizes detectable with 80% power for the completed design.

Optical density data were modeled in GraphPad as cortisol standard concentration versus optical density for both standards and saliva samples. A non-linear regression model was used to generate the standard curves, and sample cortisol concentrations were interpolated and adjusted by a factor of two to account for 1:2 dilution.

A chi-squared test was used to assess the relationship between self-reported and actual infrasound presence, indicating whether participants could correctly identify and thus consciously detect infrasound in their environment.

PANAS scores were analyzed using  $2 \times 2$  two-way ANOVAs testing effects of song condition (*unsettling* vs. *calming*) and infrasound exposure (*on* vs. *off*). Model assumptions were evaluated using residual diagnostics, including assessment of variance homogeneity. Main and interaction effects were investigated with Tukey’s post-hoc comparisons when appropriate. Where mean differences are reported, they reflect the first-listed level minus the second-listed level (for example, Off–On), so positive values indicate higher scores for the first-listed level. Because this item-level testing increased false-positive risk, and applying a single global multiplicity correction across many different tests could conversely inflate false-negative risk in small samples, item-level results were interpreted as descriptive signals rather than confirmatory findings and were emphasized only when supported by effect sizes and convergent patterns across related measures.

Cortisol data were analyzed using a  $2 \times 2 \times 2$  three-way ANOVA with song condition, infrasound exposure, and time (*pre-* vs. *post-stimulus*) as factors. Each PANAS score was coded numerically and entered as a scale (quasi-continuous) covariate as an exploratory adjustment to evaluate whether infrasound effects on cortisol change remained after accounting for post-exposure self-reported affect. Significant effects of infrasound on cortisol change were interpreted as physiological evidence of infrasound-elicited aversion when the estimated effect size magnitude warranted interpretive weight. Any such effects were then cross-referenced with variable importance scores (discussed ahead) to help contextualize the ANOVA results.

To check for participant-expectancy effects, a repeated-measures  $2 \times 2$  ANOVA compared participants' post-exposure self-reported belief that the infrasound was on/off against its actual presence. Significant effects of participants' reported detection of infrasound were to be interpreted as a potential participant-expectancy effect.

Finally, a conditional inference forest (CIF) was fitted via R to investigate variable importance. The CIF is a useful tool that accounts for bias toward predictors with many split points and high potential for interactions and is ideal for highly complex data with many variables and more predictors than cases (e.g., in datasets with self-report data from lower sample sizes, relative to the number of predictors) (Levshina, 2020). The results from the CIF provide unbiased importance scores of each predictor which are used to investigate the relationships between the considered variables and the presence of infrasound and cortisol change. R code for this model can be found in the [Supplementary materials](#).

Analyses were structured around two primary outcomes with different measurement structures. The post-exposure self-report outcomes (PANAS and related items) were analyzed as between-subject outcomes in the  $2 \times 2$  design. In contrast, pre and post-exposure salivary cortisol levels were analyzed with time as a within-participant factor alongside the between-subject factors (music condition and infrasound exposure). Exploratory follow-up analyses (e.g., item-level patterns and descriptive variable-importance summaries) were interpreted cautiously and were not treated as confirmatory evidence. This approach was used alongside effect size reporting to provide additional context when interpreting results across multiple, non-matched comparisons. Findings of interest therefore centered on results that reached statistical significance, showed stronger effect sizes, and were consistent across related analyses. Variable-importance scores were also considered descriptively to help contextualize patterns in the data and explore whether variables of interest also ranked highly in predictive importance. These scores were not treated as a substitute for inferential testing or as any form of multiple-comparisons correction; rather, they were considered as one complementary signal alongside *p*-values, effect sizes, and consistency across related measures when prioritizing which patterns warranted discussion. Effect sizes were interpreted as small ( $f \geq 0.10$ ;  $\eta^2 \geq 0.01$ ), moderate ( $f \geq 0.25$ ;  $\eta^2 \geq 0.06$ ), or large ( $f \geq 0.40$ ;  $\eta^2 \geq 0.14$ ).

### 3 Results

We found that participants in the infrasound-on condition reported higher irritation, lower interest, and rated the stimulus as sadder than those in the infrasound-off condition. Infrasound also raised salivary cortisol levels, both independently and in conjunction

with irritation and discomfort. These self-report differences and cortisol changes were not influenced by music type nor self-reported perception of the presence of infrasound. Final sample sizes amounted to  $n = 9$  participants per group ( $n_{\text{total}} = 36$ ; 9 males, 27 females;  $\mu_{\text{Age}} = 23.471$  y/o,  $SEM = 1.231$ ,  $min. = 18$  y/o,  $max = 36$  y/o). One participant was excluded due to poor saliva sample quality, resulting in  $n_{\text{total}} = 35$ . All referenced tables can be found at the end of this article and in the [Supplementary materials](#).

Sensitivity analyses indicated that with  $N = 36$ , the study had 80% power to detect large between-subject effects (Cohen's  $f \approx 0.6$ ;  $\eta^2 \approx 0.28$ ) and moderate to large within-between interaction effects in the pre-post model ( $f \approx 0.23$ – $0.35$ ;  $\eta^2 \approx 0.05$ – $0.11$ ), while smaller effects would be expected to have reduced power and should be interpreted with caution.

#### 3.1 Participant detection of infrasound

In evaluating the ability of participants to accurately report the detection of infrasound, a Chi-squared independence test between the participant's reported detection and infrasound returned a *p*-value that was greater than the conventional 5% criterion (Figure 2a;  $p = 0.2406$ ). This suggests that differences in participant responses to infrasound cannot be explained by accurate self-reported perception of the presence of infrasound.

#### 3.2 Affective self-report scores

Self-reported scores were evaluated first at the general scale level and then by item. When evaluating general PANAS scores alone, between-condition differences were observed in overall positive and negative affect for post-exposure ratings referring to how participants felt *during* and *after* the audio clip, as well as in ratings of the affective characteristics of the music itself (Supplementary Figure S1; Supplementary Tables S1–S3). Though not significant, these trends in differential affective reporting between infrasound conditions prompted closer investigation for item-level differences in the affective variables themselves.

A moderate-to-large main effect of infrasound was found on self-reported interest after exposure (Figure 2b, Table 1;  $F(1, 31) = 4.410$ ,  $p = 0.044$ ,  $\eta^2 = 0.121$ ). Participants in the infrasound-on condition reported lower interest than participants in the infrasound-off condition. No further effects were found on all other variables reporting how participants felt after stimulus exposure (Supplementary Figures 2a–g;  $p > 0.05$ ).

For participant description of the music, there was a moderate-to-large main effect of infrasound on whether participants found the music interesting (Figure 2c, Table 1;  $F(1, 31) = 4.290$ ,  $p = 0.047$ ,  $\eta^2 = 0.118$ ) in which participants reported finding the music less interesting when the infrasound was on. Participants also showed a large main effect of infrasound on whether they found the music sad (Figure 2d, Table 1;  $F(1, 31) = 11.078$ ,  $p = 0.002$ ,  $\eta^2 = 0.253$ ) when the infrasound was on. No further effects were found on all other variables reporting how participants described the music (Supplementary Figures S3a–f;  $p > 0.05$ ).

A main effect of infrasound on self-reported irritability was observed (Figure 2e, Table 1;  $F(1, 31) = 4.176$ ,  $p = 0.049$ ,  $\eta^2 = 0.096$ ), indicating an increase in irritability levels among participants during infrasound exposure to the music clip. Analysis of other emotional responses during the music exposure revealed

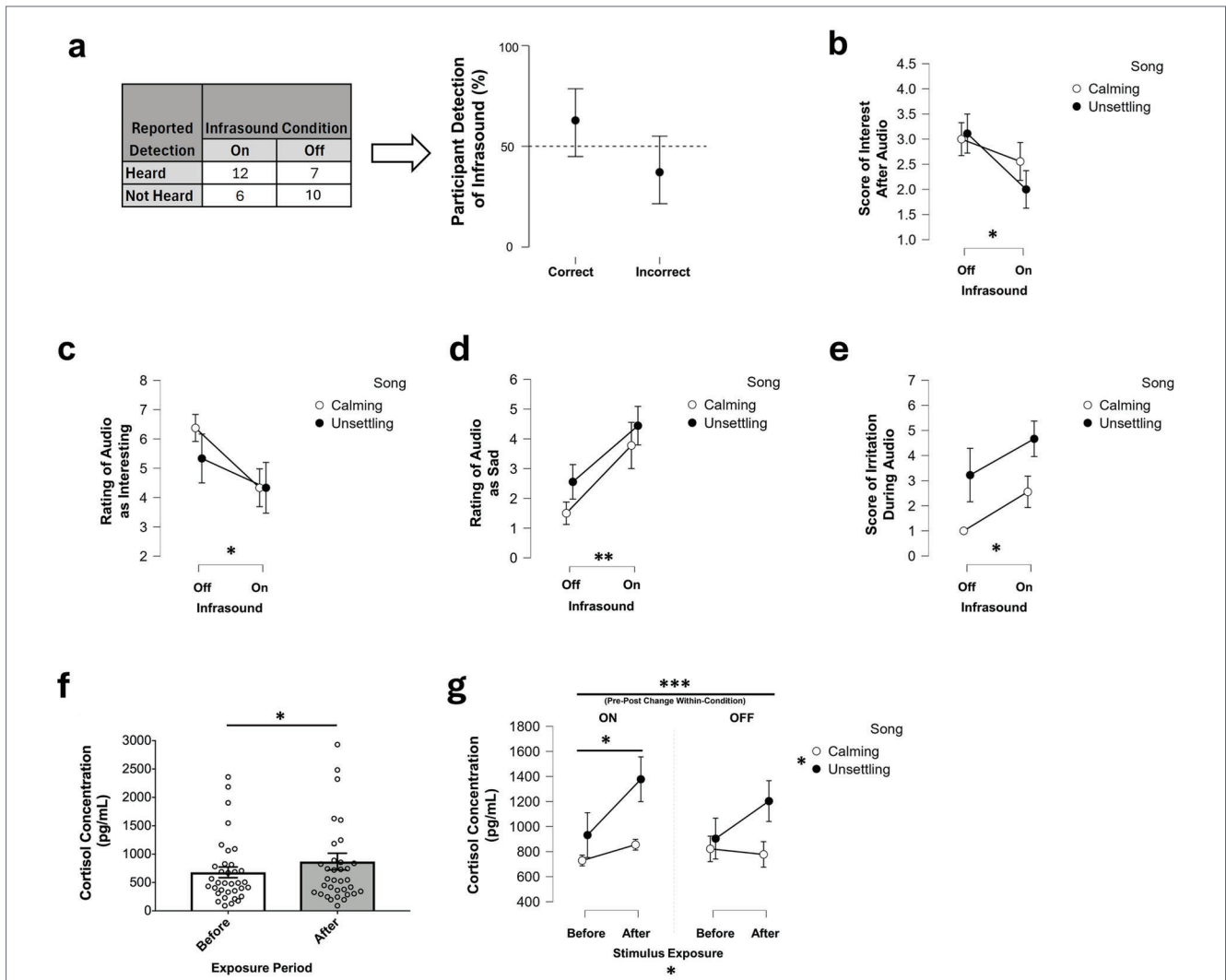


FIGURE 2

Self-report and hormonal effects of infrasound exposure. (a) Accuracy of identifying infrasound during music. (b–e) Self-reported interest, music rated as interesting/sad, and irritation by song and infrasound. (f) Cortisol change before vs. after exposure. (g) Descriptive visualization of cortisol concentration before vs. after stimulus exposure, by song and infrasound condition; effects shown are derived from the full factorial model and *post hoc* tests (stimulus exposure:  $p = 0.031$ ,  $\eta^2 = 0.142$ ; song:  $p = 0.019$ ,  $\eta^2 = 0.084$ ; infrasound on:  $p_{\text{bonf}} = 0.045$ ;  $d = 0.710$ ; within-condition pre–post:  $p_{\text{bonf}} < 0.001$ ,  $d = 0.347$ ). Black/white dots show group means  $\pm$  SEM. Lines connect condition means across infrasound levels within each song condition (not within-participant trajectories); error bars denote SEM and may be absent when SEM = 0. \* $p < 0.05$ , \*\*\* $p < 0.001$ .

TABLE 1 Summary of effects of infrasound on self-reported affective variables.

Self-report variable	Direction	F	df	$p (< 0.05)$	$\eta^2$	Importance ( $\mu > 0.002$ )
Interest after exposure	↓	4.410	(1,31)	0.044*	0.121	0.004
Music rated as interesting	↓	4.290	(1,31)	0.047*	0.118	0.006
Music rated as sad	↑	11.078	(1,31)	0.002**	0.253	0.019
Irritability during exposure	↑	4.176	(1,31)	0.049*	0.096	0.008

Directional arrows represent elevation or reduction in reporting. F corresponds to the test statistic yielded by  $2 \times 2$  two-way ANOVA.  $\eta^2$  (eta-squared) denotes effect size. Importance reflects mean variable-importance scores from the conditional inference forest; values  $> 0.002$  exceeded the minimum importance threshold used to identify informative predictors of infrasound exposure. Full outputs for each effect can be seen in the Supplementary Tables S10–S13. \* $p < 0.05$ , \*\* $p < 0.01$ .

no additional effects (Supplementary Figures S4a–f;  $p < 0.05$ ), indicating that the observed infrasound effect may be specific to irritability without a broader impact on participant emotional states.

### 3.3 Cortisol levels

Irrespective of self-reported affective scores, cortisol concentrations were higher post than pre-exposure in the infrasound-on

condition (Figure 2f;  $W(35) = 192, p = 0.022, r_{rb} = 0.390$ ) demonstrating an increase in cortisol after stimulus exposure. However, exploratory covariate-adjusted analyses indicated that infrasound-related cortisol change effects persisted after accounting for post-exposure self-reported affect. These covariate models were included as a robustness check, not as confirmatory tests of higher-order interactions.

Assumptions of normality and homoscedasticity were met for group self-report scores and cortisol levels, and a Three-Way ANOVA model (calm vs. unsettling, infrasound on vs. off, before vs. after cortisol level) with the PANAS variables as covariates was considered suitable for the data. After the music clip, feeling upset had a large main effect on cortisol change (Supplementary Table S4;  $F(1, 30) = 10.413, p = 0.003, \eta^2 = 0.215$ ) and feeling guilty had a small interaction effect with stimulus exposure on cortisol change (Supplementary Table S5;  $F(1, 31) = 4.772, p = 0.037, \eta^2 = 0.014$ ), though both results were expected. Interestingly, infrasound had a main effect on cortisol change even when accounting for significant feelings of irritability (Table 2;  $F(1, 31) = 4.557, p = 0.041, \eta^2 = 0.106$ ), as well as a moderate main effect on cortisol change when accounting for feelings of fear (Table 2;  $F(1, 31) = 4.229, p = 0.049, \eta^2 = 0.093$ ). All other effects of infrasound on cortisol change accounting for self-report scores after the music clip were not significant (Supplementary Table S6).

During the music clip, infrasound had a large main effect on cortisol change when accounting for reported scores of feeling bad (Table 2;  $F(1, 31) = 6.612, p = 0.015, \eta^2 = 0.125$ ) as well as another large effect on cortisol change when accounting for reported scores of feeling irritated (Table 2;  $F(1, 31) = 5.609, p = 0.025, \eta^2 = 0.125$ ). All

other effects on cortisol change accounting for self-report scores during the music clip were not considerable (Supplementary Table S7).

No significant effects were found on cortisol change when accounting for self-reported scores on emotive description of the music clip (Supplementary Table S8).

Within the full unadjusted factorial model (i.e., without self-report covariates), cortisol levels demonstrated a main effect of stimulus exposure (before vs. after;  $p = 0.031, \eta^2 = 0.142$ ) and a main effect of song (calming vs. unsettling;  $p = 0.019, \eta^2 = 0.084$ ), and Bonferroni-adjusted post hoc tests indicated significant between-group cortisol changes in the infrasound condition ( $p_{bonf} = 0.045; d = 0.710$ ) and within-condition pre-post cortisol changes in both conditions ( $p_{bonf} < 0.001; d = 0.347$ ). A visualization of these interactions between music and infrasound conditions can be seen in Figure 2g; inferential conclusions are based on the full factorial model and are interpreted in conjunction with both statistical significance and effect sizes for magnitude.

### 3.4 Participant-expectancy effects

When evaluating for potential expectancy effects on cortisol change brought about by participant expectations that infrasound was present, it was found that there was no main effect of participants' self-reports (Supplementary Figure S5; Supplementary Table S9;  $F(1, 31) = 0.019, p = 0.891, \eta^2 < 0.001$ ) nor an interaction effect with the actual presence of infrasound ( $F(1, 31) = 0.166, p = 0.687, \eta^2 = 0.005$ ) on cortisol change. This suggests that participants did not show

TABLE 2 Summary of infrasound-related effects on salivary cortisol across covariate-adjusted and unadjusted models.

Self-report covariate	Effect on cortisol	F	df	p (< 0.05)	$\eta^2$	Importance ( $\mu > 0.002$ )
Irritability after exposure	↑	4.557	(1,31)	0.041*	0.106	< 0.002
Afraid after exposure	↑	4.229	(1,31)	0.049*	0.093	< 0.002
Bad during exposure	↑	6.612	(1,31)	0.015*	0.125	< 0.002
Irritated during exposure	↑	5.609	(1,31)	0.025*	0.125	0.008

Unadjusted effects	Effect level	Contrast	Effect on cortisol	Inference	p (< 0.05)	$\eta^2$
Stimulus exposure	Main	Before vs. After	↑	Increase over time	0.031*	0.142
Song	Main	Calming vs. unsettling	↑ (calming) ↓ (unsettling)	Parallels song affective valence	0.019*	0.084

Post-hoc comparison	Corrected	Contrast	Effect on cortisol	Inference	$P_{bonf}$ (< 0.05)	d
Infrasound by calming vs. unsettling	Bonferroni	Infrasound/calming vs. infrasound/unsettling	↑ (calming) ↓ (unsettling)	Higher cortisol across both song types post-exposure	0.045*	0.710
Infrasound by before vs. after exposure	Bonferroni	Infrasound/before vs. infrasound/after	↑	Increased cortisol from pre-post within each infrasound condition	< 0.001***	0.347

Directional arrows represent elevation or reduction in cortisol levels associated with the listed factor or contrast. For covariate rows, F, df, p, and  $\eta^2$  summarize the infrasound effect on cortisol after adjusting for the listed self-report covariate. Importance reflects mean variable-importance scores from the conditional inference forest; values > 0.002 exceeded the minimum importance threshold used to identify informative predictors of infrasound exposure. Post-hoc p values are Bonferroni-corrected. Full outputs for covariate-adjusted effects can be seen in the Supplementary Tables S14–S17. \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001.

elevations in cortisol levels due to preconceptions that there was infrasound present.

### 3.5 Investigating variable importance via conditional inference forests

A conditional inference forest (CIF) was implemented to investigate variable importance with respect to the presence of infrasound. In this analysis, a CIF containing 500 trees was fitted to 25 random permutations of the variables of interest. After averaging importance scores, an absolute minimum of the mean importance scores was calculated at  $\mu = 0.002$ . Notably, participant descriptions of the music as sad ( $\mu = 0.019$ ,  $SD = 0.002$ ), cortisol levels after the audio exposure ( $\mu = 0.012$ ,  $SD = 0.003$ ), irritation during the music ( $\mu = 0.008$ ,  $SD = 0.002$ ), description of the music as interesting ( $\mu = 0.006$ ,  $SD = 0.002$ ), feeling upset during the music ( $\mu = 0.006$ ,  $SD = 0.002$ ), feelings of interest after exposure ( $\mu = 0.004$ ,  $SD = 0.002$ ), and feelings of alertness ( $\mu = 0.003$ ,  $SD = 0.002$ ) were the only variables with average importance score above  $\mu = 0.002$ . These results can be seen in Figure 3.

A second CIF was fitted to assess variable importance with respect to cortisol change. Following the procedure outlined for infrasound, we calculated the absolute minimum of the mean importance score to be  $\mu = 0.002$ . Notably, the presence of infrasound returned an average importance score ( $\mu = 0.06$ ,  $SD = 0.01$ ) above  $\mu = 0.002$ . [Supplementary Figure S6](#) of the supplemental materials displays the results from this CIF which shows that the distributions of variable importance score for both infrasound and cortisol change are similar.

## 4 Discussion

### 4.1 Infrasound elicits negative affective and physiological responses

In line with our primary aims, infrasound exposure was associated with more negative self-reported responses and increased salivary cortisol. These findings are interpreted in context of the post-exposure self-report and pre-post cortisol designs. Participants in the

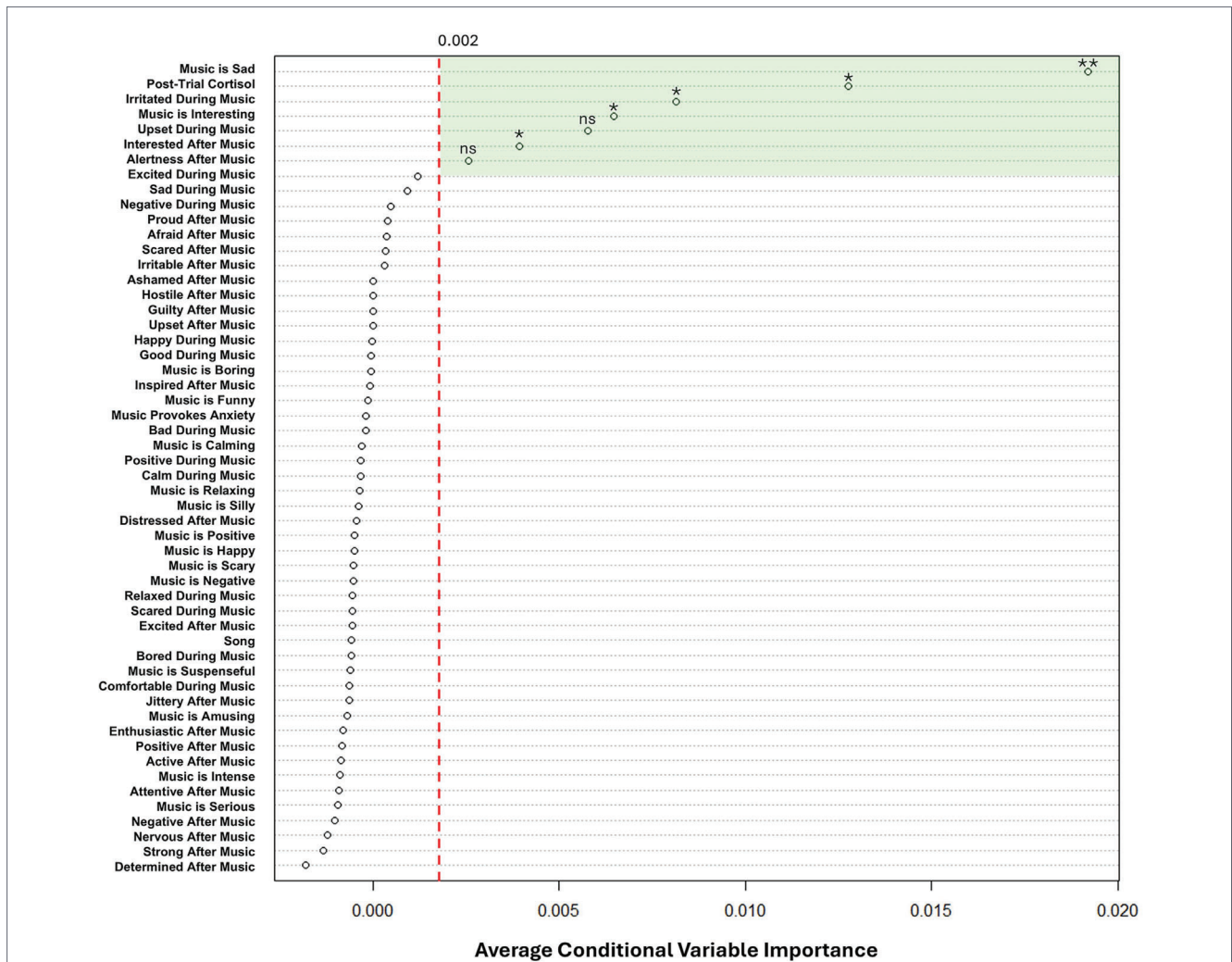


FIGURE 3

Exploratory importance rankings of variables as predictors of the presence of infrasound via a conditional inference forest (CIF). Conditional variable importance scores from a conditional inference forest (25 trials). X axis: Study variables; Y axis: Conditional importance. Red dashed line = minimum importance threshold (>0.002). Variables both significant and important were considered for interpretation; variables above threshold but not significant indicate likely interaction. Significance values are from univariate tests, not the CIF. ns, Not significant, \* $p < 0.05$ , \*\* $p < 0.01$ .

*infrasound-on* condition reported more negative post-exposure affect than those in the *infrasound-off* condition, across music conditions. Self-report measures showed that infrasound decreased interest in the music, increased irritation during listening, and increased descriptions of the music as sad across both conditions. Self-report scores also validated that calming music increased positive affect and unsettling music increased negative affect, irrespective of infrasound. Infrasound elevated cortisol levels in participants who reported greater feelings of guilt and upset while showing similar effects independent of feeling bad and irritated. This suggests that although the *infrasound-on* condition was associated with more negative post-exposure affect (particularly higher disinterest and irritation), cortisol levels increased even when accounting for heightened negative mood states. This highlights both subjective and physiological evidence of infrasound-elicited negative affect and aversion. Importantly, no noteworthy effects of infrasound were found on measures of positive affect and CIF results were broadly consistent with the significance findings, where levels of cortisol, sadness, irritation, and interest were important predictors. These findings appear to support previous studies suggesting that infrasound may increase negative affect and evoke aversive responses in humans.

## 4.2 Absence of conscious detection and expectancy effects

Participants appeared to be no better than chance at identifying the presence of infrasound, and whether the participants' thought infrasound was present or not was found to score low as a predictor of the presence of infrasound. In addition to this, participant expectations of the presence of infrasound did not show a statistically detectable association with cortisol level change. This indicates that emotional and physiological changes were unlikely to be explained by conscious audition or participant-expectancy effects. Such findings support prior research indicating that although humans may not typically audibly detect infrasonic frequencies (i.e., below ~20 Hz) (Bedard and Georges, 2000; Møller and Pedersen, 2004), the presence of infrasound may still impact emotional states or behavioral responses (Persinger, 2013; Leventhall, 2007; Møller and Pedersen, 2004). Participants who were exposed to infrasound reported feeling less interest and described the music clip itself as less interesting and more sad than those who were not. Coupled with increased irritability during the music clip with infrasound on, these findings suggest that infrasound may be aversive to humans and may negatively impact mood.

## 4.3 Infrasound evokes irritability and annoyance rather than anxiety

Interestingly, increases in self-reported anxiety were not detected, despite common suggestions that infrasound may be anxiogenic. Heightened irritability, however, without an increase in anxiety-related variables parallels previous research suggesting that infrasound intensifies annoyance (Persinger, 2013; Møller, 1984) rather than anxiety (Scatterty et al., 2023). Animal models have been used to study the adverse affective impact of infrasound on behaviour, with some fish species exhibiting aversive responses to infrasound (Scatterty et al., 2023; Karlsen, 1992a; Karlsen, 1992b; Enger et al., 1993; Sand and Karlsen, 1986; Sand and Karlsen, 2000; Bui et al., 2013; Karlsen et al., 2004; Sand et al., 2001) that can commonly be interpreted as anxiety-like or fear-like

behaviors. These aversive effects were found at amplitudes and frequencies similar to those that might be experienced when in the vicinity of human infrastructures (Salt and Hullar, 2010; Persinger, 2013; Butkus and Vasiliauskas, 2013) and those used in this study. For example (Scatterty et al., 2023), found that 15 Hz infrasound triggered aversive behavioral responses in wild-type zebrafish (*Danio rerio*) during a controlled open field test. In these fish studies, animals detected infrasound via the otolithic organs. While humans perceive auditory stimuli instead via cochlear transduction, otoliths are still present and responsible for similar vestibular senses, suggesting that infrasound may be detected through sub-auditory perception (Salt and Hullar, 2010; Karlsen, 1992b; Enger et al., 1993; Sand and Karlsen, 2000). It is possible that terrestrial vertebrates (e.g., humans) retained infrasonic perception through the otoliths as a non-auditory sense, while audition migrated to the cochlea over time. Furthermore, the extensive connectivity between the vestibular system and the limbic system in humans offers potential insights as to how vestibular sensation influences emotional responses (Rajagopalan et al., 2017; Neumann et al., 2023; Uno et al., 2006).

## 4.4 Relationship between irritation, cortisol, and aversion

The alterations in cortisol further strengthen the connection between infrasound exposure and human aversion. Cortisol was interpreted as a valence-nonspecific index of stress-related arousal, while self-report measures were used to provide affective context for interpreting the direction of experience. Infrasound increased cortisol levels even when accounting for the heightened feelings of irritability already found in the self-report measures. Infrasound likewise increased cortisol when accounting for feelings of fear and discomfort (feeling "bad"). Marginal evidence was also noted in that infrasound may have detrimental effects on levels of excitement and sadness as well. These results agree with previous findings that infrasound elicits annoyance both behaviorally and physiologically (Persinger, 2013; Møller, 1984). Interestingly, perception of the music as 'sad' was both the most significant and most important predictor of the presence of infrasound and second most important predictor of cortisol change. This could be interpreted as an affective component that complements the effects on irritation and disinterest, expressed as resulting emotional discomfort that negatively impacts mood.

The negatively affective element to the apparent irritant effects of infrasound further raises concerns about what effects more prolonged exposure could have on emotional well-being over time. These findings were independent of any interaction with the passage of time (*before vs. after*), demonstrating that infrasound had such effects regardless of any innate cortisol increase occurring over the trial period (i.e., participants becoming frustrated with the length of the experiment). Importantly, the effects of infrasound condition (*on vs. off*) on cortisol were observed across both music conditions, indicating that this pattern was also not likely driven by or confounded with music type. Prior room validation further suggests it is unlikely that uncontrolled background infrasound differences account for these findings.

## 4.5 Limitations and directions for future research

The patterns of irritation and disinterest seen in this study, interpreted as an involuntary aversive reaction, correspond to the avoidance responses observed in zebrafish by Scatterty et al. (2023),

demonstrating infrasound-elicited aversion. To further explore this finding, future studies could investigate the irritant and aversive effects of infrasound using tests specifically designed to detect differences and changes in each, such as the Brief Irritability Test (Holtzman et al., 2015) or the Multiple-Item Annoyance Scale (Schreckenberget al., 2018). This study also only exposed participants to a condition where infrasound was either present or absent and relied heavily on post-exposure self-report measures to indicate emotional affective responses. To strengthen the evidence of the irritant and aversive properties of infrasound behaviorally, future studies could employ a forced-choice task where participants choose between audio stimuli with or without infrasound. This would assess whether participants prefer to avoid stimuli containing infrasound frequencies. Similarly, PANAS data were only collected after exposure without a baseline for comparison, making within-subjects verification of self-reported affective change difficult to quantify or verify. Accordingly, PANAS findings should be interpreted as post-exposure differences between randomized conditions. A pre-exposure PANAS may also introduce priming or expectancy effects by cueing participants to monitor specific emotions during the subsequent infrasound exposure, and therefore this limitation may simply present as a trade-off in design between experimental control and baseline comparison.

Regarding frequency, only one target was used (~18 Hz) based on previous findings in zebrafish (Scatterty et al., 2023), stimulus validation, and room optimization. While this target was deemed appropriate for this study, future studies should explore whether similar or null effects can be observed in a range of frequency targets above or below ~18 Hz. The modest sample size and use of a convenience sample of young adult undergraduate students limit generalizability to other age groups and populations. While randomization across conditions in our between-subject design helped reduce the likelihood of individual differences in hearing ability and listening behaviour, future studies should replicate these findings in larger and more diverse samples. Given that the sample was predominantly female, menstrual cycle phase and hormonal contraceptive use represent unmeasured sources of variability that may influence cortisol concentrations and physiological or emotional responsiveness. These variables were not recorded in the present study and should be assessed or considered in future work where feasible.

Importantly, Figure 2f illustrates that music clips without infrasound present yielded the expected effects of calming music, reducing cortisol levels and unsettling music raising cortisol levels. Equally notable was the reversal of the calming music effect and the intensification of response to the unsettling music when infrasound was on. These findings also illustrated that the timing between initial and post-stimulus samples was sensitive enough to detect changes in cortisol levels (Figure 2f). Future studies will validate these findings by analyzing blood or urine samples to confirm salivary measures of cortisol change due to infrasound exposure with stimulus duration and sample collection times adjusted according to the physiology of each method. Although condition assignment was balanced across the testing window and cortisol was assessed using within-participant pre-post change, salivary cortisol reflects a latent physiological response and therefore the pre-exposure sample should not be interpreted as a purely instantaneous baseline. Future studies may further reduce potential for time-of-day effects by restricting sessions to narrower time windows or explicitly modeling specific diurnal time points. Future studies will also revisit animal models, leveraging salivary cortisol as a biomarker for infrasound-elicited irritation, to validate

previous findings and strengthen the results of this study. This will include returning to the zebrafish model of infrasound-elicited aversion by Scatterty et al. (2023), assessing replicate animals for cortisol level changes in skin mucus (Carbajal et al., 2019; Kulczykowska, 2019; Franco-Martinez et al., 2022), holding-water concentrations (Félix et al., 2013; Midttun et al., 2022), blood plasma (Sadoul and Geffroy, 2019), or whole-body sampling (Philippe et al., 2023; Ramsay et al., 2009). Replicate experiments using mammalian animal models (e.g., rodents) will also be considered to establish generalizability. Lastly, the evaluation of expectancy effects on cortisol change in this study only assessed participant reports on whether they believed the infrasound was on or off without accounting for how strongly they felt about their answers. A future study may further investigate the effects of participant expectation by informing a participant that the infrasound is on and evaluating their self-report and physiological responses regardless of whether the infrasound is truly on or not.

## 4.6 Conclusion

Overall, this study used a combination of self-report and biological measures to demonstrate that infrasound can have irritant, and aversive properties on humans. Similarly, infrasound appears to influence increases in negative affective evaluation. No evidence was detected in this sample suggesting that infrasound is anxiogenic or elicits positive affect during exposure to positive stimuli, implying that infrasound is associated with negatively affective states and not a general increase in arousal. Considering the prevalence of infrasound in and around human habitats, these findings emphasize the potential value of identifying and mitigating sources of infrasound pollution within our environments.

## Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding authors.

## Ethics statement

The studies involving humans were approved by MacEwan University Research Ethics Board. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

KS: Conceptualization, Formal analysis, Writing – review & editing, Methodology, Investigation, Writing – original draft. DV: Investigation, Writing – review & editing, Writing – original draft. LP: Conceptualization, Writing – review & editing, Methodology. BF: Formal analysis, Writing – original draft, Writing – review & editing. TH: Resources, Conceptualization, Writing – review & editing.

Funding acquisition, Writing – original draft. RS: Writing – original draft, Methodology, Conceptualization, Funding acquisition, Resources, Formal analysis, Writing – review & editing, Supervision, Project administration.

The author(s) TH declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

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## Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fnbeh.2026.1729876/full#supplementary-material>

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Review

# Infrasound and Human Health: Mechanisms, Effects, and Applications

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## Featured Application

This review contributes to assessing the health risks associated with occupational exposure to environmental infrasound by linking sound attributes to specific microvascular and cellular mechanisms. It also describes the opportunities provided by low-intensity infrasound, under carefully regulated conditions, for use as a non-invasive biomedical instrument for tissue engineering and therapeutic intervention.

## Abstract

Infrasound, physically defined as sound at frequencies below 20 Hertz, can travel long distances with minimal attenuation and permeate biological tissues due to its marked particle displacement and deep penetration. Generated by both natural phenomena and human-made systems, infrasound has drawn increasing scientific and public attention regarding its potential physiological and psychological effects. Experimental studies demonstrate that infrasound can modulate mechanosensitive structures at the cellular level, particularly pressure-sensitive ion channels such as PIEZO1 and TRPV4, leading to intracellular calcium influx, oxidative stress, altered intercellular communication, and in some settings, apoptosis. These responses vary according to sound pressure levels, frequencies, exposure duration, and tissue type. In the cardiovascular system, higher sound pressures have been associated with mitochondrial injury and fibrosis, whereas low sound pressures may exert context-dependent protective effects. In animal models, prolonged or intense exposure to infrasound has been shown to induce neuroinflammatory responses and memory impairment. Short-term studies in humans at moderate intensities have reported minimal physiological changes, with psychological and contextual factors influencing symptom perception. Occupational environments such as factories and agricultural settings may contain elevated levels of infrasound, underscoring the importance of systematic measurements and exposure assessments. At the same time, controlled infrasound stimulation has shown potential as an adjunct modality in bone repair and tissue regeneration, highlighting its dual capacity as both a biological stressor and a possible therapeutic tool. Overall, existing data indicate that infrasound may be harmful at chronic exposure depending on intensity and frequency, yet beneficial when precisely regulated. Future research should standardize exposure metrics, refine measurement technologies, and clarify dose–response relationships to better define the health risks and therapeutic applications of infrasound.

**Keywords:** infrasound; mechanotransduction; PIEZO1; TRPV4; inflammation



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## 1. Introduction

Sound consists of rhythmic fluctuations in air pressure superimposed against a constant atmospheric background [1]. These oscillations vary in frequency, forming the sound's spectral composition. Complex non-sinusoidal acoustic patterns predominate in the environment; they lead to several-integer multiples of the determined fundamental frequency, the so-called harmonics.

When sufficiently intense, sound can be perceived as noise or felt as vibration [2]. Although sound intensity depends on the amplitude of pressure variations, particle displacement—the movement of air particles—increases as frequency decreases, meaning low-frequency waves induce more pronounced mechanical movement than high-frequency waves of equal pressure [1,2].

Infrasound is sound with frequencies below the range of human hearing. Complex acoustic and electromagnetic patterns can mediate information at the cellular level, even at very low intensity. Frequencies below 10 Hz are considered to have particularly high information content. However, the information content of a spectrum depends on all characteristics, including, of course, the duration or time of occurrence [3,4]. It can be generated from natural sources such as wind, volcanoes, avalanches, and earthquakes. It can also be generated by man-made sources, e.g., wind turbines, diesel engines, and ventilation systems. Among man-made sources, wind turbine-generated infrasound is distinctive for its rhythmic, repetitive pattern, setting it apart from most other environmental low-frequency sources and drawing particular attention in both public discourse and scientific investigation.

To understand the effects of infrasound on biological mechanisms and its public health relevance, we review and summarize the current knowledge of infrasound's physiological and psychological impacts, discuss associated risks and therapeutic applications, and identify remaining research gaps. This manuscript employs several definitions. Primarily, we discuss frequency. We explain frequency in terms of infrasound, which is defined as sound below 20 Hz in humans [3]. Furthermore, we discuss the term amplitude. This refers to the change in the value of a measure, specifically, in this case, changes in pressure. Additionally, we discuss sound pressure. Sound pressure is a measurement of the change in the pressure of the air around the space where a sound is being produced. Finally, we measure sound intensity. Sound intensity is a measure of the energy per unit volume in a given space caused by sound. Sound intensity is proportional to the pressure of sound in that field.

We conducted a focused literature search across PubMed, Scopus, Web of Science, and Google Scholar to identify peer-reviewed studies on infrasound and its health outcomes. We used a combination of keywords, including infrasound, low-frequency noise, wind turbine, sound pressure level (SPL), mechanotransduction, PIEZO1, TRPV4, microcirculation, cardiovascular, neuroinflammation, cognition/memory, and occupational exposure. We screened titles and abstracts for relevance and selected eligible articles based on the following criteria: a clear characterization of the exposure (frequency, SPL/weighting, and duration); the reporting of outcomes from *in vitro*, animal, or human studies; and endpoints that are mechanistic, clinical, or occupationally relevant. Additionally, we conducted backward and forward citation searches of key papers and recent reviews to identify foundational and influential studies omitted from the initial database search.

## 2. Cellular and Molecular Responses

In biological tissues, infrasound propagates as longitudinal mechanical waves shaped by tissue density and elasticity. Because it undergoes minimal attenuation, infrasound can penetrate deeply and may produce resonance when its frequency aligns with that of

specific organs or tissues [4]. In resonance, the absolute strength of the stimulus is less important than the alignment of its frequency with the system's intrinsic vibrations. Even weak stimuli, when temporally and spatially synchronized, can significantly affect system stability. The human body, as an energetic organism, is comparable to an oscillator with a complex waveform, in which different organs have distinct resonance solutions [5].

Resonance can intensify mechanical strain, promoting tissue deformation, mechanotransduction, and, under sustained exposure, structural or functional damage. Modeling studies indicate that tissues with distinct acoustic impedances exhibit different resonance responses, with certain frequencies enhancing energy absorption and localized effects [6,7].

In order to maintain the integrity of cells and tissues in organisms in terms of structure, function, and communication, the unimpeded transmission of mechanical forces into biological and biochemical information is one of the most important fundamentals. At the cellular level, mechanical oscillations such as infrasound activate mechanosensitive ion channels, e.g., PIEZO1, TRPV4, and Connexin 43 (Cx43) hemichannels, by inducing membrane tension or substrate deformation [6]. These channels open to cation influx (mainly  $\text{Ca}^{2+}$ ), initiating signaling cascades that modulate proliferation, differentiation, and apoptosis [6]. PIEZO1 efficiently transduces low-frequency stimuli within the 0.5–50 Hz range, including infrasound [7]. TRPV4 is robustly activated around 16 Hz, particularly in glial cells [8,9]. Finally, Cx43 hemichannels, downstream of PIEZO1 or TRPV4, mediate ATP and glutamate release, sustaining intercellular communication [10]. Crosstalk among these channels forms a coordinated mechanosensitive network through which infrasound can influence tissue physiology and cellular homeostasis.

It is important to remember the dual nature of PIEZO channels in their context. PIEZO channels often participate in pro-inflammatory signaling, but, depending on the environment, they can also promote anti-inflammatory or homeostatic effects, mainly influenced by mechanical factors. For example, in endothelial cells, activation of PIEZO channels by laminar shear stress helps maintain vascular integrity. Conversely, when oscillatory forces dominate, pro-inflammatory responses tend to prevail, weakening vascular integrity and immune regulation [11].

At the cellular level, the effects of infrasound can influence multiple pathways, including proliferation, apoptosis, and intracellular signaling. For instance, studies on rat bone marrow mesenchymal stem cells (BMSCs) demonstrated that infrasound enhances proliferation and inhibits apoptosis, effects mediated in part through activation of the Notch signaling pathway and upregulation of the survival of a key anti-apoptotic protein [12,13]. In parallel, neuronal studies revealed that infrasound exposure induces oxidative stress and apoptosis in the hippocampus, which could be mitigated by antioxidant compounds that modulate the expression of Bcl-2, Bax, and caspase-3, underscoring the role of reactive oxygen species and apoptotic signaling in infrasound-induced cellular injury [14]. Furthermore, infrasound was found to alter blood–retinal barrier permeability by increasing the activity of calcium-activated potassium channels in retinal microvascular endothelial cells, demonstrating that infrasound can directly affect ion channel dynamics and cellular excitability [15]. These results emphasize that infrasound can actively reshape key regulatory pathways governing cell survival and functional integrity.

Infrasound has also been proven to impact glial and microbial cells. Astrocytes in the rat hippocampus responded to infrasound with increased A1 reactive astrocyte formation and elevated glutamate release via Cx43 hemichannels, effects that were modulated by the FGF2/FGFR1 pathway and microglial activation, highlighting the involvement of neuron–glia interactions in central nervous system injury [13,16]. Similarly, microbial studies demonstrated that mechanical vibration at infrasound frequencies can either stimulate or inhibit bacterial growth depending on the duration and frequency of exposure, suggesting

that both extracellular medium properties and cellular mechanosensors mediate microbial responses [17]. Finally, investigations in plant systems revealed that infrasound-induced changes in water structure and cell hydration may serve as sensitive signals of intracellular metabolic activity, indicating that physical cues can propagate molecular responses across diverse organisms [18]. Together, these findings reveal the multifaceted nature of infrasound, demonstrating its capacity to influence cellular processes through interconnected mechanical, biochemical, and biophysical mechanisms.

### 3. Systemic Effects on Organs and Tissues

#### 3.1. Cardiovascular System

##### 3.1.1. Animal Studies

Results from animal studies indicate that exposure to infrasound at high sound pressure levels (SPLs) can significantly affect components of the cardiovascular system. In contrast, human studies (particularly those conducted under controlled laboratory or epidemiological conditions) yield conflicting and complex results and often do not yield definitive conclusions.

Research focusing on rodent models has provided considerable insight into the myocardial effects of high SPL infrasound. Pei et al. (2007) [19] exposed rats to 5 Hz infrasound at 130 dB for 2 h daily over 1, 7, and 14 days, and evaluated hemodynamic, molecular, and ultrastructural indices at the end of each exposure period. The study showed a time-dependent change in the heart's function and structure. Left ventricular systolic pressure, together with  $+dP/dt$  and  $-dP/dt$ , showed a progressive increase and a decrease, respectively. Mitochondrial swelling and intracellular calcium levels also significantly and progressively increased during the exposure period. Inhibition of SERCA2 (Sarco/endoplasmic reticulum  $Ca^{2+}$ -ATPase 2) protein expression showed a unique pattern of predominance: after a one-day increase, there was a significant decrease after prolonged seven- and fourteen-day exposures. The varied muscular and ultrastructural disorganization was then accompanied by disrupted calcium homeostasis and impaired excitation–contraction–sarcomere coupling and relaxation mechanisms, which certainly deserve more attention [19].

Subsequent studies showed that exposure to infrasound induced apoptosis in neonatal rat cardiomyocytes by altering the expression of proteins involved in apoptosis pathways, including upregulation of Bax and caspases, the pro-apoptotic proteins, and downregulation of Bcl-2, the anti-apoptotic protein [20]. The same research group further demonstrated that exposure to infrasound increased oxidative stress by reducing PPAR- $\gamma$  expression and antioxidant enzyme activity, leading to cardiomyocyte damage. The pharmacological stimulation of PPAR- $\gamma$  significantly reduced these damages, as evidenced by decreased oxidative injury (lower lipid peroxidation), preservation of mitochondrial ultrastructure, and reduced cardiomyocyte apoptosis [21]. Overall, these findings indicate that increased intracellular calcium concentration, impaired mitochondrial function, activation of apoptotic pathways, and oxidative stress are among the most important mechanisms underlying myocardial damage from infrasound exposure.

Other animal studies corroborate these observations. Lousinha et al. (2018) demonstrated that rats exposed to infrasound developed coronary perivascular fibrosis, while dexamethasone attenuated the effect, implicating inflammatory pathways in the fibrotic response [22]. Similarly, Antunes et al. (2013) reported myocardial fibrosis in rats chronically exposed to low-frequency noise ( $\leq 500$  Hz, including infrasonic components), within the conceptual framework of "vibroacoustic disease" [23].

In contrast to the findings described above regarding infrasound-induced cardiomyocyte damage through increased apoptosis and oxidative stress [20,21], Jin and co-workers

studied the effects of infrasound on rat cardiac fibroblasts and demonstrated that low-SPL infrasound (80–86 dB) actually suppressed pathological processes in the fibroblasts. Specifically, low SPL exposure inhibited angiotensin II-induced proliferation and collagen synthesis, acting through the microRNA-29a/TGF- $\beta$ /Smad3 and Nrf2/HO-1 pathways. These findings raise the intriguing possibility that infrasound may exert bidirectional effects depending on dose and cellular context, being harmful at high intensities but potentially protective at lower, sub-threshold SPLs [24]. Biological tissues and organs vary in their mechanical and viscoelastic properties, structural organization, and the distribution of mechanosensory receptors. These differences can produce distinct, frequency-dependent responses to infrasound and low-frequency vibrations. Consequently, the resonant frequencies of different tissues and organs may contribute to the diverse biological effects reported in the literature. This may help explain why some tissues respond differently under similar exposure conditions. Mechanistic evidence indicates that resonance-related vibratory phenomena can affect hemodynamic, neurological, and musculoskeletal pathways differently, depending on factors such as frequency, intensity, and the mode of vibration delivery [25].

### 3.1.2. Human Studies

Experiments in *ex vivo* human tissue extend these insights. Exposure of atrial appendage muscle samples obtained during cardiac surgery to infrasound > 100 dB (Z) for 1 h showed a graded reduction in myocardial contractility, averaging a 9% decline in force per 10 dB increase above 100 dB (Z). These results provide rare direct evidence that human myocardium is functionally sensitive to infrasound at supraphysiological intensities [26].

The translation of these findings to intact humans is complex. Controlled laboratory studies from the 1980s onward have yielded heterogeneous results. Danielsson and his co-workers reported increases in diastolic blood pressure in healthy volunteers during acute exposure to 6–16 Hz infrasound at high SPLs, without concomitant changes in heart rate [27]. Likewise, Qibai et al. found that an hour of exposure to infrasound at 2.1 Hz (110 dB) or 4.1 Hz (120 dB) in healthy volunteers resulted in an increase in systolic and diastolic blood pressure, and an increase in heart rate was generally observed at 120 dB, but at 110 dB, the heart rate response was inconsistent (increase or decrease). Discomfort, headache, ear pressure, and fatigue were also reported by participants [28]. In an early study, Moller et al. observed no cardiovascular changes when subjects were exposed to short-term near-threshold levels (<20 dB above auditory threshold). However, annoyance and sensations of ear pressure were common [29]. Birnie reported small, non-significant increases in blood pressure under unspecified infrasonic exposures, again accompanied by subjective symptoms [30]. These early experiments suggested that only high-intensity infrasound (>100 d(B)Z) elicits measurable cardiovascular responses in humans, whereas near-threshold exposures are more likely to cause annoyance than physiological changes. Unfortunately, short-term studies are not sufficient to draw conclusions about long-term cardiovascular effects.

More recent and methodologically rigorous studies have focused on infrasound and low-frequency noise generated by wind turbines. Health Canada's large cross-sectional survey of over 1200 adults living near turbines found no association between exposure time and blood pressure or heart rate [31]. This study was conducted in 2012 and is based on data from dwellings in the vicinity of smaller wind turbines with rated electrical power outputs ranging from 660 kW to 3 MW. In a 72 h, double-blind, crossover study of noise-sensitive adults exposed to simulated wind turbine infrasound (1.6–20 Hz; 90 dB peak), no cardiovascular effects, including effects on heart rate, were detected [32]. However, those studies do not consider the current state of knowledge regarding the impact of infrasound on cellular mechanotransduction, as reflected in blood pressure and heart rate

measurements. Exploratory field studies have suggested possible associations between low-frequency components of wind turbine noise (20–200 Hz) and altered heart rate variability, but these findings cannot be attributed to infrasound and remain inconclusive [33].

Nonetheless, there is evidence for acute vascular effects. Deng et al. reported that exposure to short-term low-frequency noise (70–100 Hz  $\leq$  85 dB) increased cutaneous blood flow in both humans and mice, mediated in part by nitric oxide. Although these frequencies extend slightly above the infrasonic range, the findings suggest a mechanosensory role for the endothelium and highlight the need to examine vascular regulatory mechanisms at infrasonic frequencies [34–36].

Despite decades of research, many gaps remain, particularly regarding the intensity threshold of infrasound exposure-related effects, the differences between animal and human studies, the precise cellular mechanosensory pathways, and the associated markers of vascular health and blood flow at the microcirculatory level. Recent microvascular modeling has established standard reference values for blood velocity in microvessel exchanges. This enables healthy and diseased states to be distinguished using biophysical flow indicators [37]. To gain a clearer understanding, future studies should use precisely calibrated chambers, double-blind designs, and advanced mechanical analyses. In addition, standard cardiovascular and microcirculatory markers should be used to properly elucidate the true impact of infrasound on cardiovascular functions. Research using Laser Doppler Flowmetry during local thermal hyperemia has demonstrated that skin microvascular reactivity is highly sensitive to endothelial dysfunction. This underscores the importance of microcirculatory assessments in detecting early vascular impairment [38]. Normative datasets for sublingual microcirculation obtained through SDF imaging in healthy pediatric populations further demonstrate the robustness and physiological sensitivity of microvascular imaging methods [39]. Complementary findings from adult cohorts using incident dark-field imaging show age- and sex-specific variations in sublingual microcirculatory parameters, broadening the reference framework for assessing vascular function across populations [40].

### 3.2. Central Nervous System

#### 3.2.1. Animal Studies

Infrasound exposure (particularly when delivered at high SPL) has repeatedly been linked in animals and *in vitro* models to neuronal apoptosis and oxidative stress, while human data remains less clear-cut. Here, we summarize findings from diverse experimental paradigms, comparing rodent studies, cellular assays, and limited human research, and evaluating mechanistic pathways, neurofunctional outcomes, and potential protective responses.

Extensive rodent experiments have demonstrated that infrasound exposure induces hippocampal neuronal apoptosis alongside oxidative imbalance. For example, rats exposed to 8 Hz at 140 dB for 2 h/day across three days exhibited increased neuronal apoptosis in hippocampal regions, correlating with impaired spatial learning and memory [41]. In mice, repetitive exposure to 16 Hz infrasound at 130 dB for 2 h per day for 8 days increased inflammatory cytokine levels in the CNS and elevated oxidative stress, leading again to impaired memory and spatial learning due to neuronal damage in the prefrontal cortex and hippocampus [42]. Mechanistically, epigallocatechin gallate (EGCG), an antioxidant, has been shown to suppress infrasound-induced neuronal apoptosis in rat hippocampi, confirming oxidative stress as a causal mediator [43]. Together, these findings support a model in which infrasound triggers mitochondrial dysfunction, reactive oxygen species (ROS) generation, and apoptotic cascades involving p53 upregulation and Bcl-2 suppression.

Evidence on synaptic plasticity indicates that high-intensity acoustic stimulation can disrupt long-term potentiation (LTP), a core mechanism underlying learning and memory. In one study, a single 1 min of exposure to 110 dB audible sound spanning approximately 3–15 kHz inhibited hippocampal Schaffer-CA1 LTP for 24 h, while spatial learning ability remained unaffected [44]. Although this sound exposure did not involve infrasound, these data suggest that similarly intense acoustic inputs may impair synaptic strengthening, most likely through alterations in postsynaptic signaling mechanisms.

Emerging evidence also points to disturbances in intracellular calcium homeostasis. For example, exposure in the 90–130 dB range was shown to alter free intracellular calcium levels and modify NMDAR1 expression in hippocampal neurons, implicating calcium dysregulation and impaired glutamatergic signaling as key mechanisms [45]. Complementary *in vitro* work further demonstrated that cultured hippocampal neurons developed axonal degeneration following infrasound exposure, potentially reflecting cytoskeletal compromise or excitotoxic damage [46]. Animal studies have shown further vulnerabilities in the auditory system. In chinchillas, simultaneous exposure to low-frequency sound (30 Hz, 100 dB SPL) and high-intensity auditory noise (4 kHz octave band, 108 dB) caused greater damage to outer hair cells throughout the cochlea than exposure to auditory noise alone. These findings suggest that low-frequency components can exacerbate noise-induced cochlear damage and raise concerns about possible synergistic effects on the inner ear [47].

At the cellular level, rodent studies consistently implicate oxidative stress as a central driver of neuronal injury. ROS accumulation, mitochondrial dysfunction, and downstream apoptotic cascades appear to dominate. The protective effect of antioxidants such as EGCG reinforces this interpretation [43]. Beyond oxidative stress, neuroinflammatory processes have emerged as key contributors: astrocyte activation during infrasound exposure impairs learning and memory, while the pharmacological blockage of astroglial connexin-43 hemichannels mitigates these deficits, highlighting the role of glial-driven inflammation in neuronal survival [48]. Similarly, activation of the FGF2/FGFR1 pathway suppresses astrocyte-derived inflammatory cytokine production and neuronal loss, whereas antagonism of FGFR1 exacerbates injury by activating NF- $\kappa$ B [49]. Together, these data converge on astroglial NF- $\kappa$ B signaling and the release of proinflammatory mediators (IL-1 $\beta$ , TNF, and IL-6) as critical pathways.

Some studies also highlight adaptive capacity. Environmental enrichment before infrasound exposure provided robust neuroprotection in rats, preserving memory performance following 16 Hz, 130 dB exposure. This effect was accompanied by lower hippocampal oxidative stress, reduced pro-inflammatory cytokines, enhanced antioxidant defenses, and decreased apoptosis, with molecular shifts favoring cell survival (increased Bcl-2, reduced p53) [50]. Such findings suggest that preconditioning strategies may buffer the brain against infrasound-induced injury.

### 3.2.2. Human Studies

Animal studies largely highlight CNS changes, whereas human data remain limited. In a randomized pilot trial, bedroom-based infrasound exposure (6 Hz, 80–90 dB) over 28 consecutive nights induced detectable changes in resting-state brain networks, though behavioral or cognitive correlates were not clearly documented [51]. Broader epidemiological surveys of low-frequency noise (including infrasound) have associated such exposures with annoyance, subjective ear pressure, and sleep disturbance, but consistent links to cognitive performance remain elusive [52]. An earlier report noted that infrasound near the auditory threshold heightened pressure sensations and annoyance, but impaired performance only in one of nine tasks [30]. Interestingly, some brief exposure studies even suggested tran-

sient improvements in working memory, though these effects proved inconsistent across replications [53].

Low-frequency noise from environmental sources such as wind turbines, which often includes infrasound components, has been associated with disrupted sleep and reduced performance on higher-order cognitive tasks (e.g., logical reasoning, mathematical calculations). However, causality remains debated, with some reports emphasizing annoyance, restlessness, or emotional discomfort in the absence of consistent objective deficits [29,54]. The results of the Weichenberger study could provide an explanation, as could the fact that infrasound can temporarily increase alertness. It has been proven that infrasound activates three centers responsible for fear, flight, emotion, and central RR and pulse regulation. Importantly, because some of these centers are involved in attentional control and arousal, it has been suggested that activation of this pathway could, for example, wake people up at night, leaving them unable to pin down what actually caused them to waken [55].

Across rodent and cellular models, the evidence is remarkably consistent: high-intensity infrasound produces oxidative stress, neuronal apoptosis, synaptic impairment, and neuroinflammation. By contrast, human studies tend to show weaker or absent effects at moderate or near-threshold levels. This discrepancy may reflect differences in exposure intensity, interspecies sensitivity, adaptive mechanism, or methodological heterogeneity. Notably, brief human exposures have even been linked to transient cognitive enhancement [53]. In rodents, extreme intensities ( $\geq 130$  dB) reliably generate profound neurotoxicity levels [56].

### 3.3. Other Systems

#### 3.3.1. Animal Studies

The biological effects of infrasound on organ systems beyond the cardiovascular and CNS domains have been investigated in a variety of animal, human, and technical studies. Although the evidence is still fragmented and often derived from high-intensity exposures, several consistent patterns emerge. Below, the findings are discussed by system, highlighting major outcomes, mechanistic insights, and limitations in the current literature.

The data collectively provide strong evidence that sensory structures respond to infrasound; however, they also highlight that the effective levels are often higher than what is typically encountered in everyday environments. This situation is currently changing. Recent studies published by Professor Ken Mattsson and the Colas et al. group indicate that sound pressure levels (SPLs) have been significantly underestimated under various atmospheric conditions and near several wind turbines. Current plans for 7 MW-class wind turbines suggest a further increase in sound pressure levels, reaching up to 120 dB (Z) [57]. More direct pathological evidence comes from animal work. In rats, repeated exposure to 130 dB infrasound resulted in slowed gastric emptying, mucosal injury, and increased nitric oxide synthase activity; partial recovery occurred after exposure ceased [58]. These findings align with the broader pattern of oxidative and inflammatory responses described in other organ systems. Endocrine effects have been less studied, but intriguing signals exist. For example, chronic exposure in rats increased corticosterone levels and activated brown adipose tissue metabolism without causing overt glucose intolerance [59]. This points toward possible activation of stress axes and thermogenic pathways. Immune effects are mostly inferred indirectly from studies showing oxidative stress and inflammatory markers in gastrointestinal, hepatic, or reproductive tissues. Dedicated cellular and clinical studies are still missing.

Older experiments reported frequency- and duration-dependent changes in hepatocytes, with longer or more intense exposures producing irreversible alterations [60]. These findings suggest a vulnerability of hepatic tissue, possibly mediated by oxidative stress

and mitochondrial dysfunction. However, given the age of these studies and the lack of biochemical or omics-level validation, conclusions must be cautious.

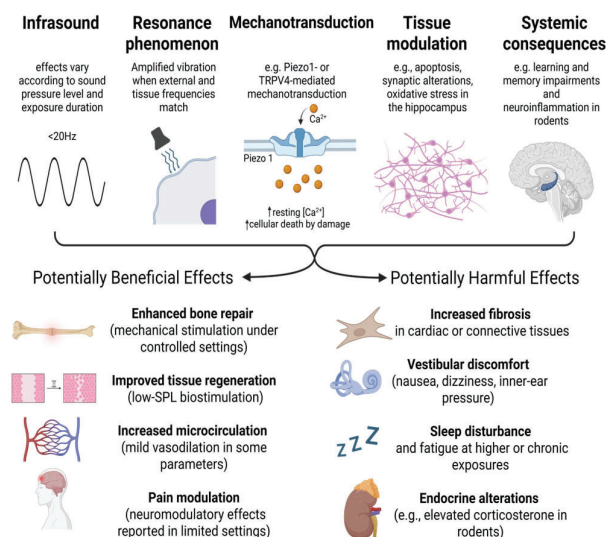
Male reproductive toxicity has been demonstrated in rodents. Repeated exposure reduced sexual behavior, suppressed testosterone, and altered the expression of steroidogenic genes [61], while other work described ultrastructural damage to testes [62]. Oxidative stress and apoptotic pathways are the most plausible mechanisms. No equivalent data exists in humans, and no *in vitro* germ-cell or Leydig cell studies have been published, leaving a major translational gap.

Animal studies suggest that infrasound may affect physical performance. In rats, endurance capacity decreased after repeated exposure, especially in animals with lower baseline ability, suggesting that infrasound may accelerate fatigue under certain conditions [63]. While this may reflect muscular strain, it is equally plausible that vestibular disturbance or altered proprioceptive feedback contributed to reduced performance.

### 3.3.2. Human Studies

In the auditory domain, psychophysical studies in humans as early as the 1970s demonstrated that infrasound is perceptible at sufficiently high sound pressure levels, with clear thresholds across the 0.5–16 Hz range [64]. Subsequent integrative work has reinforced the steep dependence of audibility on SPL [65]. Vestibular studies add an important dimension: controlled laboratory exposures have shown significant increases in postural sway and the induction of vertical nystagmus around 7 Hz at high SPLs [66]. Reports of non-auditory sensations, such as chest or abdominal vibration, support the claim that exposures are strong enough [67]. Evidence in humans is essentially absent, and there are no dedicated *in vitro* studies to clarify whether muscle fibers themselves are mechanically vulnerable. The respiratory literature is sparse. Early human studies reported minimal changes in breathing patterns during infrasonic exposure, although some participants reported discomfort or nonspecific symptoms at higher SPLs [68]. Systematic measurements of lung function or airway physiology remain lacking, and no controlled animal or cell culture models have yet clarified potential mechanistic pathways. There are also changes in the bronchial mucous membranes, as described by Alves Pereira in 2007. The images for this are in presented an earlier paper. The new PIEZO research now confirms that lung tissue also has a large number of PIEZO channels, i.e., it is sensitive to overstimulation [37,69].

According to current knowledge, the importance of external factors, particularly repeated exposure to low-frequency sounds and vibration during pregnancy, must be considered significantly more harmful than previously assumed. High sensitivity is related to various stages, particularly those of embryonic development, which are physiologically dependent on undisturbed capillary flow. Examples of specific phases of increased sensitivity include, e.g., vasculogenesis. After the differentiation of endothelial progenitor cells [70] and their fusion into a primary capillary plexus [71], the growth direction of the vascular tree is essentially regulated by blood shear stress and thus by mechanotransduction [72]. Together, these data illustrate how infrasound-triggered cellular and molecular mechanisms result in dysfunction across various organ systems, as summarized in Figure 1.



**Figure 1.** Overview of the biological mechanisms of infrasound. SPL—sound pressure level; TRPV4—transient receptor potential cation channel subfamily V member 4. Created with BioRender.com.

#### 4. Psychological and Behavioral Responses

Infrasound exposure, particularly from wind turbines used for electricity production, has been associated with a range of psychological and behavioral effects, although the underlying mechanisms remain complex and context-dependent. Experimental studies have demonstrated that expectation and framing can influence symptom perception [73,74]. For instance, participants exposed to wind turbine sound containing sub-audible infrasound reported fewer symptoms and lower annoyance when provided with positive information about infrasound, whereas negative expectations increased symptom reporting, consistent with placebo effects [74,75]. Surveys of individuals reporting low-frequency noise complaints highlight a similar pattern, with many respondents describing sensations of vibration, sleep disturbance, and secondary effects such as headaches and palpitations, despite measured sound levels often being below hearing thresholds [76]. Laboratory investigations further emphasize that perceptions of infrasound vary widely between individuals: small changes in sound pressure at infrasonic frequencies can lead to large differences in perceived annoyance, and sensations beyond hearing (such as ear pressure, vibration, and discomfort) may occur even when tones are inaudible [77,78].

Beyond subjective reports, recent research has examined potential objective correlates of prolonged exposure to infrasound in humans. Long-term studies with controlled exposure to inaudible infrasound (6 Hz, 80–90 dB) found no significant effects on global cognitive performance, psychiatric symptoms, or sleep quality, though subtle trends in self-reported physical weakness were noted [47]. Research and case studies have shown that wind turbine noise can diminish concentration and cognitive performance. Correlation factors include sleep disturbances, increased annoyance, and stress. Lab studies that include EEG and fMRI data show that relaxation and concentration become more difficult as infrasound levels increase. Thus, it can be assumed that, in proximity to wind turbines, there is a diminished cognitive function [79].

Functional connectivity analyses revealed changes in specific brain networks, including the default mode, sensorimotor, and executive control networks, which were associated with self-reported somatic symptoms and annoyance [80]. These results suggest that while infrasound may not broadly impair psychological function in healthy individuals, it can modulate brain activity and bodily perception in ways that correlate with subjective annoyance. These findings, together with behavioral studies on expectation effects, highlight the

complex interplay between perceptual, cognitive, and psychosocial factors in responses to infrasound, including individual sensitivity, contextual influences, and prior information.

## 5. Therapeutic and Biomedical Applications

Despite the plethora of studies highlighting the negative and potentially harmful consequences of infrasound exposure (from sleep disturbances to cardiovascular and neurological effects), a lesser-studied area suggests that, when used in controlled, dosed, targeted settings, this powerful physical phenomenon can become a therapeutic and innovative tool. Just as many natural agents produce beneficial biological effects at specific ranges and under safe conditions, infrasound has the potential, at appropriate levels, to modulate vital physiological pathways and stimulate the body's repair responses. The traditional view of infrasound often sees it as a dangerous "sound pollutant", but emerging evidence suggests that these low-frequency waves can have a beneficial therapeutic effect under controlled conditions. Long et al. demonstrated, in an *in vivo* study using an animal model (mice), that applying 16 Hz sound increased bone density and osteogenesis. Subsequently, he and Fan reported positive effects on proliferation, osteogenic differentiation, and mineralization using the same frequency on bone marrow mesenchymal stem cells *in vitro* [13]. Additionally, Enomoto et al. showed that, not only within the infrasonic range but also beyond it, one can exert vibrational stimulation that alters cellular migratory and metabolic activities, indicating that a broader range of cellular activities is responsive to the mechanobiological effects of vibrational stimulation [81]. Likewise, Rachlin et al. showed that low-intensity infrasound enhanced the cytotoxic effects of cisplatin by increasing membrane permeability without causing apoptosis [82]. Even so, these observations must not be compared with systems that use higher-intensity ultrasound; no direct study of such systems has been performed. Thus, claims of greater safety and/or selectivity in treatments are made without adequate evidence, and as such, the need for caution is apparent.

Early experimental studies in rats revealed that high-intensity low-frequency sound could reduce postoperative adhesion formation, likely through the micromotion of abdominal organs, which prevents fibrous bridging between tissues, without detectable adverse effects [83,84]

While the results support the potential of infrasound as a treatment for solid tumors, studies in immune cell-derived malignancies (such as B-cell lymphoma and leukemia) have shown no significant alterations in cell proliferation or apoptosis. However, ultrastructural changes were observed, suggesting subtle cellular effects worthy of further investigation. Compared with invasive methods, such as electroporation, infrasound is a noninvasive technique for enhancing the delivery of chemotherapeutic agents. Long wavelengths penetrate deeply into tissue, making them particularly appropriate for targeting tumors located deep in tissue. Although promising, the detailed mechanisms by which infrasound induces membrane permeability and chemosensitizing effects remain poorly understood. Furthermore, its effect varies across cell types and depends on several parameters, including frequency, sound pressure, and exposure duration. The combination of infrasound and chemotherapy offers a promising therapeutic approach, potentially enhancing the effectiveness of chemotherapeutic drugs while reducing systemic side effects. Infrasound could optimize treatment outcomes by selectively enhancing drug delivery to tumor cells [85]. A 2017 study first demonstrated that low-intensity infrasound can inhibit the proliferation and collagen synthesis of Ang II-stimulated cardiac fibroblasts. These findings suggest that low-intensity infrasound may serve as a novel therapeutic approach to prevent or reduce cardiac fibrosis [24].

## 6. Occupational Health and Environmental Aspects

Occupational exposure to infrasound has been extensively documented in industrial and agricultural settings. Measurements across various machinery, including tractors, grinders, conveyors, and combine harvesters, have shown that infrasound levels often exceed recommended limits, particularly during prolonged operation [86,87]. The use of modern cab-type tractors, while reducing audible noise exposure, still exposes operators to significant infrasonic pressure, sometimes surpassing occupational exposure limits within minutes of operation [88]. In addition to auditory considerations, these levels may contribute to non-auditory effects, such as fatigue, sleep disturbances, and stress, underscoring the need for effective technical and organizational interventions to reduce worker exposure [89,90]

The accuracy of describing and predicting a phenomenon depends heavily on the measurement methods and instruments used. It was noticed, conventional sound-level meters often underestimate total acoustic energy. To assess potential biobehavioral effects, it is therefore essential to measure the full frequency spectrum, capturing not just what is heard but all energy present in the environment [61,91,92].

Sound-level weighting filters are commonly applied to account for the human ear's varying frequency sensitivity. A-weighting emphasizes mid-range frequencies (around 500 Hz–6 kHz) where human hearing is most sensitive, attenuating low- and high-frequency sounds, and is widely used for general noise assessment. C-weighting flattens the response at higher sound levels, giving more weight to low frequencies, and is often used to evaluate loud environments. G-weighting targets infrasound, emphasizing frequencies below 20 Hz and reflecting pressure fluctuations interacting with the body rather than perceived loudness. Z-weighting applies no frequency correction, providing a flat response across the audible and low-frequency ranges, which is essential for capturing the full energy content of environmental sound.

Salt and Kaltenbach demonstrated this underestimation in wind turbine sounds. At 10 Hz, A-weighting recorded no measurable sound, while C- and G-weighted measures, as well as unweighted measures, indicated pressures of 40–60 dB. In the 1 Hz range, C- and G-weighted measures remained similar, whereas the unweighted measure reached ~90 dB. These levels can stimulate inner hair cells on the basilar membrane and in various body cavities, demonstrating that sub-10 Hz turbine sounds are potent biological stimuli. The C-weighted scale, which reflects ear sensitivity at higher sound levels, provides a uniform gain from ~50 Hz to ~10 kHz and may capture effects on other organ systems. In contrast, the G-weighted scale, which is less aligned with perceived loudness, better represents pressure fluctuations that interact with the human body's intrinsic properties [2].

Recent regulatory proposals and risk assessment frameworks aim to mitigate occupational exposure to infrasound [93–95]. For example, Polish standards recommend a maximum continuous G-weighted sound level of 102 dB over an 8 h workday, with unweighted peak levels not exceeding 145 dB [95]. In contrast, Balážiková advocates the use of Z-weighting in the Comprehensive Method of Acoustic Risk Assessment to avoid underestimating potential health risks [93]. Although there is still no consensus on the optimal measurement approach, these discussions highlight the importance of accurately capturing low-frequency sound to guide effective occupational safety strategies.

Individual sensitivity and context play major roles in occupational risk. Studies investigating highly sensitive populations, such as paramedics, have demonstrated that personal factors, including sensory processing sensitivity, age, and experience, can influence perceived burdensomeness of noise and infrasound exposure [89]. Moreover, phenomena such as motion sickness, simulator sickness, or idiopathic environmental intolerance illustrate that symptoms may emerge even at exposure levels below conventional safety thresholds.

These findings highlight the need for occupational health protocols to consider both physical measurements and psychosocial factors when assessing potential risks, particularly in environments combining noise, vibration, confinement, and high cognitive demand [89,90].

## 7. Concluding Remarks

Exposure to infrasound is an important environmental stressor that has received little attention and can have significant biological impacts on various body systems. Scientific evidence from cellular and animal studies, as well as limited human studies, indicates that high-intensity infrasound can induce oxidative stress, mitochondrial dysfunction, calcium accumulation, and activation of apoptotic pathways, ultimately leading to tissue damage and functional disorders in cardiovascular, nervous, and other systems. In vitro rodent models also provide compelling evidence of myocardial fibrosis, neuronal apoptosis, and oxidative imbalance in the hippocampus. Although human studies have yielded conflicting results, they indicate vascular and neurophysiological sensitivities at higher and chronic exposure levels. Ongoing research on PIEZO channels is increasingly revealing their importance in individual organs. Overall, evidence suggests that infrasound can modulate mechanical and biological pathways, thereby affecting the body's homeostatic balance.

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## Abbreviations

The following abbreviations are used in this manuscript:

IS	Infrasound
SPL	Sound pressure level
TRPV4	Transient receptor potential vanilloid 4
Cx43	Connexin 43
Hz	Hertz
ROS	Reactive oxygen species
NF- $\kappa$ B	Nuclear factor kappa B
TNF	Tumor necrosis factor
IL-1 $\beta$	Interleukin 1 beta
IL-6	Interleukin 6
LTP	Long-term potentiation
AD	Alzheimer's disease
PPAR- $\gamma$	Peroxisome proliferator-activated receptor gamma

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Dear Laura Feekins-Bate

Date: 12 May 2026

**PROPOSED SDC M40 CAMPUS (the project)  
PROPOSAL BY SLOUGH HOLDINGS UK LIMITED (the applicant)  
INFRASTRUCTURE PLANNING (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS 2017 (as  
amended) REGULATIONS 10 and 11**

Thank you for your letter of 29 April 2026 regarding the information to be provided in an environmental statement relating to the above project. HSE does not comment on EIA Scoping Reports but the following information is likely to be useful to the applicant.

### **HSE's land use planning advice**

#### Will the proposed development fall within any of HSE's consultation distances?

According to HSE's records, the proposed application boundary for this Nationally Significant Infrastructure Project is not within the consultation zone of any major accident hazard sites ['MAHS'] or major accident hazard pipelines ['MAHP'], as defined under The Pipeline Safety Regulations 1996. This is based on the 'Site Boundary' shown in drawings Figure 22 on page 233 and Figure 1 'Site Location' on PDF page 315 in the Environmental Impact Assessment Scoping Report, ['EIA Scoping Report'] EN0110030-000007-EN0110030\_SDC M40 Campus\_EIA Scoping Report ([EN0110030-000007-EN0110030\\_SDC M40 Campus\\_EIA Scoping Report.pdf](#)). This document has been accessed through the Planning Inspectorate's website.

HSE's Land Use Planning advice [[HSE: Land use planning - HSE's land use planning methodology](#)] is dependent on the location of areas where people may be present and their type within HSE's land-use planning zones. Based on the information in the EIA Scoping Report, April 2026 it is unlikely that HSE would advise against the development. Please note that the advice is based on HSE's existing policy for providing land-use planning advice and the information which has been provided. HSE's advice in response to a subsequent planning application may differ should HSE's policy or the scope of the development change by the time the Development Consent Order application is submitted.

#### Would Hazardous Substance Consent be needed?

Based on the EIA Scoping Report April 2026, it is not clear whether the applicant has considered the hazard classification of any chemicals that are proposed to be present at the development. Hazard classification is relevant to the potential for accidents. For example, hazardous substances planning consent is required to store or use any of the Categories of Substances or Named Hazardous Substances set out in Schedule 1 of [The Planning \(Hazardous Substances\) Regulations 2015](#) as amended, if those hazardous substances will be present on, over or under the land at or above the controlled quantities. There is an 'addition rule' in Part 4 of Schedule 1 for below-threshold substances.

Table 61 on page 195, which details ‘*Risk events and associated potential effects (Completed Development)*’ contains references to substances which may qualify as Hazardous Substances under [The Planning \(Hazardous Substances\) Regulations 2015](#). The table includes references to: ‘*large amounts of fuels*’, ammonia, hydrogen and natural gas. These substances may require Hazardous Substances Consent.

Table 61 starting on page 195 includes two statements in the column titled ‘*Possible mitigation available (to be confirmed through assessment)*’, suggesting that a possible project mitigation measure is: ‘*Adherence to COMAH Regulations 2015*’. It is likely that a site qualifying as a COMAH site under [The Control of Major Accident Hazards Regulations 2015](#), would require a Hazardous Substances Consent.

Paragraph 3.4.6. states that: ‘*Water treatment plants may be required to provide water to both the Data Centre Campus and the Energy Centre, which will utilise raw water. Storage facilities will be required.*’. Hazardous substances that are stored on-site related to a water treatment facility may require Hazardous Substances Consent. If hazardous substances planning consent is required, please consult the relevant Hazardous Substance Authority (usually the Local Planning Authority) on the application.

**Future plans:** Section 3.6. ‘*Decarbonisation Readiness*’ suggests across paragraphs 3.6.1. to 3.6.5. that the project is considering Hydrogen Conversion as its chosen decarbonisation pathway. Further information is then given in 5.10. ‘*Decarbonisation Readiness and Decommissioning*’, indicating that hydrogen use is being considered. Paragraph 6.2.65. states: ‘*Dispersion modelling of the associated hydrogen combustion emissions will follow the methodology set out above, based on the Energy Centre running on 100% hydrogen as a worst case.*’. The use of hydrogen may require Hazardous Substances Consent.

### Consideration of Risk Assessments

[Regulation 5\(4\)](#) of the [Infrastructure Planning \(Environmental Impact Assessment\) Regulations 2017](#) requires the assessment of significant effects to include, where relevant, the expected significant effects arising from the proposed development’s vulnerability to major accidents. HSE’s role in NSIPs is summarised in Advice Note 11 ‘working with public bodies in the infrastructure planning process’ Annex G on the Planning Inspectorate’s website [Nationally Significant Infrastructure Projects - Advice on working with public bodies in the infrastructure planning process, Annex G: The Health and Safety Executive - GOV.UK \(www.gov.uk\)](#). This document includes the consideration of risk assessments under the heading “Risk assessments”.

In Chapter 6.8 (starting on page 182) of the EIA Scoping Report [EN0110030-000007-EN0110030\\_SDC\\_M40 Campus EIA Scoping Report.pdf](#), provides some possible major accidents and disasters, including those from COMAH facilities (6.8.20), Major accident hazard pipelines (6.8.21) and gas transmission networks (6.8.23). It is noted that paragraph 6.8.17 on page 185 indicates that there are existing methane installations on the western part of the site and that the installation is shown in *Figure 6 Indicative Gas Pipeline and National Grid Overhead Powerline Routing* on page 269. It is further noted that the second row of the Table shown on page 192 indicates that risks from ‘*hazardous facilities / major hazard pipelines*’ will be considered in further assessments.

We would advise that the above is considered further in line with Advice Note 11 Annex G taking account of the following: “*it may be beneficial for applicants to undertake a risk assessment as early as possible to satisfy themselves that their design and operation will meet the requirements of relevant health and safety legislation as design of the Proposed Development progresses.*”. Note, that there are no requirements for any risk assessments submitted to and approved by the relevant planning authority to also be considered by HSE.

### Explosives sites

Explosives Inspectorate has no comment to make as there are no HSE licenced explosives sites in the vicinity of the proposed development.

### Electrical Safety

No comment from a planning perspective.

At this time, please send any further communication on this project directly to the HSE's designated e-mail account for NSIP applications at [nsip.applications@hse.gov.uk](mailto:nsip.applications@hse.gov.uk) . We are currently unable to accept hard copies, as our offices have limited access.

Yours sincerely

A solid black rectangular box used to redact the signature of Cathy Williams.

Cathy Williams  
CEMHD4 NSIP Consultation Team

Laura Feekins-Bate  
Environmental Services Infrastructure Decisions and  
Applications Service Planning Inspectorate  
QUADIENT  
69 Buckingham Avenue  
Slough  
Berkshire  
SL1 4PN

Our ref: PL00801844  
Your ref: EN0110030

Date: 20<sup>th</sup> May 2026

*Sent via email*

Dear Ms Feekins-Bate

**re: SDC M40 Campus EIA Scoping**

Thank you for your correspondence of the 29<sup>th</sup> April 2026 consulting us about the above EIA Scoping Report.

Sitting immediately to the east of the application sites is a Scheduled Monument known as the *Templars Site at Moat Farm, Hedgerley (HA UID 1006922)*. There are also several Grade II Listed Buildings and a Grade II Registered Park and Garden within the immediate area. This development could, potentially, have impacts to these assets from development within their settings.

Our response will focus on those highly designated heritage assets that have the potential to experience significant effects from the development. We would defer to Buckinghamshire Council's archaeological and conservation advisors to assess the impact on Grade II Listed Buildings, Registered Parks & Gardens and non-designated heritage assets.

The Scoping Report proposes to scope out below ground archaeological impacts from the scheme, owing to the sites almost exclusive location within an existing landfill site. We advise that there may be archaeological impacts resulting from the Biodiversity Net Gain requirements of the scheme and from any peripheral infrastructure works associated with the scheme. We would encourage the applicant to contact Buckinghamshire Council if they have not already, to discuss these impacts.

The Scoping Report proposes that the Templar Site, although made up of below ground archaeological remains, is most appropriately considered within the Built Heritage Chapter of the ES. The rationale for this is based on the site's historic relationship with Moat Farm. We support this position and do not raise any objection.



We do however advise that compilation of the Built Heritage Chapter for the ES draws on archaeological expertise to assess the impact to the Scheduled Monument. The stepped process within the Historic England Good Practice Advice Note 3: The Setting of Heritage Assets (2017) should be followed to identify potential harm to the Knights Templar site from the proposed development and any associated works within its setting (including earthwork bunds, for example) and, if so, what mitigation could reduce and minimise that harm.

We hope that the above comments are helpful in relation to the scoping of the EIA and the reporting of significant effects. In addition to this information, we would remind you that the NPPF (para.207) and National Policy Statement 1 (for energy) para 5.9.9, 5.9.10 and 5.9.27 also requires that all heritage impacts need to be considered and that an assessment of non-significant effects should be supplied separately to, or as technical appendix to the ES.

If you have any queries about any of the above, or would like to discuss anything further, please contact me.

Yours Sincerely

Jo Short

**Inspector of Ancient Monuments** Berkshire, Buckinghamshire & Oxfordshire  
**London and South-East Region**

NATIONALLY SIGNIFICANT INFRASTRUCTURE PROJECT CONSULTATION

Planning Inspectorate  
Environmental Services  
Infrastructure Decisions and Applications Service  
Planning Inspectorate  
c/o QUADIENT  
69 Buckingham Avenue  
Slough  
SL1 4PN

**Applicant:** Slough Holdings UK Limited

**Application ref:** PLN/2026/0914

**Proposal:** Consultation from Planning Inspectorate prior to adoption of Scoping request relating to Environmental Statement (ES) for the Development Consent relating to proposed SDC M40 Campus project comprising a Data Centre Campus of three units, together with an integrated on site energy generation centre and associated development including access and landscaping at Green Belt land located north of the M40 motorway and south of the A40 Oxford Road, Hedgerley Green

**Valid on:** 29 April 2026

**Decision:** Thank you for consulting Milton Keynes City Council on the above application.

Milton Keynes City Council has **no objection** to the proposal.

- 1 Given the distance from the proposals the Council does not consider it likely that the development will impact on Milton Keynes. On this basis the Council have no comments to make.

**Date of decision:** 26 May 2026

**Jon Palmer, Head of Planning**



Defence  
Infrastructure  
Organisation

Ministry of Defence  
Safeguarding Department  
DIO Head Office  
St George's House  
Whittington  
Lichfield  
Staffordshire  
WS14 9PY

Planning ref: EN0110030

DIO ref: 10070774

Mobile: [REDACTED]

E-mail: DIO-Safeguarding-  
Statutory@mod.gov.uk

Laura Feekins-Bate

The Planning Inspectorate

By Email Only

27th May 2026

Dear Laura

Proposal: The SDC M40 Campus project (referred to as the Proposed Development) will provide both a Data Centre Campus (comprising of three individual data centres with associated office space and fuel storage) and an integrated energy generation centre (the 'Energy Centre'), with associated infrastructure, access and extensive landscaping across the Site

Thank you for consulting the Ministry of Defence (MoD) on the above Scoping Opinion which was received by this office on the 29<sup>th</sup> April 2026.

The Defence Infrastructure Organisation (DIO) Safeguarding Team represents the Ministry of Defence (MOD) as a consultee in UK planning and energy consenting systems to ensure that development does not compromise or degrade the operation of defence sites such as aerodromes, explosives storage sites, air weapon ranges, and technical sites or training resources such as the Military Low Flying System.

Slough Holdings UK Limited submitted an Environmental Impact Assessment Scoping Report (the Scoping Report) in relation to the construction and operation of a Data Centre Campus, integrated energy generation centre and associated infrastructure.

At this stage because details of the development and supporting infrastructure are not fully available, and only a red line scoping boundary is available for the proposed development, only an initial assessment has been completed, and we can provide the following advice.

The proposed development site occupies the statutory safeguarding zone surrounding RAF Northolt. The site is approximately 12 km Northwest from RAF Northolt and occupies the statutory aerodrome height safeguarding zone surrounding the aerodrome.

### Aerodrome heights

The airspace above and around aerodromes is safeguarded to maintain an assured, obstacle free environment for aircraft manoeuvre. This development site sits beneath a piece of protected airspace called the Obstacle Limitation Surface (OLS). The OLS needs to be kept free of obstruction from tall structures to ensure that aircraft transiting to and from or circuiting the aerodrome can do so safely. The OLS in the proposed development boundary is set at 45.7m. The proposed Data Centre is not expected to cause a physical infringement of the OLS. However, should the application progress the integrated energy generation centre, which will include tall and narrow structures, such as stacks at this location could cause an infringe and be of concern to the MoD.

In conclusion, at this scoping application stage, where no details are available for the designs or maximum heights of the Data Centre or integrated energy generation, the MoD representations are limited to the principle of the development only. In summary, the MoD has concerns about this development and requests that the MOD should be consulted at all future stages for this proposed development to complete a full detailed safeguarding assessment.

The MoD must emphasise that the advice provided within this letter is in response to the data and information detailed in the developer's documents titled Environmental Impact Assessment Scoping Report dated April 2026. Any variation of the parameters (which include the location, dimensions, form, and finishing materials) detailed may significantly alter how the development relates to MoD safeguarding requirements and cause adverse impacts to safeguarded defence assets or capabilities. In the event that any amendment, whether considered material or not by the determining authority, is submitted for approval, the MoD should be consulted and provided with adequate time to carry out assessments and provide a formal response.

I trust this is clear however should you have any questions please do not hesitate to contact me.

Yours sincerely

DIO Safeguarding Team



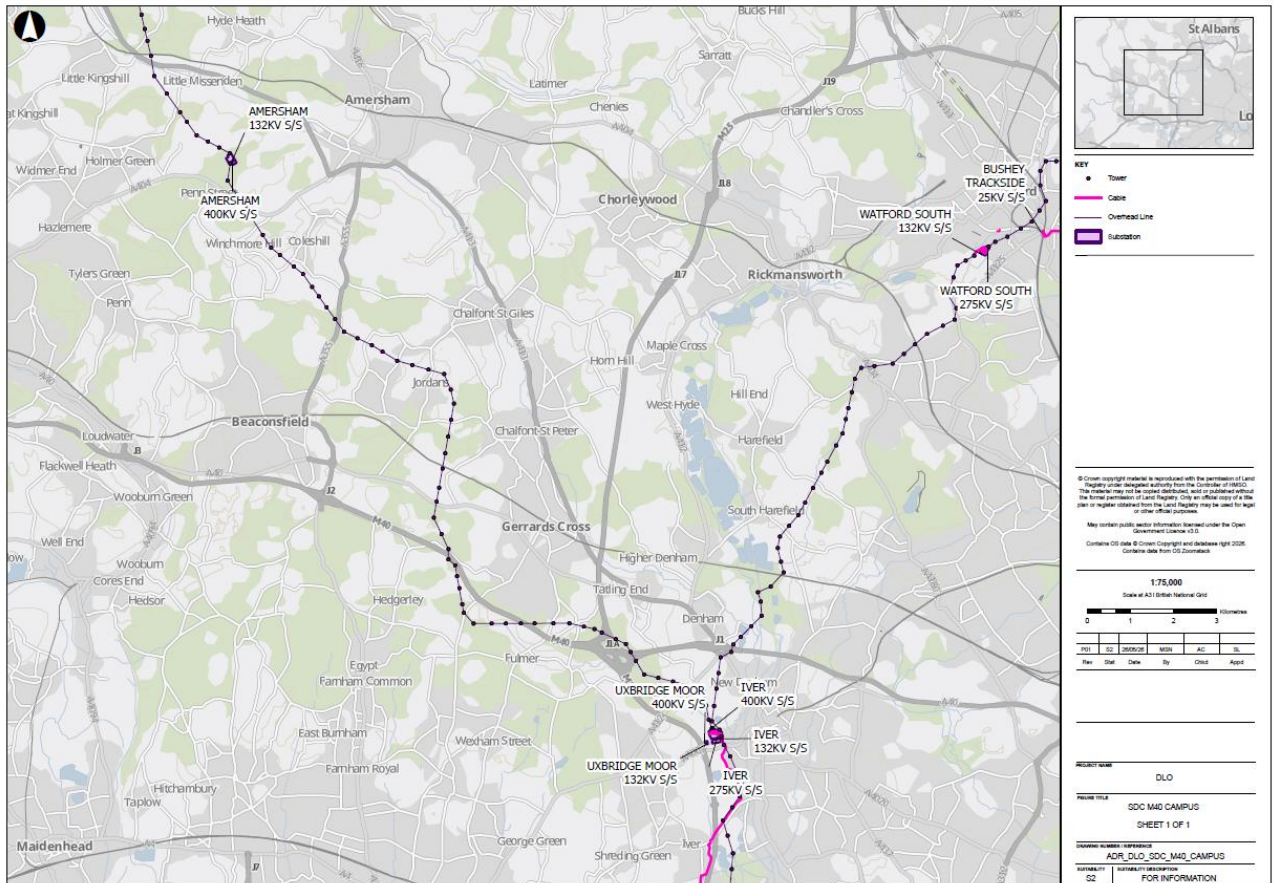


Figure 1: NGET Assets in proposed development area

## New infrastructure

The National Energy System Operator (NESO) took over the electricity network planning responsibility from National Grid Electricity System Operator Limited (NGESO) on the 1st October 2024. Please consult with NESO separately from NGET where further information on the strategic need or capacity is sought.

Please refer to the Holistic Network Design (HND) and the NESO website to view the strategic vision for the UK's ever growing electricity transmission network: <https://www.neso.energy/publications/beyond-2030/holistic-network-design-offshore-wind>; and <https://www.neso.energy/publications/beyond-2030>

**It should be noted that there may be further interactions with additional new strategic infrastructure where the projects are in their early development.**

NGET requests that all existing and future assets are given due consideration given their criticality to the high-voltage transmission of electricity across the UK. We remain committed to working with the promoter in a proactive manner, enabling both parties to deliver successful projects wherever reasonably possible. As such we encourage that ongoing discussion and consultation between both parties is maintained on interactions with existing or future assets, land interests, connections or consents and any other NGET interests which have the potential to be impacted prior to submission of the Proposed DCO.

The Great Grid Upgrade is the largest overhaul of the electricity grid in generations, we are in the middle of a transformation, with the energy we use increasingly coming from cleaner greener sources. Our infrastructure projects across England and Wales are helping to connect more renewable energy to homes and businesses. To find out more about our current projects please refer to our network and infrastructure webpage. <https://www.nationalgrid.com/electricity-transmission/network-and-infrastructure/infrastructure-projects>. Where it has been identified that your project interacts with or is in close proximity to one of NGET's infrastructure projects, we would welcome further discussion at the earliest opportunity.

These projects are all essential to increase the overall network capability to connect the numerous new offshore wind farms that are being developed, and transport new clean green energy to the homes and businesses where it is needed.

The following points should be taken into consideration.

## Specific Comments – Electricity Infrastructure:

- NGET's Overhead Line/s is protected by a Deed of Easement/Wayleave Agreement which provides full right of access to retain, maintain, repair and inspect our asset
- Statutory electrical safety clearances must be maintained at all times. Any proposed buildings must not be closer than 5.3m to the lowest conductor. NGET recommends that no permanent structures are built directly beneath overhead lines. These distances are set out in EN 43 – 8 Technical Specification for “overhead line clearances Issue 5 (2019)”.
- If any changes in ground levels are proposed either beneath or in close proximity to our existing overhead lines, then this would serve to reduce the safety clearances for such overhead lines. Safe clearances for existing overhead lines must be maintained in all circumstances.
- The relevant guidance in relation to working safely near to existing overhead lines is contained within the Health and Safety Executive's ([www.hse.gov.uk](http://www.hse.gov.uk)) Guidance Note GS 6 “Avoidance of Danger from Overhead Electric Lines” and all relevant site staff should make sure that they are both aware of and understand this guidance.
- Plant, machinery, equipment, buildings or scaffolding should not encroach within 5.3 metres of any of our high voltage conductors. When those conductors are under their worst conditions of maximum “sag” and “swing” and overhead line profile (maximum “sag” and “swing”) drawings should be obtained using the contact details above.
- If a landscaping scheme is proposed as part of the proposal, we request that only slow and low growing species of trees and shrubs are planted beneath and adjacent to the existing overhead line to reduce the risk of growth to a height which compromises statutory safety clearances.
- Drilling or excavation works should not be undertaken if they have the potential to disturb or adversely affect the foundations or “pillars of support” of any existing tower. These foundations always extend beyond the base area of the existing tower and foundation (“pillar of support”) drawings can be obtained using the contact details above.
- NGET high voltage underground cables are protected by a Deed of Grant; Easement; Wayleave Agreement or the provisions of the New Roads and Street Works Act. These provisions provide NGET full right of access to retain, maintain, repair and inspect our assets. Hence, we require that no permanent / temporary structures are to be built over our cables or within the easement strip. Any such proposals should be discussed and agreed with NGET prior to any works taking place.
- Ground levels above our cables must not be altered in any way. Any alterations to the depth of our cables will subsequently alter the rating of the circuit and can compromise the reliability, efficiency and safety of our electricity network and requires consultation with National Grid prior to any such changes in both level and construction being implemented.

## **Further Advice**

NGET requests to be consulted at the earliest stages to ensure that the most appropriate protective provisions are included within the DCO application to safeguard the integrity of our apparatus and to remove the requirement for objection. All consultations should be sent to the following email address: [box.landandacquisitions@nationalgrid.com](mailto:box.landandacquisitions@nationalgrid.com)

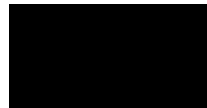
We hope the above information is useful. If you require any further information, please do not hesitate to contact the Land Development Liaison team. In the meantime, we look forward to receipt of further information and consultation relating to potential impacts on our assets.

The information in this letter is provided notwithstanding any discussions taking place in relation to connections with electricity customer services.

Yours faithfully,



Tiffany Bate  
Lead Development Liaison Officer  
Customer Connections Site Solutions (CCSS)  
Land, Planning and External Affairs (LPEA)



Rachel Hagan  
Development Liaison Support Officer  
Customer Connections Site Solutions (CCSS)  
Land, Planning and External Affairs (LPEA)

Technical Guidance Note 287

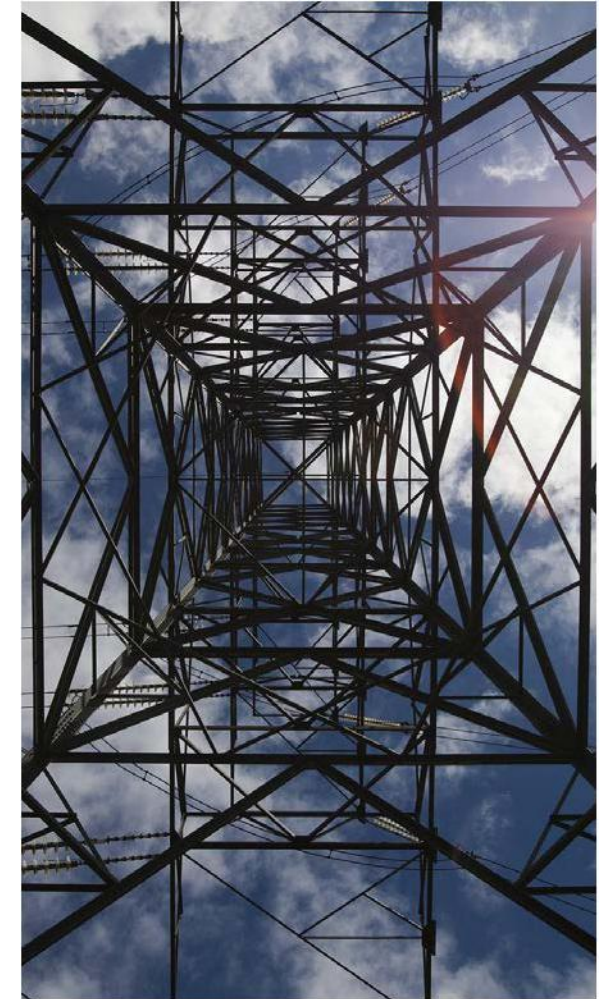
# Third-party guidance for working near National Grid Electricity Transmission equipment

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#### Disclaimer

National Grid Gas Transmission and National Grid Electricity Transmission or their agents, servants or contractors do not accept any liability for any losses arising under or in connection with this information. This limit on liability applies to all and any claims in contract, tort (including negligence), misrepresentation (excluding fraudulent misrepresentation), breach of statutory duty or otherwise. This limit on liability does not exclude or restrict liability where prohibited by the law, nor does it supersede the express terms of any related agreements.



# Purpose and scope

The purpose of this document is to give guidance and information to third parties who are proposing, scheduling or designing developments close to National Grid Electricity Transmission assets.

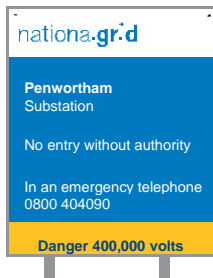
The scope of the report covers information on basic safety and the location of our assets – and also highlights key issues around particular types of development and risk areas.

In the case of electrical assets, National Grid does not authorise or agree safe systems of work with developers and contractors. However, we will advise on issues such as electrical safety clearances and the location of towers and cables. We also work with developers to minimise the impact of any National Grid assets that are nearby.

## How to identify specific National Grid sites

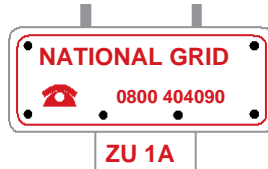
### Substations

The name of the Substation and emergency contact number will be on the site sign.



### Overhead Lines

The reference number of the tower and the emergency contact number will be on this type of sign.



## Contact National Grid

### Plant protection

For routine enquiries regarding planned or scheduled works, contact the Asset Protection team online, by email or phone.

**www.lsbud.co.uk**

**Email:** [assetprotection@nationalgrid.com](mailto:assetprotection@nationalgrid.com)

**Phone:** 0800 001 4282

### Emergencies

In the event of occurrences such as a cable strike, coming into contact with an overhead line conductor or identifying any hazards or problems with National Grid's equipment, phone our emergency number 0800 404 090 (option 1).

If you have apparatus within 30m of a National Grid asset, please ensure that the emergency number is included in your site's emergency procedures.

### Consider safety

Consider the hazards identified in this document when working near electrical equipment



## Part 1

# Electricity transmission infrastructure

National Grid owns and maintains the high-voltage electricity transmission network in England and Wales (Scotland has its own networks). It's responsible for balancing supply with demand on a minute-by-minute basis across the network.

### Overhead lines

Overhead lines consist of two main parts – pylons (also called towers) and conductors (or wires). Pylons are typically steel lattice structures mounted on concrete foundations. A pylon's design can vary due to factors such as voltage, conductor type and the strength of structure required.

Conductors, which are the 'live' part of the overhead line, hang from pylons on insulators. Conductors come in several different designs depending on the amount of power that is transmitted on the circuit.

In addition to the two main components, some Overhead Line Routes carry a Fibre Optic cable between the towers with an final underground connection to the Substations.

In most cases, National Grid's overhead lines operate at 275kV or 400kV.

### Underground cables

Underground cables are a growing feature of National Grid's network. They consist of a conducting core surrounded by layers of insulation and armour. Cables can be laid in the road, across open land or in tunnels. They operate at a range of voltages, up to 400kV.

### Substations

Substations are found at points on the network where circuits come together or where a rise or fall in voltage is required. Transmission substations tend to be large facilities containing equipment such as power transformers, circuit breakers, reactors and capacitors. In addition Diesel generators and compressed air systems can be located there.

## Part 2

# Statutory requirements for working near high-voltage electricity

The legal framework that regulates electrical safety in the UK is *The Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002*. This also details the minimum electrical safety clearances, which are used as a basis for the Energy Networks Association (ENA) TS 43-8. These standards have been agreed by CENELEC (European Committee for Electrotechnical Standardisation) and also form part of the *British Standard BS EN 50341-1:2012 Overhead Electrical Lines exceeding AC 1kV*. All electricity companies are bound by these rules, standards and technical specifications. They are required to uphold them by their operator's licence.

### Electrical safety clearances

It is essential that a safe distance is kept between the exposed conductors and people and objects when working near National Grid's electrical assets. A person does not have to touch an exposed conductor to get a life-threatening

electric shock. At the voltages National Grid operates at, it is possible for electricity to jump up to several metres from an exposed conductor and kill or cause serious injury to anyone who is nearby. For this reason, there are several legal requirements and safety standards that must be met.

Any breach of legal safety clearances will be enforced in the courts. This can and has resulted in the removal of an infringement, which is normally at the cost of the developer or whoever caused it to be there. Breaching safety clearances, even temporarily, risks a serious incident that could cause serious injury or death.

National Grid will, on request, advise planning authorities, developers or third parties on any safety clearances and associated issues. We can supply detailed drawings of all our overhead line assets marked up with relevant safe areas.



« [Section continued from previous page](#)

### **Your Responsibilities - Overhead lines**

Work which takes place near overhead power lines carries a significant risk of coming into proximity with the wires. If any person, object or material gets too close to the wires, electricity could 'flashover' and be conducted to earth, causing death or serious injury. You do not need to touch the wires for this to happen. The law requires that work is carried out in close proximity to live overhead power lines only when there is no alternative, and only when the risks are acceptable and can be properly controlled. Statutory clearances exist which must be maintained, as prescribed by the Electricity Safety, Quality and Continuity Regulations 2002.

Under the Health and Safety at Work etc. Act 1974 and Management of Health and Safety at Work Regulations 1999, you are responsible for preparing a suitable and sufficient risk assessment and safe systems of work, to ensure that risks are managed properly and the safety of your workforce and others is maintained. Your risk assessment must consider and manage all of the significant risks and put in place suitable precautions/controls in order to manage the work safely. You are also responsible for ensuring that the precautions identified are properly implemented and stay in place throughout the work.

Work near overhead power lines must always be conducted in accordance with GS6, 'avoiding danger from overhead power lines', and any legislation which is relevant to the work you are completing.

### **What National Grid will provide**

National Grid can supply profile drawings in PDF and CAD format showing tower locations and relevant clearances to assist you in the risk assessment process.

### **What National Grid will not provide**

National Grid will not approve safe systems of work or approve design proposals

## Part 3

# What National Grid will do for you and your development

### Provision of information

National Grid should be notified during the planning stage of any works or developments taking place near our electrical assets, ideally a minimum notification period of 8 weeks to allow National Grid to provide the following services:

#### Drawings

National Grid will provide relevant drawings of overhead lines or underground cables to make sure the presence and location of our services are known. Once a third party or developer has contacted us, we will supply the drawings for free.

# 400kV

*The maximum nominal voltage of the underground cables in National Grid's network*

#### Risk or impact identification

National Grid can help identify any hazards or risks that the presence of our assets might bring to any works or developments. This includes both the risk to safety from high-voltage electricity and longer-term issues, such as induced currents, noise and maintenance access that may affect the outcome of the development. National Grid will not authorise specific working procedures, but we can provide advice on best practice.





## Risks or hazards to be aware of

This section includes a brief description of some of the hazards and issues that a third party or developer might face when working or developing close to our electrical infrastructure.

### Land and access

National Grid has land rights in place with landowners and occupiers, which cover our existing overhead lines and underground cable network. These agreements, together with legislation set out under the *Electricity Act 1989*, allow us to access our assets to maintain, repair and renew them. The agreements also lay down restrictions and covenants to protect the integrity of our assets and meet safety regulations. Anyone proposing a development close to our assets should carefully examine these agreements.

Our agreements often affect land both inside and outside the immediate vicinity of an asset. Rights will include the provision of access, along with restrictions that ban the development of land through building, changing levels, planting and other operations. Anyone looking to develop close to our assets must consult with National Grid first.

### For further information, contact Asset Protection:

Email: [assetprotection@nationalgrid.com](mailto:assetprotection@nationalgrid.com)  
Phone: 0800 001 4282

### Electrical clearance from overhead lines

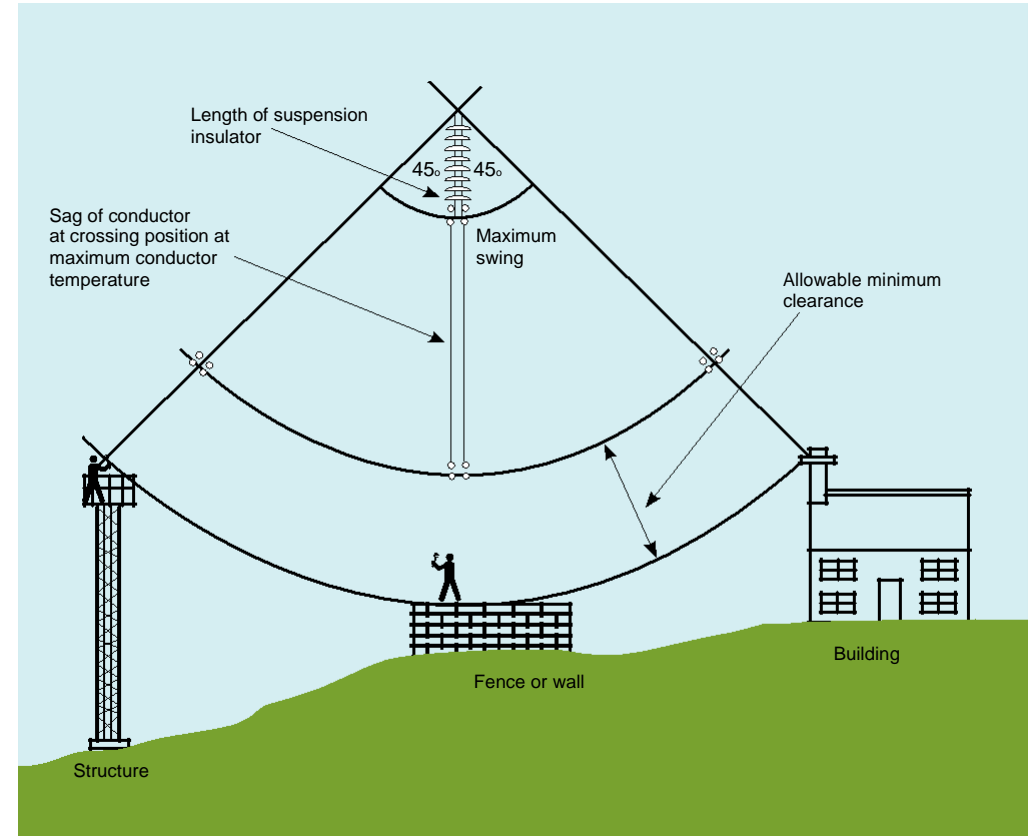
The clearance distances referred to in this section are specific to 400kV overhead lines. National Grid can advise on the distances required around different voltages i.e. 132kV and 275kV.

As we explained earlier, *Electrical Networks Association TS 43-8* details the legal clearances to our overhead lines. The minimum clearance between the conductors of an overhead line and the ground is 7.3m at maximum sag. The sag is the vertical distance between the wire's highest and lowest point. Certain conditions, such as power flow, wind speed and air temperature can cause conductors to move and allowances should be made for this.

The required clearance from the point where a person can stand to the conductors is 5.3m. To be clear, this means there should be at least 5.3m from where someone could stand on any structure (i.e. mobile and construction equipment) to the conductors. Available clearances will be assessed by National Grid on an individual basis.

National Grid expects third parties to implement a safe system of work whenever they are near Overhead Lines.

Diagram not to scale



There should be at least 5.3m between the conductors and any structure someone could stand on

We recommend that guidance such as *HSE Guidance Note GS6 (Avoiding Danger from Overhead Power Lines)* is followed, which provides advice on how to avoid danger from all overhead lines, at all voltages. If you are carrying out work near overhead lines you must contact National Grid, who will provide the relevant profile drawings.

# 7.3m

The required minimum clearance between the conductors of an overhead line, at maximum sag, and the ground

Section continues on next page »



The undergrounding of electricity cables at Ross-on-Wye

« Section continued from previous page

**Underground cables** Underground cables operating at up to 400kV are a significant part of the National Grid Electricity Transmission network. When your works will involve any ground disturbance it is expected that a safe system of work is put in place and that you follow guidance such as *HSG 47 (Avoiding Danger from Underground Services)*.

You must contact National Grid to find out if there are any underground cables near your proposed works. If there are, we will provide cable profiles and location drawings and, if required, on-site supervision of the works. Cables can be laid under roads or across industrial or agricultural land. They can even be layed in canal towpaths and other areas that you would not expect.

Cables crossing any National Grid high-voltage (HV) cables directly buried in the ground are required to maintain a minimum separation that will be determined by National Grid on a case-by-case basis. National Grid will need to do a rating study on the existing cable to work out if there are any adverse effects on either cable rating. We will only allow a cable to cross such an area once we know the results of the re-rating. As a result, the clearance distance may need to be increased or alternative methods of crossing found.

For other cables and services crossing the path of our HV cables, National Grid will need confirmation that published standards and clearances are met.

### Impressed voltage

Any conducting materials installed near high-voltage equipment could be raised to an elevated voltage compared to the local earth, even when there is no direct contact with the high-voltage equipment. These impressed voltages are caused by inductive or capacitive coupling between the high-voltage equipment and nearby conducting materials and can occur at distances of several metres away from the

equipment. Impressed voltages may damage your equipment and could potentially injure people and animals, depending on their severity. Third parties should take impressed voltages into account during the early stages and initial design of any development, ensuring that all structures and equipment are adequately earthed at all times.

Section continues on next page »



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### Earth potential rise

Under certain system fault conditions – and during lightning storms – a rise in the earth potential from the base of an overhead line tower or substation is possible. This is a rare phenomenon that occurs when large amounts of electricity enter the earth. This can pose a serious hazard to people or equipment that are close by.

We advise that developments and works are not carried out close to our tower bases, particularly during lightning storms.

### Noise

Noise is a by-product of National Grid's operations and is carefully assessed during the planning and construction of any of our equipment. Developers should consider the noise emitted from National Grid's sites or overhead lines when planning any developments, particularly housing. Low-frequency hum from substations can, in some circumstances, be heard up to 1km or more from the site, so it is essential that developers find adequate solutions for this in their design. Further information about likely noise levels can be provided by National Grid.

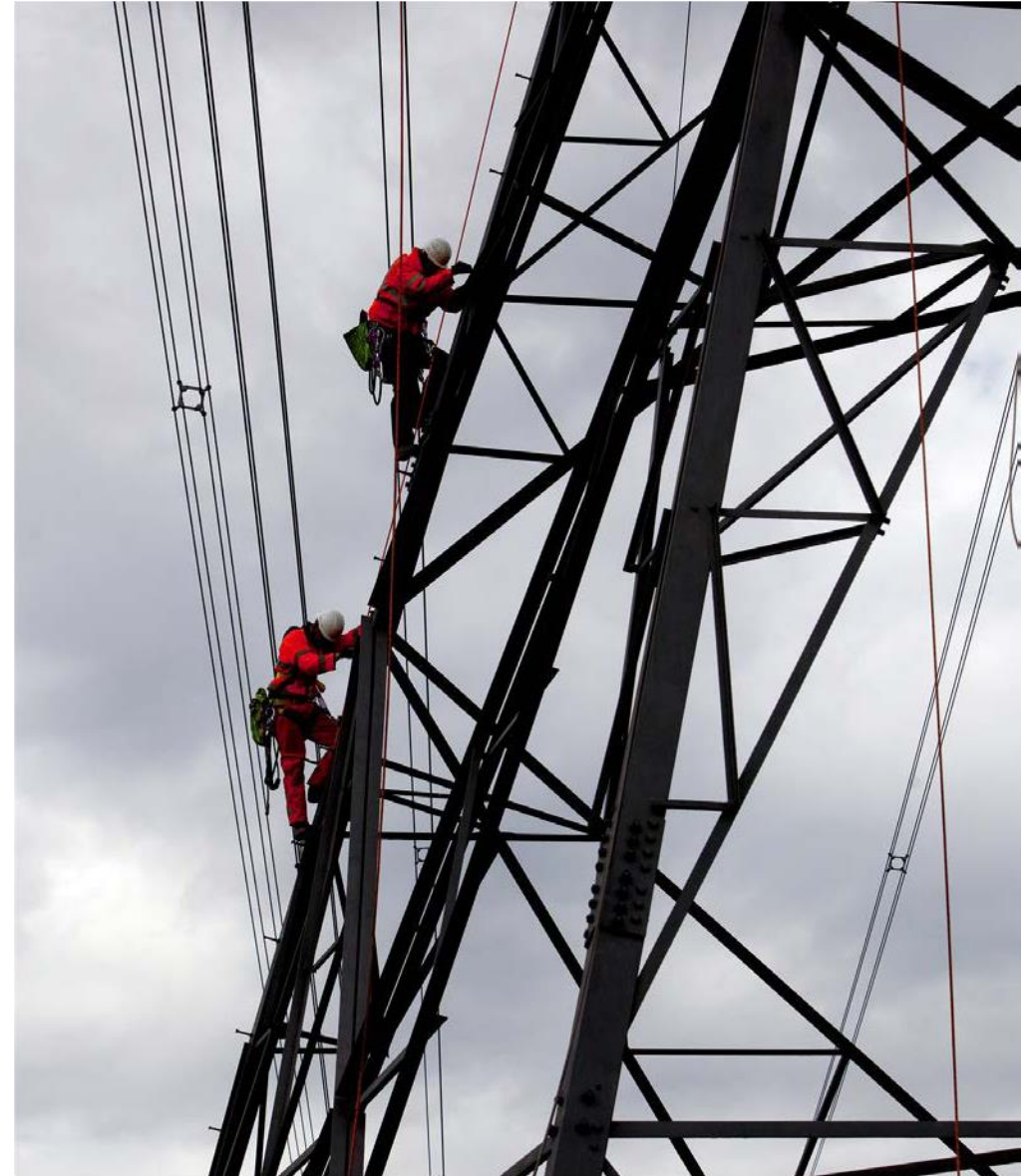
### Maintenance access

National Grid needs to have safe access for vehicles around its assets and work that restricts this will not be allowed. In terms of our overhead lines, we wouldn't want to see any excavations made, or permanent structures built, that might affect the foundations of our towers. The size of the foundations around a tower base depends on the type of tower that is built there. If you wish to carry out works within 30m of the tower base, contact National Grid for more information. Our business has to maintain access routes to tower bases with land owners. For that reason, a route wide enough for an HGV must be permanently available. We may need to access our sites, towers, conductors and underground cables at short notice.

# 30m

*If you wish to carry out work within this distance of the tower base, you must contact National Grid for more information*

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### Fires and firefighting

National Grid does not recommend that any type of flammable material is stored under overhead lines. Developers should be aware that in certain cases the local fire authority will not use water hoses to put out a fire if there are live, high-voltage conductors within 30m of the seat of the fire (as outlined in ENA TS 43-8).

In these situations, National Grid would have to be notified and reconfigure the system – to allow staff to switch out the overhead line – before any firefighting could take place. This could take several hours.

We recommend that any site which has a specific hazard relating to fire or flammable material should include National Grid's emergency contact details (found at the beginning and end of this document) in its fire plan information, so any incidents can be reported.

Developers should also make sure their insurance cover takes into account the challenge of putting out fires near our overhead lines.

### Excavations, piling or tunnelling

You must inform National Grid of any works that have the potential to disturb the foundations of our substations or overhead line towers. This will have to be assessed by National Grid engineers before any work begins.

*BS ISO 4866:2010* states that a minimum distance of 200m should be maintained when carrying out quarry blasting near our assets. However, this can be reduced with specific site surveys and changes to the maximum instantaneous charge (the amount of explosive detonated at a particular time).

All activities should observe guidance layed out in *BS 5228-2:2009*.

### Microshocks

High-voltage overhead power lines produce an electric field. Any person or object inside this field that isn't earthed picks up an electrical charge. When two conducting objects – one that is grounded and one that isn't – touch, the charge can equalise and cause a small shock, known as a microshock. While they are not harmful, they can be disturbing for the person or animal that suffers the shock.

For these reasons, metal-framed and metal-clad buildings which are close to existing overhead lines should be earthed to minimise the risk of microshocks. Anything that isn't earthed, is conductive and sits close to the lines is likely to pick up a charge. Items such as deer fences, metal palisade fencing, chain-link fences and metal gates underneath overhead lines all need to be earthed.

For further information on microshocks please visit [www.emfs.info](http://www.emfs.info).



# 200m

*The minimum distance that should be maintained from National Grid assets when quarry blasting*



## Specific development guidance

### Wind farms

National Grid's policy towards wind farm development is closely connected to the *Electricity Networks Association Engineering Recommendation L44 Separation between Wind Turbines and Overhead Lines, Principles of Good Practice*. The advice is based on national guidelines and global research. It may be adjusted to suit specific local applications.

There are two main criteria in the document:

(i) The turbine shall be far enough away to avoid the possibility of toppling onto the overhead line

(ii) The turbine shall be far enough away to avoid damage to the overhead line from downward wake effects, also known as turbulence

The toppling distance is the minimum horizontal distance between the worst-case pivot point of the wind turbine and the conductors hanging in still air. It is the greater of:

- the tip height of the turbine plus 10%
- or, the tip height of the turbine plus the electrical safety distance that applies to the voltage of the overhead line.

To minimise the downward wake effect on an overhead line, the wind turbine should be three times the rotor distance away from the centre of the overhead line.

Wake effects can prematurely age conductors and fittings, significantly reducing the life of the asset. For that reason, careful consideration should be taken if a wind turbine needs to be sited within the above limits. Agreement from National Grid will be required.

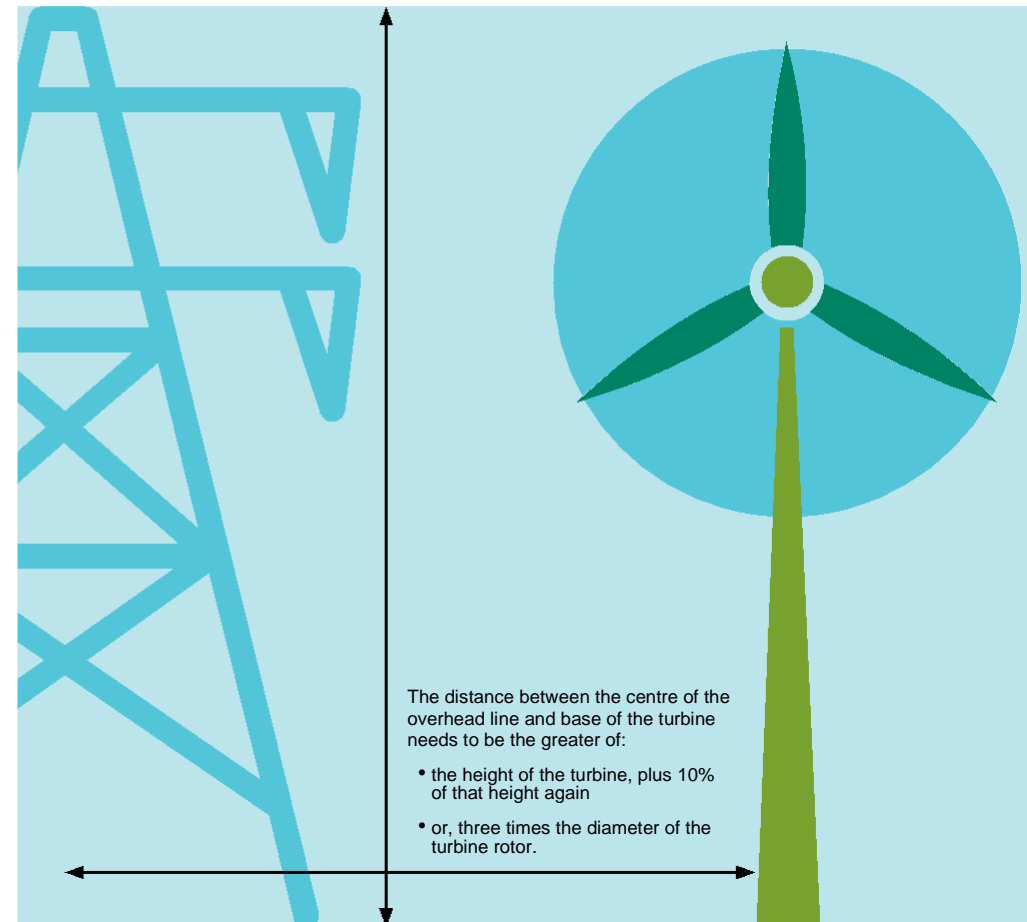
### Commercial and housing developments

National Grid has developed a document called *Design guidelines for development near pylons and HVO power lines*, which gives advice to anyone involved in planning or designing large-scale developments that are crossed by, or close to, overhead lines.

The document focuses on existing 275kV and 400kV overhead lines on steel lattice towers, but can equally apply to 132kV and below. The document explains how to design large-scale developments close to high-voltage lines, while respecting clearances and the development's visual and environmental impact.

Section continues on next page »

Diagram not to scale



Turbines should be far enough away to avoid the possibility of toppling onto the overhead line



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The advice is intended for developers, designers, landowners, local authorities and communities, but is not limited to those organisations.

Overall, developers should be aware of all the hazards and issues relating to the electrical equipment that we have discussed when designing new housing.

As we explored earlier, National Grid's assets have the potential to create noise. This can be low frequency and tonal, which makes it quite noticeable. It is the responsibility of developers to take this into account during the design stage and find an appropriate solution.

### Solar farms

While there is limited research and recommendations available, there are several key factors to consider when designing Solar Farms in the vicinity of Overhead Power Lines.

Developers may be looking to build on arable land close to National Grid's assets. In keeping with the safety clearance limits that we outlined earlier for solar panels directly underneath overhead line conductors, the highest point on the solar panels must be no more than 5.3m from the lowest conductors.

This means that the maximum height of any structure will need to be determined to make sure safety clearance limits aren't breached. This could be as low as 2m. National Grid will supply profile drawings to aid the planning of solar farms and determine the maximum height of panels and equipment.

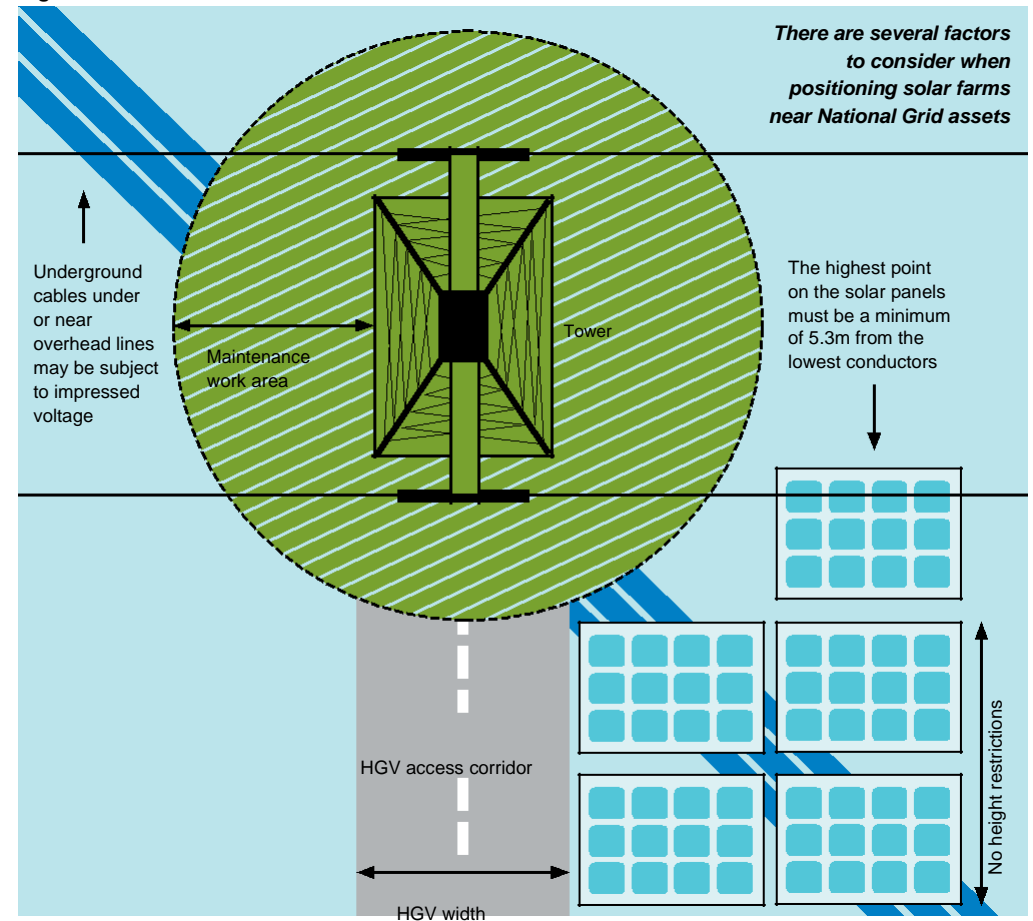
Solar panels that are directly underneath power lines risk being damaged on the rare occasion that a conductor or fitting falls to the ground. A more likely risk is ice falling from conductors or towers in winter and damaging solar panels.

There is also a risk of damage during adverse weather conditions, such as lightning storms, and system faults. As all our towers are earthed, a weather event such as lightning can cause a rise in the earth potential around the base of a tower. Solar panel support structures and supply cables should be adequately earthed and bonded together to minimise the effects of this temporary rise in earth potential.

Any metallic fencing that is located under an overhead line will pick up an electrical charge. For this reason, it will need to be adequately earthed to minimise microshocks to the public.

For normal, routine maintenance and in an emergency National Grid requires unrestricted access to its assets. So if a tower is enclosed in a solar farm compound, we will need full access for our vehicles,

Diagram not to scale



Including access through any compound gates. During maintenance – and especially re-conductoring – National Grid would need enough space near our towers for winches and cable drums. If enough space is not available, we would require solar panels to be temporarily removed.



## Asset protection agreements

In some cases, where there is a risk that development will impact on National Grid's assets, we will insist on an asset protection agreement being put in place. The cost of this will be the responsibility of the developer or third party.

## Contact details

### Emergency situations

If you spot a potential hazard on or near an overhead electricity line, do not approach it, even at ground level. Keep as far away as possible and follow the six steps below:

- Warn anyone close by to evacuate the area
- Call our 24-hour electricity emergency number: 0800 404 090 (Option 1)<sup>1</sup>
- Give your name and contact phone number
- Explain the nature of the issue or hazard
- Give as much information as possible so we can identify the location – i.e. the name of the town or village, numbers of nearby roads, postcode and (ONLY if it can be observed without putting you or others in danger) the tower number of an adjacent pylon
- Await further contact from a National Grid engineer

<sup>1</sup> It is critically important that you don't use this phone number for any other purpose. If you need to contact National Grid for another reason please use our Contact Centre at [www2.nationalgrid.com/contact-us](http://www2.nationalgrid.com/contact-us) to find the appropriate information or call 0800 0014282.

### Routine enquiries

Email:  
[assetprotection@nationalgrid.com](mailto:assetprotection@nationalgrid.com)

Call Asset Protection on:  
0800 0014282

Opening hours:  
Monday to Friday 08:00-16:00

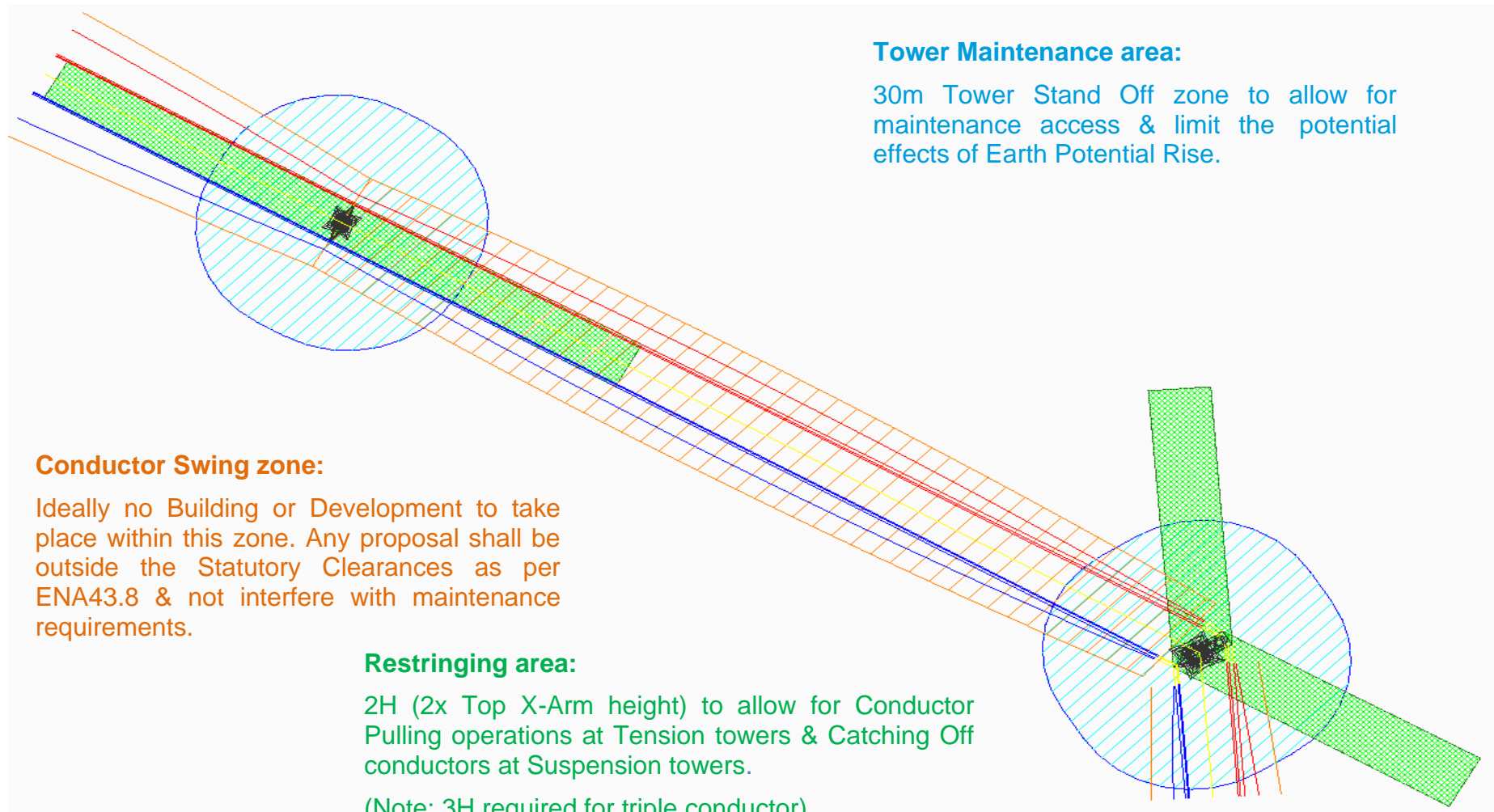
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## OHL Tower Stand Off & Reconducting Area



### Conductor Swing zone:

Ideally no Building or Development to take place within this zone. Any proposal shall be outside the Statutory Clearances as per ENA43.8 & not interfere with maintenance requirements.

### Restringing area:

2H (2x Top X-Arm height) to allow for Conductor Pulling operations at Tension towers & Catching Off conductors at Suspension towers.

(Note: 3H required for triple conductor)

### Tower Maintenance area:

30m Tower Stand Off zone to allow for maintenance access & limit the potential effects of Earth Potential Rise.

**From:** [REDACTED]  
**To:** [SDC M40 Campus](#)  
**Subject:** FORMAL RESPONSE EIA SCOPING@2026 05 26: (#26936) FW: EN0110030 - SDC M40 Campus - EIA Scoping and Consultation and Regulation 11 Notification  
**Date:** 26 May 2026 16:58:53

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FAO: Laura Feekins-Bate, Planning Inspectorate

Reference: EN0110030

Our reference: #26936

Location: Land North of the M40 motorway and South of the A40 Oxford Road

Proposal: Application by Slough Holdings UK Limited (the applicant) for an Order granting Development Consent for the SDC M40 Campus (the proposed development)

Dear Laura,

Thank you for your letter dated 29 April 2026 consulting us on the EIA Scoping Opinion in relation to the above.

National Highways has been appointed by the Secretary of State for Transport as strategic highway company under the provisions of the Infrastructure Act 2015 and is the highway authority, traffic authority and street authority for the strategic road network (SRN). The SRN is a critical national asset and as such National Highways works to ensure that it operates and is managed in the public interest, both in respect of current activities and needs as well as in providing effective stewardship of its long-term operation and integrity.

We will therefore be concerned with proposals that have potential to impact the safe and efficient operation of the SRN, in this case the M40 motorway.

We note that the applicant is seeking an Order for Development Consent to provide a Data Centre Campus (comprising of three individual data centres with associated office space and fuel storage) and an integrated energy generation centre (the 'Energy Centre') which will supply energy to the Data Centre Campus. The application includes associated infrastructure, access, and landscaping across the site. Inclusion of a Waste Heat Recovery / District Heating Plant is being considered, but not yet confirmed. The application Site is currently vacant, but has previously been used for landfill.

Whilst we do not offer a view on the overall scope of the Environmental Statement, given the location of the site approximately 3km from M40 Junction 2, we wish to be included in further discussions with the applicant to develop the scope and any modelling requirements to inform Transport Assessment, which should assess any potential impacts to the M40 motorway and take account any other development in the area. As the site directly abuts the M40 boundary, we will also require further

engagement with the applicant regarding boundary matters such as landscaping and drainage.

Please continue to consult us as this proposal develops via our planning inbox: [planningse@nationalhighways.co.uk](mailto:planningse@nationalhighways.co.uk)

Regards

**Mrs Beata Ginn (Assistant Spatial Planner (Area 3))**

Operations Directorate, Spatial Planning Team South  
National Highways | Ground Floor, Building 1000, Cathedral Square, Guildford,  
GU2 7YL.

**Mobile:** [REDACTED]

**Web:** <https://nationalhighways.co.uk/our-roads/planning-and-the-strategic-road-network-in-england/>

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**National Highways Limited | General enquiries: 0300 123 5000 | National Traffic Operations Centre, 3 Ridgeway, Quinton Business Park, Birmingham B32 1AF | <https://nationalhighways.co.uk> | [info@nationalhighways.co.uk](mailto:info@nationalhighways.co.uk)**

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## Georgia Pathy

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**From:** NATS Safeguarding <NATSSafeguarding@nats.co.uk>  
**Sent:** 01 May 2026 08:50  
**To:** SDC M40 Campus  
**Subject:** RE: EN0110030 - SDC M40 Campus - EIA Scoping and Consultation and Regulation 11 Notification [SG41421]

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

**Categories:** EST

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Our Ref: SG41421

Dear Sir/Madam

The proposed development has been examined from a technical safeguarding aspect and does not conflict with our safeguarding criteria. Accordingly, NATS (En Route) Public Limited Company ("NERL") has no safeguarding objection to the proposal.

However, please be aware that this response applies specifically to the above consultation and only reflects the position of NATS (that is responsible for the management of en route air traffic) based on the information supplied at the time of this application. This letter does not provide any indication of the position of any other party, whether they be an airport, airspace user or otherwise. It remains your responsibility to ensure that all the appropriate consultees are properly consulted.

If any changes are proposed to the information supplied to NATS in regard to this application which become the basis of a revised, amended or further application for approval, then as a statutory consultee NERL requires that it be further consulted on any such changes prior to any planning permission or any consent being granted.

Yours faithfully

**NATS**

NATS Safeguarding

E: [natssafeguarding@nats.co.uk](mailto:natssafeguarding@nats.co.uk)

4000 Parkway, Whiteley,  
Fareham, Hants PO15 7FL  
[www.nats.co.uk](http://www.nats.co.uk)



NATS Internal

---

**From:** SDC M40 Campus <SDCM40Campus@planninginspectorate.gov.uk>

**Sent:** 29 April 2026 15:36

**Subject:** EN0110030 - SDC M40 Campus - EIA Scoping and Consultation and Regulation 11 Notification

Your attachments have been security checked by Mimecast Attachment Protection. Files where no threat or malware was detected are attached.

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Dear Sir/ Madam

Please see attached correspondence on the proposed SDC M40 Campus project.

The applicant for the proposed development intends to make an application for development consent under the Planning Act 2008. The applicant has sought a scoping opinion from the Planning Inspectorate, on behalf of the Secretary of State, as to the scope and level of detail of the information to be provided within the environmental statement that will accompany the future application.

The Planning Inspectorate has identified you as a consultation body to inform the scoping opinion and is therefore inviting you to submit comments by **27 May 2026**. The deadline is a statutory requirement that cannot be extended.

Further information is included within the attached letter.

Kind regards  
Laura



**Laura Feekins-Bate**  
Senior Environmental Advisor  
Planning Inspectorate  
T 0303 444 5828

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@PINSgov Planning Inspectorate [planninginspectorate.gov.uk](https://www.planninginspectorate.gov.uk)

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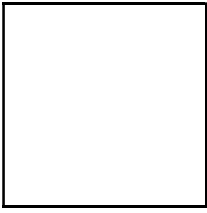
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---

Date: 21 May 2026  
Our ref: 547823  
Your ref: EN0110030



sdcm40campus@planninginspectorate.gov.uk

**BY EMAIL ONLY**

Customer Services  
Hornbeam House  
Crewe Business Park  
Electra Way  
Crewe  
Cheshire  
CW1 6GJ

T 0300 060 3900

Dear Laura Feekins-Bate,

**Environmental Impact Assessment Scoping Consultation under Regulation 10 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) – Regulation 11**

**Proposal:** SDC M40 Campus

Thank you for seeking our advice on the scope of the Environmental Statement (ES) in the consultation dated 29 April 2026, received on the same date.

Natural England is a non-departmental public body. Our statutory purpose is to ensure that the natural environment is conserved, enhanced, and managed for the benefit of present and future generations, thereby contributing to sustainable development.

A robust assessment of environmental impacts and opportunities, based on relevant and up to date environmental information, should be undertaken prior to an application for a Development Consent Order (DCO). Annex A to this letter provides Natural England's advice on the scope of the Environmental Impact Assessment (EIA) for the proposed development.

Should the proposal be amended in a way which significantly affects its impact on the natural environment then, in accordance with Section 4 of the Natural Environment and Rural Communities Act 2006, Natural England should be consulted again.

For any further advice on this consultation please contact the case officer Jonathan Shavelar and copy to [consultations@naturalengland.org.uk](mailto:consultations@naturalengland.org.uk).

Yours sincerely

Jonathan Shavelar  
Senior Officer  
Thames Solent Team

## Annex A – Advice related to EIA Scoping Requirements

### 1 General Principles

Regulation 11 of the Infrastructure Planning Regulations 2017 - (The EIA Regulations) sets out the information that should be included in an Environmental Statement (ES) to assess impacts on the natural environment. This includes:

- A description of the development – including physical characteristics and the full land use requirements of the site during construction and operational phases.
- Appropriately scaled and referenced plans which clearly show the information and features associated with the development.
- An assessment of alternatives and clear reasoning as to why the preferred option has been chosen.
- A description of the aspects and matters requested to be scoped out of further assessment with adequate justification provided<sup>1</sup>.
- Expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation etc.) resulting from the operation of the proposed development.
- A description of the aspects of the environment likely to be significantly affected by the development including biodiversity (for example fauna and flora), land, including land take, soil, water, air, climate (for example greenhouse gas emissions, impacts relevant to adaptation, cultural heritage and landscape and the interrelationship between the above factors).
- A description of the likely significant effects of the development on the environment – this should cover direct effects but also any indirect, secondary, cumulative, short, medium, and long term, permanent and temporary, positive, and negative effects. Effects should relate to the existence of the development, the use of natural resources (in particular land, soil, water and biodiversity) and the emissions from pollutants. This should also include a description of the forecasting methods to predict the likely effects on the environment.
- A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.
- An outline of the structure of the proposed ES.

From the Scoping report provided, Natural England consider that these general principles **will** be appropriately addressed through the EIA process.

### 2 Cumulative and in-combination effects

The ES should fully consider the implications of the whole development proposal. This should include an assessment of all supporting infrastructure.

An impact assessment should identify, describe, and evaluate the effects that are likely to result from the project in combination with other projects and activities that are being, have been or will be carried out. The following types of projects should be included in such an assessment (subject to available information):

- a. existing completed projects
- b. approved but uncompleted projects
- c. ongoing activities
- d. plans or projects for which an application has been made and which are under consideration by the consenting authorities; and
- e. plans and projects which are reasonably foreseeable, i.e. projects for which an application has not yet been submitted, but which are likely to progress before completion of the development and for which sufficient information is available to assess the likelihood of cumulative and in-combination effects.

The scope of an in-combination assessment should include plans and projects which are 'live' at the same time as the assessment being undertaken. These can potentially include:

1. The incomplete or non-implemented parts of plans or projects that have already commenced;
2. Plans or projects given consent or given effect but not yet started;
3. Plans or projects currently subject to an application for consent or proposed to be given effect;
4. Projects that are the subject of an outstanding appeal;
5. Ongoing plans or projects that are the subject of regular review and renewal;
6. Any draft plans being prepared by any public body; and
7. Any proposed plans or projects that are reasonably foreseeable and/or published for consultation prior to application.

### **3 Environmental data**

Natural England is required to make available information it holds where requested to do so. National datasets held by Natural England are available [here](#).

Detailed information on the natural environment is available at [www.magic.gov.uk](http://www.magic.gov.uk).

Natural England's Site of Special Scientific Interest (SSSI) Impact Risk Zones are a GIS dataset which can be used to help identify the potential for the development to impact on a SSSI. The dataset and user guidance can be accessed from the [Natural England Open Data Geportal](#).

Natural England does not hold local information on local sites, local landscape character, priority habitats and species or protected species. Local environmental data should be obtained from the appropriate local bodies. This may include the local environmental records centre, the local wildlife trust, local geo-conservation group or other recording society.

### **4 Biodiversity and Geodiversity**

Natural England advises that the potential impact of the proposal upon features of nature conservation interest and opportunities for habitat creation/enhancement should be included within this assessment in accordance with appropriate guidance. Guidelines for Ecological Impact Assessment (EclA) have been developed by the Chartered Institute of Ecology and Environmental Management (CIEEM) and are available on their [website](#).

The assessment will need to include potential impacts of the proposal upon sites and features of nature conservation interest as well as opportunities for nature recovery through biodiversity net gain (BNG).

Paragraph 6.4.4 of the EIA Scoping Report states that the Buckinghamshire Local Nature Recovery Strategy (LNRS) is under development. This is now published and available [online](#). We advise that the development's BNG and any relevant mitigation or enhancement opportunities take advantage of the LNRS.

### **5 Designated nature conservation sites**

#### **5.1 International and European sites**

The ES should thoroughly assess the potential for the proposal to affect internationally designated sites of nature conservation importance / European sites, including marine sites where relevant. This includes Special Protection Areas (SPA), Special Areas of Conservation (SAC), listed Ramsar sites, candidate SAC and proposed SPA.

European site conservation objectives are available [here](#). An appropriate assessment will be required where a plan or project is likely to have a significant effect upon a European Site, either individually or in combination with other plans or projects.

Evidence Plans are a useful mechanism NSIP applicants can use to agree what information should be provided to the Planning Inspectorate and Natural England when undertaking Habitats Regulations Assessment (HRA). Agreeing the evidence-needs of the project early prior to applying for Development Consent may help reduce delays in the process. More information on Evidence Plans is available [here](#).

Paragraph 6.4.16 of the Scoping Report sets out the ecological receptors within the ecological study area and includes Burnham Beeches Special Area of Conservation (SAC), Chiltern Beechwoods SAC, Windsor Forest and Great Park SAC and Southwest London Waterbodies Special Protection Area (SPA).

It is noted that potential impacts to Burnham Beeches SAC through air quality emissions are included for further assessment (6.4.52 of Scoping Report), these impacts should be assessed in line with [guidance](#) on habitats regulations assessment.

## 5.2 Nationally designated sites

### Sites of Special Scientific Interest

Sites of Special Scientific Interest are protected under the Wildlife and Countryside Act 1981 (as amended). Further information on SSSIs and interest features can be found at [www.magic.gov](http://www.magic.gov).

The ES should include a full assessment of the direct and indirect effects of the development on the features of special interest within the SSSI and identify appropriate mitigation measures to avoid, minimise or reduce any adverse significant effects.

Paragraph 6.4.16 of the Scoping Report sets out the ecological receptors within the ecological study area and appears to include all relevant Sites of Special Scientific Interest, but please note we have not been able to carry out an exhaustive desk study.

## 5.3 Regionally and Locally Important Sites

The ES should consider any impacts upon local wildlife and geological sites, including local nature reserves. Local Sites are identified by the local wildlife trust, geoconservation group or other local group. Where impacts cannot be avoided, the ES should set out proposals for mitigation of any impacts and if appropriate, compensation measures and opportunities for enhancement and improving connectivity with wider ecological networks. They may also provide opportunities for delivering beneficial environmental outcomes.

These are contacts for the relevant local body in this area who will may able to provide further information.

<b>Contact</b>	<b>Email</b>	<b>Telephone</b>
Buckinghamshire & Milton Keynes Environmental Records Centre	<a href="mailto:erc@buckscc.gov.uk">erc@buckscc.gov.uk</a>	01296382431
Buckinghamshire and Milton Keynes Natural Environment Partnership	<a href="mailto:nep@buckinghamshire.gov.uk">nep@buckinghamshire.gov.uk</a>	N/a
BBOWT	<a href="mailto:info@bbowt.org.uk">info@bbowt.org.uk</a>	01865 775476

## 5.4 Air Quality

Natural England provides the following standard advice on air pollution. This advice relates to the protection of protected sites under the Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations) and the Wildlife and Countryside Act 1981.

Protected sites are 'sites of special scientific interest' (SSSIs) and 'habitats sites' (also called 'European sites'). For the purposes of this advice, Habitats Sites are Special Areas of Conservation (SACs), possible SACs, Special Protection Areas (SPAs), Potential SPAs, Ramsar sites, and sites identified, or required, as compensatory measures for adverse effects on Habitats Sites. Although their regulatory frameworks differ, the general principles and approach for air pollution assessment outlined for Habitats Sites are also relevant for SSSIs. Where the following advice applies to both, we use the term protected sites. Where the advice or approach differs, the individual terms are used.

Standing advice on air pollution and development is also available [here](#).

Table 1 provides the steps that we advise should be taken to assess air quality impacts on protected sites. The applicant should provide their own assessment containing the information and detailed modelling necessary.

**Table 1: Sequential approach to air quality assessments**

Stage	Step	Supplemental evidence/ basis for judgment
<b>Initial screening for credible risk of an effect</b>	1	<p>Check Distance criteria - could significant emissions reach a protected site? Yes = move to Step 2 No = no further HRA required</p> <p>The <a href="#">Air Pollution Information System</a> (APIS) includes an introduction to air pollution.</p> <p>APIS provides site specific information on the interest features of individual protected sites and the sensitivity to air quality impacts of those features.</p> <p>Please see Table 2 for industrial air pollution screening distances.</p> <p>For road traffic impacts, roads on the affected road network that lie within 200m of a designated site should be considered.</p> <p>Use <a href="#">Magic Map</a> to check the location of designated sites. Search for the location then select the 'Designations' option.</p>
	2	<p>Check if the qualifying habitats or supporting habitat of qualifying species are sensitive to air quality impacts. Yes = move to Step 3 No = no further HRA required</p> <p>APIS Site relevant Critical Loads and Levels (based on literature and professional judgement) <a href="http://www.apis.ac.uk/src/">http://www.apis.ac.uk/src/</a></p> <p>Some habitats may not have a critical load because there is not enough data. In these cases, you should find the critical load for a similar habitat type or feature.</p> <p>The qualifying features of Habitats Sites can be identified in the relevant Site Conservation Objectives and Supplementary advice packages, which include a definitive list of legally qualifying features. These objectives are available <a href="#">here</a>. Alternatively, a list of qualifying features can also be found by searching for the Habitats Site and SSSIs on <a href="#">Designated Sites View</a>, alongside Conservation Objectives and Supplementary Advice for Habitats Sites.</p> <p>The above links will also show whether any of the qualifying features for Habitats Sites have a Restore or Maintain Conservation Objective in relation to air quality thresholds (critical levels or loads).</p> <p>If the site is a SPA or an SAC/SSSI designated for an animal species (as opposed to a habitat), determine whether the predicted pollution effects on the supporting habitat will have a negative effect on the notified species.</p>

<p><b>Detailed AQ modelling</b></p>	<p>3</p>	<p>Undertake detailed modelling using a recognised dispersal model – i.e. Atmospheric Dispersion Modelling System (ADMS)</p> <p>Unless robust site-specific evidence is provided, we advise the lower range of the critical load should be used in modelling. If there are site specific reasons why it is more appropriate to use the higher end of the range, then this should be clearly evidenced.</p>	<p>Air Quality modelling should include relevant scenarios that are clearly identified.</p> <p>One such example of scenarios is a baseline plus future forecasts as follows: Baseline, a construction year, and future operational year(s), do nothing (without proposal), do something (with proposal); taking into account background trends for each pollutant).</p> <p>For proposals that will emit pollutants from a point source, it is helpful to provide isopleths of the dispersion modelling results, showing the predicted contours of pollutant concentration and deposition of the development. These may be assessed against the locations of protected sites and sensitive features within those sites.</p> <p>At least 3 years of meteorological data should be included within the AQ modelling for sources other than for road transport modelling</p> <p>The Institute of Air Quality Management (IAQM) has produced the following document to assist its members in the assessment of the air quality impacts of development on designated nature conservation sites: <a href="#">air-quality-impacts-on-nature-sites-2020.pdf</a></p>
<p><b>Applying screening thresholds</b></p>	<p>4a</p>	<p>Apply Screening Threshold Alone If below threshold alone, move to step 4b. If above = move straight to step 5</p>	<p>Ascertain the Process Contribution (PC) from the plan or project (emissions and predicted deposition). Apply Screening threshold (1% of critical level or load) alone using the <u>annual averages</u>.</p> <p>If the process contribution is less than 1% of the relevant long-term benchmark (Environmental Assessment Level, Critical Level or Critical Load), the emission is not likely to have a significant effect <u>alone</u> irrespective of the background levels.</p>
<p><b>Detailed Assessment of ecological impacts</b></p>	<p>5</p>	<p>This step is to consider the ecological impacts of AQ on the interest features of the designated site and is not based only on numerical figures.</p> <p>If it is not certain whether sensitive features are located within the areas to be impacted, a site visit may be helpful to determine this.</p> <p>For SSSIs, this step should provide all the information necessary, including any required mitigation, for the decision maker to determine if there would be an adverse effect on a SSSI.</p>	<p>The following information is likely to be helpful for the decision maker:</p> <p>Is the sensitive feature(s) located within the pollution footprint? Should it be there for the site to meet its Conservation Objectives or is there some other, natural reason (e.g. hydrology), why the sensitive feature(s) would not be expected to occur there?</p> <p>Check APIS Trends Tab for reasonable expectation on whether background pollution may be decreasing or not.</p>

		If Habitats Sites are impacted by the proposals, move to Step 6.	Habitats that have already been subject to high background nitrogen deposition can develop tolerance to further deposition. This cannot be used to justify further exceedance as it would undermine conservation objectives to reverse decline. You should consider predicted effects on the species richness of a habitat against the site's conservation objectives.
<b>Appropriate Assessment (AA) for habitats sites</b>	<b>6</b>	<p>The competent authority to undertake their AA to conclude whether or not there will be an adverse effect on integrity (AEOI) of habitats sites. Any mitigation proposed should also be assessed at this point.</p> <p>Should the AA conclude that the proposal would have an AEOI that cannot be excluded with mitigation measures, consider the derogation route of the HRA process.</p> <p>Should compensation measures be required under derogation, please contact Natural England for specific advice.</p> <p>Note: If an AA has been undertaken of the proposals <u>alone</u> and concluded that there will not be an adverse effect on integrity, if there are residual impacts that are not fully mitigated, these will need to be considered in combination with other plans or projects</p>	<p>Where mitigation is required to enable a conclusion of no adverse effect on integrity to be reached the AA must be able to show that mitigation measures can be relied upon to avoid adverse effects over the full lifetime of the project (ie construction, operation and decommissioning where relevant). To be viable, such measures should be <b>effective, reliable, timely, guaranteed</b> and of <b>sufficient duration</b>. The assessment of such measures should be supported by evidence.</p> <p>When deciding on whether the proposals set out in the NSIP will have an adverse effect on Integrity on a Habitats Site, the Conservation Objectives and any supplementary advice should be taken into account. Including whether the site is already exceeding the environmental thresholds for ammonia, nitrogen oxides and nitrogen deposition and has a restore conservation objective.</p>

### Mitigation measures

If you cannot conclude there is no adverse effect, the applicant will need to apply mitigation measures. Measures will only be appropriate if you can quantify their effectiveness in reducing emissions on the protected site. You should check that mitigation measures are in place to avoid adverse effects on site integrity over the lifetime of the project.

Mitigation may include measures that:

- the applicant volunteers
- you impose through formal conditions or restrictions in any permission or authorisation – these may be different or stricter measures than ones proposed by the applicant

Examples could include:

- relocation or redesign of developments to avoid impacts on protected sites
- control of other emissions of the same pollutants with an overlapping effect
- a change in stack height for industrial processes
- Euro 6 standards for construction machinery
- adding wooded shelterbelts, trees, green walls and hedges to limit dispersal of emissions, as long as these measures in themselves would not negatively impact the protected site

**Table 2: Industrial air pollution screening distances**

Emission source	Distance for SSSIs	Distance for habitats sites
Industrial developments	2km	5km
General combustion processes (under 20MW energy input)	500m	500m
General combustion processes (20MW to 50MW energy input)	2km	2km

<b>General combustion processes (over 50MW energy input)</b>	<b>2km</b>	<b>10km</b>
Mechanical and biological waste treatment	500m	500m
Landfill waste	2km	2km
Compost (under 500 tonnes maximum annual operational throughput)	500m	500m
Compost (500 to 75,000 tonnes maximum annual operational throughput)	1km	1km
Compost (over 75,000 tonnes maximum annual operational throughput)	2km	2km
Airports, helipads and other aviation proposals	5km	5km
Oil and gas exploration and extraction	500m	500m
Quarries	200m	200m
Other industrial developments causing air pollution	500m	500m

## **6 Protected Species - Species protected by the Wildlife and Countryside Act 1981 (as amended) and by the Conservation of Habitats and Species Regulations 2017 (as amended)**

The ES should assess the impact of all phases of the proposal on protected species (including, for example, great crested newts, reptiles, birds, water voles, badgers and bats). Natural England does not hold comprehensive information regarding the locations of species protected by law, but advises on the procedures and legislation relevant to such species. Records of protected species should be sought from appropriate local biological record centres, nature conservation organisations, groups and individuals; and consideration should be given to the wider context of the site for example in terms of habitat linkages and protected species populations in the wider area, to assist in the impact assessment.

The conservation of species protected by law is explained in Part IV and Annex A of Government Circular 06/2005 [Biodiversity and Geological Conservation: Statutory Obligations and their Impact within the Planning System](#). The area likely to be affected by the proposal should be thoroughly surveyed by competent ecologists at appropriate times of year for relevant species and the survey results, impact assessments and appropriate accompanying mitigation strategies included as part of the ES.

In order to provide this information there may be a requirement for a survey at a particular time of year. Surveys should always be carried out in optimal survey time periods and to current guidance by suitably qualified and where necessary, licensed, consultants. Natural England has adopted [standing advice](#) for protected species which includes links to guidance on survey and mitigation.

Applicants should check to see if a mitigation licence is required using Natural England guidance on licensing [Natural England wildlife licences](#). Applicants can also make use of Natural England's charged service [Pre Submission Screening Service](#) for a review of a draft wildlife licence application. Natural England then reviews a full draft licence application to issue a Letter of No Impediment (LONI) which explains that based on the information reviewed to date, that it sees no impediment to a licence being granted in the future should the DCO be issued. This is done to give the Planning Inspectorate confidence to make a recommendation to the relevant Secretary of State in granting a DCO. [Advice Note Eleven, Annex C – Natural England and the Planning Inspectorate](#)

[National Infrastructure Planning](#) contains further information on the LONI process.

## 7 Priority Habitats and Species

Priority Habitats and Species are of particular importance for nature conservation and included in the England Biodiversity List published under section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. Most priority habitats will be mapped either as Sites of Special Scientific Interest, on the Magic website or as Local Wildlife Sites. Lists of priority habitats and species can be found [here](#). Natural England does not routinely hold species data. Such data should be collected when impacts on priority habitats or species are considered likely.

Consideration should also be given to the potential environmental value of brownfield sites, often found in urban areas and former industrial land. Sites can be checked against the (draft) national Open Mosaic Habitat (OMH) inventory published by Natural England and freely available to [download](#). Further information is also available [here](#).

An appropriate level habitat survey should be carried out on the site, to identify any important habitats present. In addition, ornithological, botanical, and invertebrate surveys should be carried out at appropriate times in the year, to establish whether any scarce or priority species are present.

The ES should include details of:

- Any historical data for the site affected by the proposal (e.g. from previous surveys)
- Additional surveys carried out as part of this proposal
- The habitats and species present
- The status of these habitats and species (e.g. whether priority species or habitat)
- The direct and indirect effects of the development upon those habitats and species
- Full details of any mitigation or compensation measures
- Opportunities for biodiversity net gain or other environmental enhancement

## 8 Ancient Woodland, ancient and veteran trees

The ES should assess the impacts of the proposal on the ancient woodland and any ancient and veteran trees, and the scope to avoid and mitigate for adverse impacts. It should also consider opportunities for enhancement. We welcome that the Scoping Report scopes ancient woodland into the assessment.

Ancient woodland is an irreplaceable habitat of great importance for its wildlife, its history, and the contribution it makes to our diverse landscapes. Paragraph 5.4.16 of National Policy Statement EN-1 sets out the government's commitment to maintain and enhance the existing area of ancient woodland and in paragraph 5.4.55 that development should be refused where there are impacts to irreplaceable habitats unless there are 'wholly exceptional reasons'.

The ES should include details of where impacts might occur from this development proposal on the local ancient woodland and how these can be mitigated. Information that might require consideration to inform this work includes:

- Any historical data for the site affected by the proposal (e.g. from previous surveys);
- Additional surveys carried out as part of this proposal, likely to include detailed habitat and species surveys;
- The habitats and species present;
- The status of these habitats and species (e.g. whether priority species or habitat);
- The direct and indirect effects of the development upon those habitats and species; and
- Full details of any mitigation or compensation that might be required.

Natural England maintains the Ancient Woodland [Inventory](#) which can help identify ancient woodland. The [wood pasture and parkland inventory](#) sets out information on wood pasture and parkland.

The [ancient tree inventory](#) provides information on the location of ancient and veteran trees. Natural England and the Forestry Commission have prepared [standing advice](#) on ancient woodland, ancient and veteran trees.

## 9 Biodiversity Net Gain

The government has recently published [their response](#) to consultation on biodiversity net gain (BNG).

This announcement confirms that the mandatory requirement to achieve BNG will apply to all NSIP applications made on or after 2 November 2026.

The process for implementing BNG for NSIPs is set out in the Environment Act 2021. Defra will coordinate the publication of biodiversity gain statements for every National Policy Statement (NPS). These statements, which will be published in May 2026, will have the same effect as if they were in the NPS (once BNG is live) and will later be incorporated into the relevant NPS when they are next reviewed.

## 10 Nationally designated landscapes

The development site is approximately 1.7km from the boundary of the Chilterns National Landscape and has the potential to impact on the setting of the national landscape. Although the distance from the National Landscape is referenced in the Scoping Report, it is not clear whether or not the ES will assess potential impacts to the National Landscape (via impacts to the setting).

Paragraph 5.10.8 of National Policy Statement EN-1 references potential impacts arising from projects outside the boundary of Nationally Designated Landscapes. It specifies that the duty to seek to further the purposes of the landscape applies to potentially impactful projects outside of the boundary.

Although the Scoping Report references EN-2 (4.2.19) and how natural gas generating structures commonly include features of high landscape impacts (exhaust stacks, cooling towers, etc.) we would highlight that the potential impacts to the National Landscape do not appear to have been fully recognised.

The environmental assessment should refer to the relevant [National Character Areas](#). Character area profiles set out descriptions of each landscape area and statements of environmental opportunity.

The EIA should include a full assessment of the potential impacts of the development on local landscape character using [landscape assessment methodologies](#). We encourage the use of Landscape Character Assessment (LCA), based on the good practice guidelines produced jointly by the Landscape Institute (LI) and Institute of Environmental Management and Assessment (IEMA) in 2013. LCA provides a sound basis for guiding, informing, and understanding the ability of any location to accommodate change and to make positive proposals for conserving, enhancing or regenerating character.

A landscape and visual impact assessment should also be carried out for the proposed development and surrounding area. Natural England recommends use of the methodology set out in Guidelines for Landscape and Visual Impact Assessment 2013 (3rd edition) produced by LI and IEMA.

The assessment should also include the cumulative effect of the development with other relevant existing or proposed developments in the area. This should include an assessment of the impacts of other proposals currently at scoping stage.

To ensure high quality development that responds to and enhances local landscape character and distinctiveness, the siting and design of the proposed development should reflect local

characteristics and, wherever possible, use local materials. Account should be taken of local design policies, design codes and guides as well as guidance in the [National Design Guide](#) and [National Model Design Code](#). The ES should set out the measures to be taken to ensure the development will deliver high standards of design and green infrastructure. It should also set out detail of layout alternatives, where appropriate, with a justification of the selected option in terms of landscape impact and benefit.

The National Infrastructure Commission has also produced [Design Principles for National Infrastructure - NIC](#) endorsed by Government in the National Infrastructure Strategy.

## **11 Connecting people with nature**

The ES should consider potential impacts on access land, common land, public rights of way and, where appropriate, the England Coast Path and coastal access routes and coastal margin in the vicinity of the development. It should assess the scope to mitigate for any adverse impacts.

Rights of Way Improvement Plans (ROWIP) can be used to identify public rights of way within or adjacent to the proposed site that should be maintained or enhanced.

Measures to help people to better access the countryside for quiet enjoyment and opportunities to connect with nature should be considered. Such measures could include reinstating existing footpaths or the creation of new footpaths, cycleways, and bridleways. Links to other green networks and, where appropriate, urban fringe areas should also be explored to help promote the creation of wider green infrastructure. Access to nature within the development site should also be considered, including the role that natural links have in connecting habitats and providing potential pathways for movements of species.

Relevant aspects of local authority green infrastructure strategies should be incorporated where appropriate.



## **Proposed DCO Application by Slough Holdings UK Limited for SDC M40 Campus**

### **Royal Mail response to EIA Scoping Consultation**

Under section 35 of the Postal Services Act 2011, Royal Mail has been designated by Ofcom as a provider of the Universal Postal Service. Royal Mail is the only such provider in the United Kingdom. The Act provides that Ofcom's primary regulatory duty is to secure the provision of the Universal Postal Service. Ofcom discharges this duty by imposing regulatory conditions on Royal Mail, requiring it to provide the Universal Postal Service.

Royal Mail's performance of the Universal Service Provider obligations is in the public interest and should not be affected detrimentally by any statutorily authorised project. Accordingly, Royal Mail seeks to take all reasonable steps to protect its assets and operational interests from any potentially adverse impacts of proposed development.

Royal Mail and its advisor BNP Paribas Real Estate have reviewed the EIA Scoping Report dated April 2026. There are several operational Royal Mail properties within 10km of the proposed scheme.

The construction of this infrastructure proposal has been identified as having potential to impact on Royal Mail operational interests, particularly given the impact the proposed development could have on the Strategic Road Network, particularly the A40. However, at this point in time Royal Mail is not able to provide a consultation response due to insufficient information being available to adequately assess the level of risk to its operation and the available mitigations for any risk. Consequently, Royal Mail wishes to reserve its position to submit a consultation response/s at a later stage in the consenting process and to give evidence at any future Public Examination, if required.

In the meantime, any further consultation information on this infrastructure proposal and any questions of Royal Mail should be sent to:

**Holly Trotman** ([REDACTED]@royalmail.com), Senior Planning Lawyer, Royal Mail Group Limited

**Callum Connor** ([REDACTED]@struttandparker.com), Strutt & Parker.

Please can you confirm receipt of this holding statement by Royal Mail.

End





UK Health  
Security  
Agency

Environmental Hazards and Emergencies Department  
Seaton House, City Link  
London Road  
Nottingham, NG2 4LA

[nsipconsultations@ukhsa.gov.uk](mailto:nsipconsultations@ukhsa.gov.uk)  
[www.gov.uk/ukhsa](http://www.gov.uk/ukhsa)

Your Ref: xxxxxxxx  
Our Ref: 95044CIRIS

Ms Laura Feekins-Bate  
Senior Environmental Advisor  
The Planning Inspectorate  
c/o QUADIENT  
69 Buckingham Avenue  
Slough SL1 4PN

26<sup>th</sup> May 2026

Dear Ms Feekins-Bate

**Nationally Significant Infrastructure Project  
SDC M40 Campus EN0110030  
Scoping Consultation Stage**

Thank you for including the UK Health Security Agency (UKHSA) in the scoping consultation phase of the above application. ***Please note that we request views from the Office for Health Improvement and Disparities (OHID) and the response provided below is sent on behalf of both UKHSA and OHID.*** The response is impartial and independent.

The health of an individual or a population is the result of a complex interaction of a wide range of different determinants of health, from an individual's genetic make-up to lifestyles and behaviours, and the communities, local economy, built and natural environments to global ecosystem trends. All developments will have some effect on the determinants of health, which in turn will influence the health and wellbeing of the general population, vulnerable groups and individual people. Although assessing impacts on health beyond direct effects from for example emissions to air or road traffic incidents is complex, there is a need to ensure a proportionate assessment focused on an application's significant effects.

Having considered the submitted scoping report we wish to make the following comments:

**Environmental Public Health**

We understand that the promoter will wish to avoid unnecessary duplication and that many issues including air quality, emissions to water, waste, contaminated land etc. will be covered elsewhere in the Environmental Statement. We believe the summation of relevant

issues into a specific section of the report provides a focus which ensures that public health is given adequate consideration. The section should summarise key information, risk assessments, proposed mitigation measures, conclusions and residual impacts, relating to human health. Compliance with the requirements of National Policy Statements and relevant guidance and standards should also be highlighted.

In terms of the level of detail to be included in an ES, we recognise that the differing nature of projects is such that their impacts will vary. UKHSA and OHID's predecessor organisation Public Health England produced an advice document *Advice on the content of Environmental Statements accompanying an application under the NSIP Regime*<sup>1</sup>, setting out aspects to be addressed within the Environmental Statement<sup>1</sup>. This advice document and its recommendations are still valid and should be considered when preparing an ES. Please note that where impacts relating to health and/or further assessments are scoped out, promoters should fully explain and justify this within the submitted documentation.

Our position is that pollutants associated with road traffic or combustion, particularly particulate matter and oxides of nitrogen are non-threshold; i.e, an exposed population is likely to be subject to potential harm at any level and that reducing public exposure to non-threshold pollutants (such as particulate matter and nitrogen dioxide) below air quality standards will have potential public health benefits. We support approaches which minimise or mitigate public exposure to non-threshold air pollutants, address inequalities (in exposure) and maximise co-benefits (such as physical exercise). We encourage their consideration during development design, environmental and health impact assessment, and development consent.

### **Electric and Magnetic Fields (EMF)**

The applicant should assess the potential public health impact of EMFs arising from the electrical infrastructure associated with the facility. For more information on how to carry out the assessment, please see the accompanying [UKHSA reference document](#). Alternatively, a statement should be provided that explains why EMFs can be scoped out.

Yours sincerely,

On behalf of UK Health Security Agency

*Please mark any correspondence for the attention of National Infrastructure Planning Administration.*

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<sup>1</sup>  
<https://khub.net/documents/135939561/390856715/Advice+on+the+content+of+environmental+statements+accompanying+an+application+under+the+Nationally+Significant+Infrastructure+Planning+Regime.pdf/a86b5521-46cc-98e4-4cad-f81a6c58f2e2?t=1615998516658>

**From:** [REDACTED]  
**To:** [SDC M40 Campus](#)  
**Cc:** [REDACTED]  
**Subject:** EN0110030 - Scoping Consultation - Application by Slough Holdings UK Limited (the applicant) for an Order granting Development Consent for the SDC M40 Campus  
**Date:** 26 May 2026 11:14:21

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Good morning

Further to the consultation in respect of the above NSIP project Scoping Report.

<https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/EN0110030/documents>

I can confirm that having reviewed the submitted EIA Scoping Report (April 2026) by Slough Holdings UK Limited, West Northamptonshire Council do not have any comments at this stage.

We would however wish to be consulted on any further details, in particular any Transport Assessment submitted, and reserve the right to comment further.

Kind Regards

Nicky Scaife  
Major Projects Team Leader

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Any views expressed in this email are those of the individual sender and are not necessarily those of West Northamptonshire Council unless explicitly stated.

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**Date:** 26 May 2026  
**WBC App. No.:** 261053



**WOKINGHAM  
BOROUGH COUNCIL**

FAO Laura Feekins-Bate  
Planning Inspectorate, Env Decisions and  
Applications Service  
C/O QUADIANT  
Buckingham Avenue  
Slough  
SL1 4PN

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Development Management &  
Compliance

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P.O. Box 157

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Shute End, Wokingham

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Berkshire, RG40 1BN

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Tel: (0118) 974 6000

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Minicom No: (0118) 974 6991

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Via e-mail only to:

[sdcm40campus@planninginspectorate.gov.uk](mailto:sdcm40campus@planninginspectorate.gov.uk)

Dear Ms. Laura Feekins-Bate,

**ADJOINING LOCAL AUTHORITY CONSULTATION RESPONSE**

**Hants App. No.:** HCC/2025/0677

**WBC App. No.:** 261053

**Site Address:** SDC M40 Campus, Land north of M40 and south of A40 Oxford Road, Buckinghamshire.

**Proposal:** Consultation from the Planning Inspectorate on an EIA Scoping application for the SDC M40 Campus.

I refer to the above consultation request registered on 29 April 2026. Following appraisal of the application, the Local Planning Authority advise the following:

1. Any Traffic Management Plan and Construction Traffic Management Plans to direct HGVs associated with the Data Centres to travel via the Motorway network in the subregion and utilise the M40, M4 and A404 (M) rather than the A4 or A4130 within Wokingham Borough. This is requested for both the Construction Phase and Operational Phases of the proposed data centres, and

2. It is expected there to be minimal car traffic on the Wokingham road network given the Data Centre Campus is adjacent to the M40, north-west of Beaconsfield Services. The Data Centre Campus is located c.17 miles from the northern boundary of Wokingham Borough and c.28 miles from Wokingham Town Centre.

I trust the application will be considered in accordance with the relevant planning policies.

Yours sincerely,



Justin Turvey  
Head of Development Management - Place & Growth