



Appendix 13-PD-5: Habitats Regulations Assessment Screening Report

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Appendix 13-PD-5: Habitats Regulations Assessment Screening Report

1. Introduction

1.1 Overview

- 1.1.1 This Habitats Regulations Assessment (HRA) Screening Report has been produced to support the PEI Report for the Grand Union Canal (GUC) Transfer (hereafter referred to as the 'Proposed Development'). The purpose of this HRA Screening Report is to assess the potential impacts of the Proposed Development on Habitats Sites (previously known as European sites), including Special Protection Areas (SPAs), potential SPAs, Special Areas of Conservation (SACs), candidate SACs, and Ramsar sites and proposed Ramsar sites. Furthermore, impacts on existing sites compensating for damage to Habitats Sites must also be considered. Under the Conservation of Habitats and Species Regulations 2017 (as amended) ('the Regulations'), any scheme must be assessed for likely significant effects (LSEs) and, where these are deemed present, adverse effects on the integrity of Habitats Sites.
- 1.1.2 The Proposed Development will transfer water from Severn Trent's (ST) supply area via up to approximately 120 km of canal to areas of forecast deficit in Affinity Water's (AfW) supply area. A new Advanced Water Treatment Plant (AWTP) at the existing Minworth Wastewater Recycling Centre (WwRC) will further treat water that would have otherwise been discharged into River Tame. An approximately 15 km long new buried pipeline will carry highly treated, recycled water to an outfall at the Coventry Canal at Atherstone. The Coventry, Oxford and Grand Union Canals will convey water to a location near Great brickhill, south-east of Milton Keynes, where water will then be abstracted, treated to drinking water standards, prior to being pumped through a pipeline to an existing covered, underground reservoir near Luton for distribution to AfW's customers.
- 1.1.3 This HRA Screening Report updates the initial report submitted at the Scoping stage to account for the latest design updates. It brings together evidence and initial analyses from the RAPID process and the PEI Report, amalgamating evidence presented therein into a single document that provides the Applicant's view on LSEs. This document also sets out the scope of further works to be undertaken prior to DCO application submission in order to either update the position on LSEs, or to feed into the Report to Inform the HRA accompanying the DCO application. This HRA Screening Report comprises the following sections:

- a. Introduction to the Proposed Development;
 - b. Background on the legislative framework underpinning the HRA process;
 - c. Overview of the adopted assessment methodology;
 - d. Summary of the available evidence base, data gathering and relevant Habitats Sites;
 - e. Background to the impact pathways associated with the Proposed Development;
 - f. HRA Stage 1: Screening for LSEs; and
 - g. Summary of preliminary conclusions.
- 1.1.4 This document therefore represents the HRA screening (Stage 1: Likely Significant Effects) stage of HRA; it effectively forms the Evidence Plan of the HRA process. It will ultimately feed into the Report to Inform HRA (including Appropriate Assessment [AA]) to accompany the DCO application.

1.2 Description of the Proposed Development

- 1.2.1 For ease of description and reference, the Proposed Development has been divided into the following parts, each of which is described in more detail in the following sections (see **Figure 13-A3-1** in Appendix 1 of this report for a general layout):
- a. Part 1: Minworth to Atherstone:
 - i. Part 1a: Minworth AWTP;
 - ii. Part 1b: Minworth to Atherstone pipeline;
 - b. Part 2: Works to the Coventry, Oxford and Grand Union canals;
 - c. Part 3: Works to Daventry and Drayton Reservoirs;
 - d. Part 4: Abstraction, storage and treatment and pipeline to an existing underground reservoir near Luton:
 - i. Part 4a: Abstraction, storage and treatment; and
 - ii. Part 4b: Pipeline to an existing underground reservoir near Luton.
- 1.2.2 Decommissioning of the Proposed Development is not within the scope of the PEI Report, on the basis that the Proposed Development will be operated indefinitely. The need for ongoing maintenance and replacement of the components of the Proposed Development will be considered as part of the operational phase assessment.

Part 1a: Minworth AWTP

- 1.2.3 Part 1a of the Proposed Development includes the construction, operation and maintenance of various structures and infrastructure relating to Minworth AWTP. This will receive recycled water from the existing Minworth WwRC,

which would have otherwise been discharged to the River Tame, for further treatment to a higher water quality standard. The AWTP will be designed to treat bulk organics, nutrients and priority contaminants. The transfer of a maximum of 115 MI/d of treated recycled water from the WwRC to the AWTP (which would have otherwise contributed to hydrological flows in the River Tame and Trent catchment and, ultimately, the Humber Estuary Habitats Sites) is the main impact pathway associated with Part 1a.

- 1.2.4 This HRA Screening Report is informed by modelling exercises undertaken during the RAPID process. However, hydraulic and hydrological modelling of the Rivers Tame and Trent is being updated and will inform updated assessments which will be presented in the ES, including the HRA, after the Phase Two Public Consultation.

Part 1b: Minworth to Atherstone Pipeline

- 1.2.5 Part 1b of the Proposed Development seeks to deliver highly treated recycled water from the AWTP to an outfall on the Coventry Canal at Atherstone via a new approximately 15 km long pipeline.
- 1.2.6 The pipeline will be constructed using open cut trenching across open greenfield sites following establishment of the final 50 m pipeline corridor. At major crossing points (the crossing of the River Tame) where open cut trenching is not feasible, trenchless techniques (i.e. pipe jacking or horizontal directional drilling [HDD]) will be utilised to instal the new pipeline.
- 1.2.7 Construction works for Part 1b of the Proposed Development will be undertaken in close proximity to, or under, the River Tame (the latter in relation to the proposed trenchless crossing). Therefore, the main impact pathways associated with Part 1b relate to water quality impacts and vibration disturbance to Humber Estuary SAC qualifying features present in functionally linked habitat (i.e. the Rivers Tame and Trent).

Part 2: Works to the Coventry, Oxford and Grand Union Canals

- 1.2.8 The water transferred from the AWTP via the new pipeline and discharged at the Atherstone outfall will increase the volume of water flowing through the canal network. However, the works proposed for the canal network will carefully manage this additional flow volume. Part 2 of the Proposed Development will comprise the following elements:
- a. An outfall structure at Atherstone to control the discharge of the recycled water transferred from the Minworth AWTP;
 - b. Construction of pumped (requiring new pumping stations) and gravity bypasses to bypass locks, as not all existing locks and bypass weirs will be able to pass maximum transfer flows while maintaining safe navigation;

- c. Raising of sections of canal bank levels where required to maintain a minimum freeboard (the vertical distance from the top of the canal bank to the water surface) – required to prevent potential overtopping, and prevent water loss;
- d. Construction of transfer locks located in selected pounds to reduce the extent of bank raising by breaking up the hydraulic gradient along the pound;
- e. Potential modification of one existing canal bridge (Milton Keynes – Bridge 88, Peartree Bridge) to ensure safe navigation and headroom clearance, where water levels are predicted to increase during peak transfer;
- f. Modification of existing control and waste weirs to prevent water loss and premature discharge to adjacent connected watercourses;
- g. Potential modification to the Iron Trunk Aqueduct or introduction of a fourth transfer lock; and
- h. Works to selected infrastructure assets along the canals to ensure that they are sufficiently resilient for the water transfer.

1.2.9 Each of the above works may also require:

- a. Construction and on-going maintenance works to facilitate temporary and permanent access;
- b. Temporary construction working areas and compounds;
- c. Utilities connections; and
- h. Other associated above and below ground works relating to the canal network (e.g. works to towpaths and to improve local towpath access points, facilities for boaters, such as mooring sites, rings etc., potential works to existing vacant / surplus canal side buildings / re-use, installation of signage, site reinstatement and habitat establishment, landscaping).

1.2.10 Potential impact pathways associated with Part 2 of the Proposed Development include construction phase water quality impacts in the Upper Nene Gravel Pits SPA/Ramsar, as well as operational water quantity, level and flow impacts in the Upper Nene Gravel Pits SPA/Ramsar (via the Northampton Arm at Gayton Junction), River Mease SAC (via its confluence with the River Tame) and Ensor's Pool SAC (via groundwater flows).

Part 3: Works to Daventry and Drayton Reservoirs

1.2.11 Initial water resource modelling for the Proposed Development (accounting for the risk of unplanned asset outage, periods of higher demand and requirement to support flows in the River Trent) confirms that a continuous water supply from Minworth WwRC to the GUC poses a potential problem under extended drought conditions. The River Trent (to which the WwRC contributes hydrological flows via the River Tame) has hands off flow requirements under certain environmental conditions. To ensure that the operation of the Proposed Development does not increase the frequency of

the hands off flow being triggered the transfer of recycled water from Minworth WwRC out of the River Tame catchment may be reduced or stopped for periods of up to 10 days.

- 1.2.12 The Daventry and Drayton Reservoirs are proposed to provide the water storage to support the Proposed Development, whereby the reservoirs can be drawn down to augment the transfer in the GUC during periods when outage, higher demand or the requirement to manage the River Trent hands off flow are triggered. The reservoirs will also still operate to ensure a supply of water for navigation to the canal.
- 1.2.13 At the proposed Braunston Pumping Station, the pumped transfer main is split into two pipes: one pipe (approximately 450 mm diameter) will feed the reservoirs and the other pipe (approximately 700 mm diameter) will be used to bypass the Braunston Tunnel.
- 1.2.14 The proposed works at Daventry Reservoir will comprise:
- a. Replacement of the existing inlet structure with a new structure and connecting it to an existing large culvert using pre-cast culvert sections;
 - b. Construction of an additional outlet structure;
 - c. Bank raising along the existing channel leading from the reservoir to the Grand Union Canal; and
 - d. Replacement of the existing culvert discharging to the Grand Union Canal with a larger structure.
- 1.2.15 The proposed works at Drayton Reservoir will comprise:
- a. Provision of a discharge structure to the existing inlet to the southwest of the reservoir; and
 - b. Works to the existing overflow structure to the north of the reservoir through the provision of an additional siphon and siphon discharge chamber.
- 1.2.16 There will be flow monitoring and level controls at the intake to the pumping station and monitoring for the delivery into the new pipeline and for delivery from the pipeline into each reservoir at the new discharge structures. There will also be flow monitoring and level sensors at the discharge structures back into the canal.
- 1.2.17 The impact pathways that are relevant to Part 3 of the Proposed Development (i.e. water quality and water quantity, level and flow) primarily relate to the Upper Nene Gravel Pits SPA/Ramsar, which is hydrologically connected to Daventry Reservoir via an arm of the GUC and the River Nene.

Part 4a: Abstraction, Storage and Treatment

- 1.2.18 Part 4a pertains to the abstraction, storage and treatment of water from the GUC prior to its delivery to AfW customers.
- 1.2.19 Water will be abstracted from the GUC at the southern end of the transfer route via a new weir near Great Brickhill, south-east of Milton Keynes. A new water main pipeline will transfer canal water to the proposed Galley Water Treatment Works (WTW). The weir would consist of an intake at the canal side to abstract water from the canal in a controlled way and at a low flow rate. A new pumping station would be constructed to transfer water to its pre-treatment open-air storage site at Galley WTW. It is anticipated that the new water storage site will comprise an earth embankment (up to 8 m) and a likely surface area ranging from 7-11 ha. The new WTW will treat water to drinking water standards. The WTW will encompass various infrastructure elements, including site buildings (maximum height of 15 m), storage tanks, process units, pipelines and storage equipment.
- 1.2.20 Due to the nature of proposals and the distance to/sensitivities of the relevant Habitats Sites, there are no linking impact pathways for Part 4a of the Proposed Development.

Part 4b: Pipeline to an Underground Reservoir near Luton

- 1.2.21 Part 4b of the Proposed Development comprises the transfer of the treated water from the new WTW (Part 4a of the Proposed Development) to an existing covered underground reservoir near Luton via a new underground pipeline (approximately 28 km in length). It will comprise the construction, operation and maintenance of the following infrastructure:
- a. New underground pipeline to transfer treated water;
 - b. Works to facilitate temporary and permanent access;
 - c. Temporary construction working areas and compounds;
 - d. Connection point for the pipeline to the AfW underground reservoir; and
 - e. Other associated above and below ground works relating to the pipeline, including the following above ground assets:
 - i. Air valve access manholes in the field to the east of the Dunstable Downs crossing, and at one or two high points to the west of Eaton Bray;
 - ii. A non-return valve access manhole located immediately to the west of the Dunstable Downs crossing; and
 - iii. An access manhole to a washout chamber located near a minor water course, either at the A505 crossing, or between the Eastern Way and the A4012.

- 1.2.22 The construction methodology for the new underground pipeline will be similar to that described for the new pipeline in Part 1b. No specific hydrological impact pathways have been identified in relation to Part 4a and 4b, since this section of the Proposed Development lies downstream from all Habitats Sites in the ZoI that are sensitive to water quality and flow changes. However, construction phase atmospheric pollution impacts associated with vehicular traffic are considered relevant in relation to the Chilterns Beechwoods SAC.

1.3 Quality Assurance

- 1.3.1 This report was undertaken in line with AECOM's Integrated Management System (IMS). The IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our certification to the international standards BS EN ISO 9001:2008 and 14001:2004 and BS OHSAS 18001:2007.
- 1.3.2 All AECOM Ecologists working on this project are members (at the appropriate level) of the Chartered Institute of Ecology and Environmental Management (CIEEM) and follow their code of professional conduct (Ref. 1).

2. Legislative Framework

2.1 Introduction

- 2.1.1 As part of the assessment of a development, it is necessary to consider whether the Proposed Development is likely to result in 'significant' effects on Habitats Sites, which are protected under the Regulations (Ref. 2) and Government policy.
- 2.1.2 The UK left the European Union (EU) on 31 January 2020 under the terms set out in the European Union (Withdrawal Agreement) Act 2020 (termed the 'Withdrawal Act'). However, the most recent amendments to the Regulations (i.e., Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (Ref. 3) make it clear that the need for HRA continues to apply. Whilst the 2019 Regulations make changes to the Habitats regime and terminology (e.g., by introducing the term 'national site network'), this document uses the term Habitats Sites to refer to all European sites potentially affected by the Proposed Development in line with current standard practice and the National Policy Statement for Water Resources Infrastructure (NPS WRI) (Ref. 4). The NPPF also requires proposed SPAs and candidate SACs to be treated as Habitats Sites along with Ramsar sites and proposed Ramsar sites (wetlands of international importance). In addition, sites being used to deliver compensatory measures for adverse effects on site integrity are also classed as Habitats Sites.

- 2.1.3 The HRA process applies the ‘Precautionary Principle’¹ to Habitats Sites. Regulation 63 of the Regulations requires a ‘Competent Authority’, in this case the SoS (who is informed by recommendations of PINS as the appointed Examining Authority), to undertake an ‘Appropriate Assessment’ (AA) of any plan or project (alone or in-combination with other plans and projects) which is likely to have a significant effect on a Habitats Site unless the project is directly connected with the management of the site (see **Plate 1** below for the legislative basis of AA). Following the conclusions of the assessment, the Competent Authority may proceed with or consent to the plan or project only after having ascertained that it will not result in adverse effects on the integrity of a Habitats Site, or if it will adversely affect the integrity of a Habitats Site, that there are imperative reasons of overriding public interest (IROPI) for the project, all reasonable alternatives have been considered and adequate compensation has been identified in accordance with Regulation 64.

Conservation of Habitats and Species Regulations 2017 (as amended)

Regulation 63 states that:

“A competent authority, before deciding to ... give any consent, permission or other authorisation for, a plan or project which – (a) is likely to have a significant effect on a European site ... (either alone or in combination with other plans or project)... must make an appropriate assessment of the implications of the plan or project in view of the site’s conservation objectives... The competent authority may agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site.”

Plate 1: The legislative basis for Appropriate Assessment

- 2.1.4 In accordance with the mitigation hierarchy, all plans and projects should identify any potential LSEs early in the plan/project making process, either altering the plan/project to avoid such effects or introducing mitigation measures to the point where no adverse effects on integrity remain. In reaching its final conclusion, the Competent Authority must consult with the

¹ The Precautionary Principle, which is referenced in Article 191 of the Treaty on the Functioning of the European Union, has been defined by the United Nations Educational, Scientific and Cultural Organisation (UNESCO, 2005) as: ‘When human activities may lead to morally unacceptable harm [to the environment] that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm. The judgement of plausibility should be grounded in scientific analysis.’

Statutory Nature Conservation Body (in this case, Natural England) and take account of their comments. They may also consult the general public if considered appropriate.

2.2 Relevant Case Law

- 2.2.1 Although the UK is no longer part of the EU, a series of rulings of the Court of Justice of the European Union (CJEU) are still relevant to HRA in the UK. This HRA is in accordance with the principles established through these precedence cases. The relevant rulings and their implications for this HRA are summarised in **Table 1** and this HRA is cognisant of these rulings.

Table 1: Case law relevant to the HRA of the Proposed Development

Case	Ruling	Relevance to HRA
People Over Wind and Sweetman v Coillte Teoranta (C-323/17)	The ruling of the CJEU in this case requires that any conclusion of 'no likely significant effect' on a Habitats Site at the screening stage must be made prior to any consideration of mitigation measures to avoid or reduce harm to such a site. The determination of likely significant effects at the screening stage should not in the opinion of the CJEU, constitute an attempt at detailed technical analysis. This should be conducted as part of the AA.	This ruling clarified that 'mitigation' (i.e., measures that are specifically introduced to avoid or reduce a harmful effect on a Habitats Site that would otherwise arise) should not be taken into account when forming a view on likely significant effects at the screening stage. Mitigation should instead only be considered at the AA stage. This HRA has been cognisant of that ruling.
Waddenzee (C-127/02)	The ruling in this case clarified that AA must be conducted using best scientific knowledge in the field, and that the Competent Authority must be satisfied that there is no reasonable doubt as to the absence of adverse effects on the integrity of a Habitats Site. The Waddenzee ruling also provided clarity on the definition of 'significant effect,' specifically that any effect from a plan or project on the conservation objectives of any Habitats Site will be a significant effect.	Adopting the precautionary principle, a 'likely' significant effect in this HRA is interpreted as one which is 'possible' and cannot be objectively ruled out. The test of significance of effects has been conducted with reference to the conservation objectives of relevant Habitats Sites.

Case	Ruling	Relevance to HRA
Holohan and Others v An Bord Pleanála (C-461/17)	The conclusions of the Court in this case were that consideration must be given during AA to: Effects on qualifying habitats and/or species of a SAC or SPA, even when occurring outside of the boundary of a Habitats Site, if these are relevant to the site meeting its conservation objectives; and Effects on non-qualifying habitats and/or species on which the qualifying habitats and/or species depend and which could result in adverse effects on the integrity of the Habitats Site.	This relates to the concept of functionally linked habitat (i.e., areas outside of the boundary of a Habitats Site which supports its qualifying feature(s)). In addition, consideration must be given to non-qualifying features upon which qualifying habitats and/or species rely. This HRA has taken the use of functionally linked habitats into account in relation to anadromous fish and otter.
T.C Briels and Others v Minister van Infrastructuur en Milieu (C-521/12)	The ruling of the CJEU in this case determined that compensatory measures cannot be used to support a conclusion of no adverse effect on site integrity.	Compensation can only be considered at the derogation stage of HRA and not during AA. Compensation must be delivered when AA concludes that there will be adverse effects on site integrity, and the development represents IROPI and reasonable alternatives have been considered.

3. Assessment Methodology

3.1 Introduction

- 3.1.1 This HRA Screening Report has been undertaken with reference to the general European Commission (EC) guidance on HRA (Ref. 5), general guidance on HRA published by the UK Government in July 2019 (Ref. 6) and February 2021, and PINS's most recent Advice Note on Nationally Significant Infrastructure Projects (NSIPs) (Ref. 7)
- 3.1.2 The assessment of a project under the Habitats Regulations can be split into four stages. **Plate 2** below outlines all the stages of HRA according to the most recent PINS advice note (Ref. 7).
- 3.1.3 Whilst the HRA decisions must be taken by the Competent Authority (the SoS, informed by the recommendations of the appointed Examining Authority), the information needed to support this decision-making must be provided by the Applicant. The information needed for the Competent Authority to establish whether there are any LSEs arising from the Proposed Development and to assist in carrying out an AA (if required), is therefore the main purpose of this HRA Screening Report.
- 3.1.4 The PINS advice note on HRAs in relation to NSIPs (Ref. 7), as well as guidance from the Department for Business, Energy and Industrial Strategy (Ref. 8; noting that this Department is now the Department for Energy Security and Net Zero) necessitates an evaluation of the potential for the Proposed Development to require other consents which could also require HRA by different competent authorities, and a statement to identify whether significant effects are considered likely regarding Habitats Sites in devolved administrations or European Economic Area (EEA) States. It is confirmed that the Preliminary Order Limits (POL) of the Proposed Development do not overlap with areas of devolved administrations or with those of other EEA States. It is also the case that no parallel consents are required for the Proposed Development which would require additional HRA to be carried out. The entirety of the Proposed Development lies within central and south-east England, part of the United Kingdom, and there are no pathways arising from the Proposed Development that could result in LSEs to Habitats Sites in devolved administrations or other EEA States.

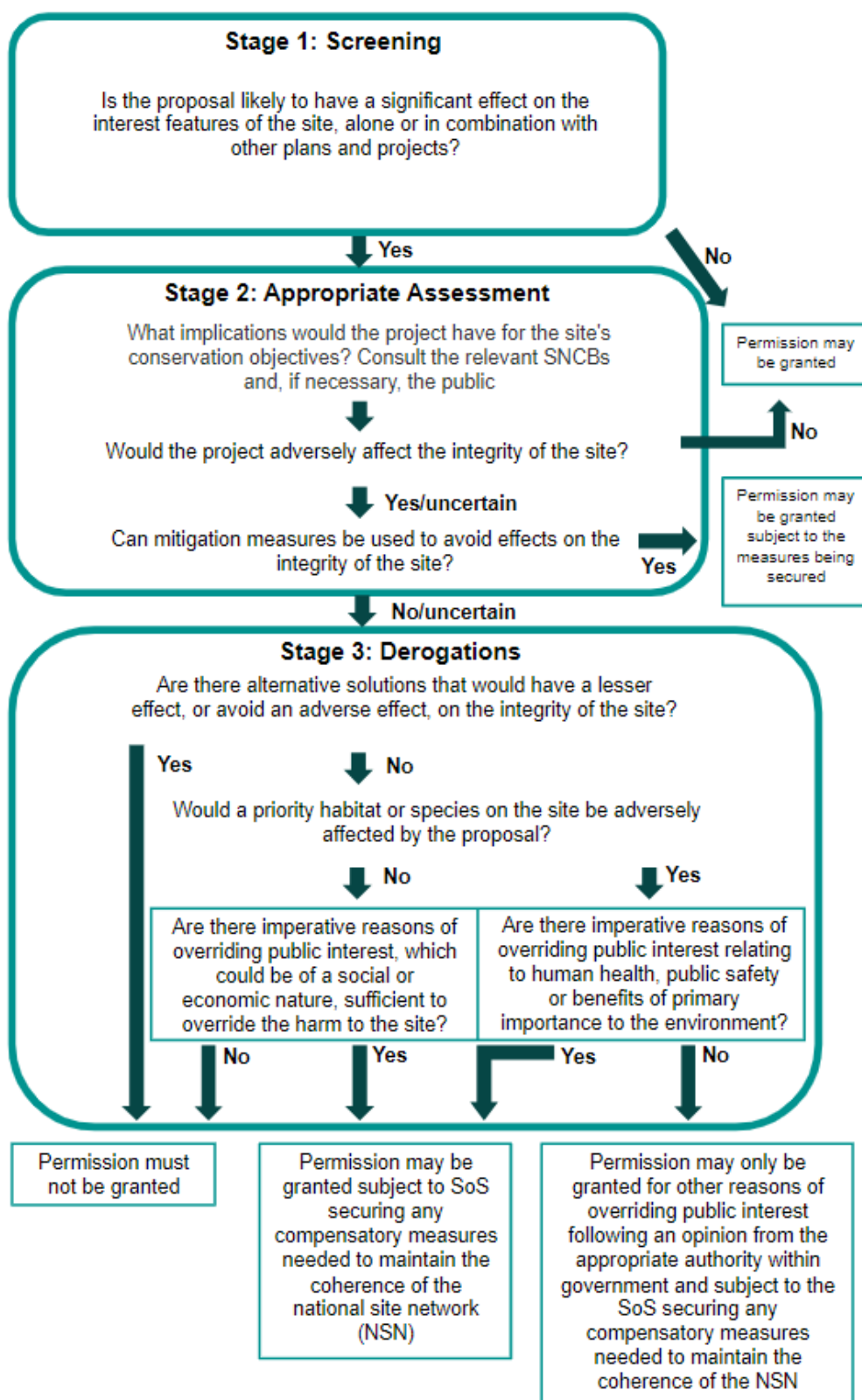


Plate 2: Four Stage Approach to HRA of development projects

3.2 Description of HRA Tasks

HRA Stage 1 – Screening for Likely Significant Effects (LSEs)

- 3.2.1 This HRA Screening Report represents Stage 1 of the HRA process. ‘HRA Stage 1: Screening for Likely Significant Effects’ is the assessment of the likelihood of a plan or project resulting in LSEs on the features of a Habitats Site. If the screening assessment concludes that LSEs are present, this is the trigger for an AA to be undertaken as set out in Regulation 63(1).
- 3.2.2 The objective of the LSEs screening exercise is to screen out those aspects of a project or plan that can, without more detailed appraisal, be said to be unlikely to result in LSEs upon Habitats Sites. This is usually because there is no mechanism for an interaction (i.e., a pathway) with Habitats Sites. Any remaining aspects are then taken forward to AA. The assessment must also consider the potential for LSEs in-combination with other plans and projects.
- 3.2.3 As shown in **Table 1**, this HRA Screening Report has been prepared in accordance with all principles set out in relevant case law and guidance relating to the 2017 Regulations, the Habitats Directive (Ref. 9) and Birds Directive (Ref. 10). This includes the ruling by the CJEU in the case of *People Over Wind and Peter Sweetman v Coillte Teoranta (C-323/17)* (Ref. 11). This case held that: "it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site" (Paragraph 40). This establishes that mitigation measures cannot be considered at the screening stage, but they can be taken into account in an AA. The implication of this is that the screening stage must be undertaken on a precautionary basis with no regard to mitigation measures.

HRA Stage 2 – Appropriate Assessment (AA)

- 3.2.4 Where it is determined that a conclusion of ‘no LSEs’ cannot be drawn at the screening stage, the HRA assessment proceeds to the next stage of HRA known as ‘HRA Stage 2: Appropriate Assessment’. Government guidance highlights that ‘Appropriate Assessment’ is not a technical term (Ref. 6). In other words, there are no specific technical analyses, or level of detail, that are classified by law as belonging to AA rather than the screening for LSEs. The AA constitutes whatever level of further assessment is required to determine whether an adverse effect on the integrity of a Habitats Site would arise as a result of the planning proposal.
- 3.2.5 By virtue of the fact that HRA Stage 2 follows the screening process, there is an understanding that the analysis will be more detailed than that undertaken at the screening stage. One of the key considerations during HRA Stage 2 is whether there is available mitigation that would entirely

address the identified LSEs, allowing for a conclusion of no adverse effect on site integrity. In practice, HRA Stage 2 takes any element of the development that could not be excluded as having LSEs following HRA Stage 1 and assesses the potential for an effect in more detail, with a view to concluding whether that element would cause an adverse effect on the site integrity of a Habitats Site. Adverse effects on a Habitats Site's integrity include disruption of the coherent structure and function of said site (Ref. 6) and its ability to achieve its Conservation Objectives.

- 3.2.6 In 2018, the Holohan ruling (Ref. 12) was handed down by the CJEU. Paragraph 40 of the ruling states that: "Article 6(3) of the Habitats Directive must be interpreted as meaning that an 'appropriate assessment' must, on the one hand, catalogue the entirety of habitat types and species for which a site is protected, and, on the other, identify and examine both the implications of the proposed project for the species present on that site, and for which that site has not been listed, and the implications for habitat types and species to be found outside the boundaries of that site, provided that those implications are liable to affect the conservation objectives of the site' [emphasis added]. The Report to inform the AA will be in accordance with the Holohan ruling, particularly with regard to mobile qualifying species in the Humber Estuary SAC and River Mease SAC.
- 3.2.7 Where necessary, measures are recommended for incorporation into the project or plan in order to mitigate and / or avoid adverse effects on Habitats Sites.

In-Combination Scope

- 3.2.8 It is a requirement of the Habitats Regulations that the impacts and effects of any planning proposal being assessed are not only considered in isolation but also in combination with other plans and projects that may also have effects on the Habitats Site(s) in question.
- 3.2.9 When undertaking this part of the assessment it is essential to consider the principal intention behind the legislation, i.e., to ensure that those projects or plans (which in themselves may have minor impacts) are not simply dismissed on that basis but are evaluated for any contribution they may make to an overall significant effect in-combination with other projects and plans. In practice, in-combination assessment is therefore of greatest relevance when a development proposal would otherwise be screened out because its individual contribution is inconsequential.

3.2.10 The following plans and projects² are considered to have the potential to act in-combination with the Proposed Development (as considered during the RAPID process). Only projects that are likely to have a connection to Habitats Sites are listed below e.g. those close to Ensor's Pool SAC or Chilterns Beechwoods SAC or which are likely to have water resource implications. However, in-combination assessment will be kept up to date throughout the HRA process leading up to DCO submission:

- a. Water transfer from the North West and Midlands to the South East to support the South East of England during drought events (1A in **Appendix 23-PD-2: Preliminary Shortlist of Other Developments** in PEI Report **Volume 4**).
- b. Full application for the demolition of all buildings on site and the erection of up to 1,240 sqm GEA of commercial/business floorspace (E), 15 residential units (C3) and 4 live/work units (C3/E), with associated car parking, access, public realm (885 in **Appendix 23-PD-2** in PEI Report **Volume 4**)
- c. Hybrid application (a) Full application for the demolition of existing buildings and new vehicular, pedestrian & cycle access. (b) Outline application with all matters reserved (except access on to public highway) for mixed-use development (941 in **Appendix 23-PD-2** in PEI Report **Volume 4**)
- d. Land is allocated for a residential-led development comprising 1,525 dwellings (288 in **Appendix 23-PD-2** in PEI Report **Volume 4**)
- e. Development of up to 361 market and affordable homes, and associated infrastructure, including open space, play space, landscaping, SuDs, and green infrastructure, and demolition of ruinous agricultural structure. Outline, all matters reserved (131 in **Appendix 23-PD-2** in PEI Report **Volume 4**)
- f. New railway line between Bedford and Cambridge (proposed by East West Railway Company Limited);
- g. High Speed (HS) 2, Phase 1 London to Birmingham (proposed by High Speed 2 Limited);
- h. Proposed New Residential Retirement Care Village with Retirement Living, Assisted Living, High Dependency Care Units, Community Club House, Ancillary Retail Units and Conservatory (proposed by Black Shu Ltd);

² The list of 'committed developments' that have the potential to result in likely significant environmental impacts in-combination with the Proposed Development will be continually updated throughout the HRA process leading up to DCO submission to account for any new/amended committed development(s).

- i. Installation of an Energy Park comprising a wind turbine, ground-mounted solar arrays, a Battery Energy Storage System (BESS) and ancillary site infrastructure (proposed by Arnold White Group Limited); and
 - j. Minworth STT Strategic Resource Option (which has been included in the Aquator model see below).
- 3.2.11 See **Appendix 23-PD-2: Preliminary Shortlist of Other Developments** in PEI Report **Volume 4**, which will be reviewed and updated as the design of the Proposed Development develops.
- 3.2.12 At this stage of the HRA the list of relevant other plans and projects identified is those most likely to have an 'in combination' effect, such as because the overlap with the DCO boundary or that may also affect abstraction from the same watercourses. This will be reviewed as necessary in response to feedback on this HRA.
- 3.2.13 While the potential of these other projects to result in effects in combination with the Proposed Development has been considered, and will continue to be considered, this assessment does not encompass full HRAs of each of the proposed schemes.
- 3.2.14 Future in-combination scenarios have also been considered where built into the currently utilised version of the Aquator model (refer to the Annex B2 Tame & Trent Hydrological and Hydraulic Modelling Report for further details (Ref. 14) – for example, changes to future abstractions and discharges in the River Tame and Trent catchment. Ongoing modelling for the Report to Inform HRA for the DCO application will include the AMP8 and AMP9 scenarios that have been incorporated by Severn Trent.

4. Available Evidence, Data Gathering and Habitats Sites Scope

4.1 Evolution of Evidence Base and Stakeholder Engagement

- 4.1.1 The following reports relevant to this HRA Screening Report were completed at the Gate 2 environmental investigation stage, and were developed further at Gate 3:
 - a. Minworth Gate 2 Annex B1 Aquatic Ecology Monitoring (Ref. 13);
 - b. Minworth Gate 2 Annex B2 Hydrological & Hydraulic Modelling (updated for Gate 3) (Ref. 14);
 - c. Minworth Gate 2 Annex B4 Environmental Assessment Report (EAR) (including HRA Screening) (Ref. 15); and

- d. Minworth Gate 2 Annex B3.1.2 Appendix B(ii) Aquatic Ecology (Ref. 16) (updated for Gate 3 as the Rivers Tame and Trent Fish Passage Assessment, which has informed the HRA).

- 4.1.2 The assessment scope for Gate 3 was informed by the aforementioned studies and ongoing regulator and stakeholder engagement, as will be the scope for the Report to inform the HRA accompanying the DCO application. For example, regulator and stakeholder comments from the Gate 2 submissions were used to inform the Gate 3 assessments (described in this HRA Screening Report where relevant) and help identify the requirements for work in support of the DCO application, which is ongoing at the time of writing. As an example, the Gate 3 evidence underpinning this HRA has been updated with detailed hydrological modelling of the River Tame and River Trent in response to comments from the Environment Agency at Gate 2.
- 4.1.3 The hydrological assessments undertaken during the RAPID process have considered the potential impacts on the River Tame and Trent system of the Proposed Development alone due to the proposed reduction in discharge to the River Tame, as well as in-combination with the separate STT SRO (230 MI/d combined).

4.2 Limitations

- 4.2.1 It should be noted that the flow impact analysis undertaken to assess the implications of the diversion of recycled water from Minworth WwRC includes a limitation. The hydrological models of the River Tame and River Trent used to support the assessment are spatially limited to the non-tidal sections of the River Trent. Representation of additional flow between the tidal limit of the River Trent at Cromwell Weir and the Trent-Humber confluence are, therefore, based on available gauging information. Accordingly, estimations of the total flow volumes into the Humber Estuary from the Trent catchment will be an underestimate and conservative, thereby reducing the potential effect of the limitation by representing an adequate 'worst-case' scenario that is assessed in the HRA.
- 4.2.2 It is important to note that the hydrological impact assessment of the Proposed Development has not yet been completed. Hydrological modelling exercises being undertaken for the DCO application are ongoing and some field survey data (e.g. otter surveys) are outstanding. This further evidence will become available as the Proposed Development progresses towards the submission stage and will be considered in the Report to Inform the HRA accompanying the DCO application.

Relevant Habitats Sites & Information Sources

- 4.2.3 Generally, there is no guidance that explicitly dictates the physical scope of an HRA of a development project. While HRAs are often undertaken with pre-defined impact buffers, it is considered that this is not suitable for the Proposed Development. This is because many of the impact pathways that are relevant to the Proposed Development relate to hydrological pathways or qualifying species that may use functionally linked habitats far beyond the designated site boundary (i.e. otter *Lutra lutra*, river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*). Therefore, this HRA has solely adopted a source-pathway-receptor model to identify the Habitats Sites relevant to the Proposed Development. This approach considers site-specific sensitivities, including impact pathways that operate at larger spatial scales. Available guidance suggests that a radius of 30 km should be used for any Habitats Site for which bats are a qualifying feature (Ref. 17). However, there are no Habitats Sites designated for bats within 30 km of the Proposed Development.

Impact Sources

- 4.2.4 Applying the source-pathway-receptor approach, the potential impacts that could arise from the Proposed Development were considered. The broad categories of impact sources which could arise are set out in **Table 2**.

Table 2: Impact pathways that could arise from the Proposed Development

Impact category	Brief description
Water quantity, level and flow	Impacts which alter the hydrological processes within a Habitats site or in an area used by its qualifying features. For example, reduced levels or flows in groundwater or watercourses may occur due to water impoundment or abstraction, or other reductions in flow. These processes can have various cascading impacts on designated habitats and species, for example fish passage for migratory species.
Water quality	This may arise in the construction and operational phases of a development. It includes surface runoff containing suspended sediment or other aquatic pollutants such as hydrocarbons, chemicals, fuels and oils, or changes in salinity in the estuarine environment. Changes in water quality may also affect olfactory cues for migratory fish, which those species use to navigate to their natal waters.
Noise and visual disturbance (in functionally linked habitat)	Visual disturbance (e.g. birds being flushed due to the visible proximity of people) is likely to occur due to the physical movement of vehicles and site staff in proximity to qualifying species (potentially at greater distances than noise disturbance, particularly when considering overflying birds). Noise and/or vibration disturbance will occur as a result of particularly noisy construction activities, such as impact piling or the operation of noise plant. Depending on its scale, visual and noise disturbance may occur during the construction and operational phases of a development.
Atmospheric pollution	This encompasses the release of dust (i.e., particles of sufficiently large size to coat vegetation and interfere with photosynthesis) and atmospheric pollutants that can be directly toxic to vegetation or contribute to nitrogen deposition and, therefore, eutrophication. Overall nitrogen deposition is primarily determined by the release of oxides of nitrogen (NO _x ; associated with combustion from vehicle exhausts) and ammonia (NH ₃ , associated predominantly with industrial processes and agriculture, but also with vehicle exhausts).

Impact pathways

- 4.2.5 For an impact to result in a negative effect on a qualifying feature of a Habitats Site, a pathway between the impact source and that feature must exist. For each of the types of impact which could arise (as set out in **Table 2**) the maximum distance at which an effect could occur was determined based on the pathway(s) by which such impact(s) could reach a Habitats Site or its qualifying feature(s). These impact pathway buffer zones were based on published guidance and available research evidence wherever possible, and professional judgment. The adopted impact buffers are set out in **Table 3**.

Table 3: Impact pathway buffer distances

Impact category	Buffer distance
Water quantity, level and flow	No buffer used – relies on there being a hydrological connection to a Habitats Site according to the source-pathway-receptor model, for example the c. 130 km of Rivers Tame and Trent between Minworth WwRC and the Humber Estuary.
Water quality	No buffer used – relies on there being a hydrological connection to a Habitats Site according to the source-pathway-receptor model (as above).
Noise and visual disturbance	500 m for general noise and/or visual disturbance, based on professional judgment.
Atmospheric pollution	50-500 m for dust generation (Ref. 18) and 200 m for emissions from road traffic (Ref. 19). However, the Habitats Sites ultimately included in the assessment also depend on the modelled Affected Road Network (ARN) associated with a proposal.

- 4.2.6 The following Habitats Sites with linking impact pathways to and determined to lie within the Zone of Influence (Zol) of the Proposed Development) have been identified:

- a. Ensor's Pool SAC (approximately 1.1 km distant);
- b. River Mease SAC (approximately 12.9 km distant);
- c. Upper Nene Gravel Pits SPA (approximately 7.1 km distant, but the nearest hydrological connection is 20 km at a tributary of the River Nene originating from Daventry Reservoir);
- d. Upper Nene Gravel Pits Ramsar (approximately 7.1 km distant, but the nearest hydrological connection is 20 km at a tributary of the River Nene originating from Daventry Reservoir);

- e. Chilterns Beechwoods SAC (approximately 3.8 km distant)
- f. Humber Estuary SPA (approximately 136 km distant);
- g. Humber Estuary Ramsar (approximately 125 km distant); and
- h. Humber Estuary SAC (approximately 125 km distant).

4.2.7 The locations of the above Habitats Sites in relation to the Proposed Development are shown in Appendix A (**Figure 13-A3-2**). A summary of the qualifying features of each of the Habitats Sites taken through to screening, and their distance from the Scheme is provided in **Table 4**. The Conservation Objectives and current threats/pressures to site integrity for each relevant Habitats Site are summarised in **Table 5**.

4.2.8 To fully inform the screening for LSEs stage, several studies and online information databases have been consulted. These include:

- a. Surface water catchment GIS Shapefiles for the relevant hydrological catchments;
- b. Modelling of hydrological impacts of the Proposed Development on the River Mease SAC and Humber Estuary SAC/SPA/Ramsar, including potential in-combination effects with the STT SRO and LR SRO;
- c. Fish passage assessments undertaken for the River Trent and River Tame;
- d. Natural England's Site Improvement Plans (SIPs) and Supplementary Conservation Advice Notes (SACOs) for the relevant Habitats Sites; and
- e. Multi Agency Geographic Information for the Countryside (MAGIC) data and its links to SSSI citations and the JNCC website.

Table 4: Habitats Sites taken forward to HRA Screening

Name	Approximate distance to the Proposed Development	Habitats Site description	Summary of qualifying features
Humber Estuary SPA	The Proposed Development lies approximately 136 km from the SPA.	The Humber Estuary SPA is located on the east coast of England and comprises extensive wetland and coastal habitats. The inner estuary supports extensive areas of reedbed, with areas of mature and developing saltmarsh backed by grazing marsh in the middle and outer estuary. On the north Lincolnshire coast, the saltmarsh is backed by low sand dunes with marshy slacks and brackish pools. Parts of the estuary are owned and managed by conservation organisations. The estuary supports important numbers of waterbirds (especially geese, ducks and waders) during the migration periods and in winter. In summer, it supports important breeding populations of bittern <i>Botaurus stellaris</i> , marsh harrier <i>Circus aeruginosus</i> , avocet <i>Recurvirostra avosetta</i> and little tern <i>Sterna albifrons</i> .	The SPA site qualifies under Article 4.1 by regularly supporting the following Annex 1 species in any season: • Avocet <i>Recurvirostra avosetta</i> (wintering and breeding); • Bittern <i>Botaurus stellaris</i> (wintering and breeding); • Hen harrier <i>Circus cyanea</i> (wintering); • Golden plover <i>Pluvialis apricaria</i> (wintering); • Bar-tailed godwit <i>Limosa lapponica</i> (wintering); • Ruff <i>Philomachus pugnax</i>(passage); • Marsh harrier <i>Circus aeruginosus</i> (breeding); and • Little tern <i>Sterna albifrons</i> (breeding). The site qualifies under article 4.2 of the Birds Directive (79/409/EEC) as it is used regularly by the following regularly occurring migratory species other than those listed in Annex I) in any season: • Shelduck <i>Tadorna tadorna</i> (wintering); • Knot <i>Calidris canutus</i> (wintering and passage); • Dunlin <i>Calidris alpina</i> (wintering and passage);

Name	Approximate distance to the Proposed Development	Habitats Site description	Summary of qualifying features
			- Black-tailed godwit <i>Limosa limosa</i> (wintering and passage); and - Redshank <i>Tringa totanus</i> (wintering and passage). Assemblage qualification: The SPA site qualifies under article 4.2 of the Birds Directive (79/409/EEC) as it is used regularly by over 20,000 waterbirds (waterbirds as defined by the Ramsar Convention) in any season such as dark-bellied brent goose <i>Branta bernicla bernicla</i>, shelduck, wigeon <i>Anas penelope</i>, teal <i>Anas crecca</i>, mallard <i>Anas platyrhynchos</i>, pochard <i>Aythya ferina</i>, scaup <i>Aythya marila</i>, goldeneye <i>Bucephala clangula</i>, bittern, oystercatcher <i>Haematopus ostralegus</i>, avocet, ringed plover <i>Charadrius hiaticula</i>, golden plover, grey plover <i>P. squatarola</i>, lapwing <i>Vanellus vanellus</i>, knot, sanderling <i>Calidris alba</i>, dunlin, ruff, black-tailed godwit, bar-tailed godwit, whimbrel <i>Numenius phaeopus</i>, curlew <i>N. arquata</i>, redshank, greenshank <i>Tringa nebularia</i> and turnstone <i>Arenaria interpres</i>.
Humber Estuary Ramsar	The Proposed Development lies approximately 125 km from the Ramsar.	The Humber Estuary is the largest macro-tidal estuary on the British North Sea coast. It drains a catchment of some 24,240 km ² and is the site of the largest single input of freshwater from Britain into the North Sea. It	The Ramsar site is designated for: Ramsar Criterion 1: The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal

Name	Approximate distance to the Proposed Development	Habitats Site description	Summary of qualifying features
		has the second-highest tidal range in Britain (max 7.4 m) and approximately one-third of the estuary is exposed as mud or sand flats at low tide. The inner estuary supports extensive areas of reedbed with areas of mature and developing saltmarsh backed in places by limited areas of grazing marsh in the middle and outer estuary. On the north Lincolnshire coast the saltmarsh is backed by low sand dunes with marshy slacks and brackish pools. The estuary regularly supports internationally important numbers of waterfowl in winter and nationally important breeding populations in summer.	mud and sand flats, saltmarshes, and coastal brackish/saline lagoons. Ramsar Criterion 3: The Humber Estuary Ramsar site supports a breeding colony of grey seals <i>Halichoerus grypus</i> at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad <i>Bufo calamita</i>. Ramsar Criterion 5: Assemblages of international importance – non-breeding season. Ramsar Criterion 6: Species/populations occurring at levels of international importance: • Golden plover (passage and wintering); • Knot (passage and wintering); • Dunlin (passage and wintering); • Black-tailed godwit (passage); • Redshank (passage and wintering); • Shelduck (wintering); and • Bar-tailed godwit (wintering). Ramsar Criterion 8: The Humber Estuary acts as an important migration route for

Name	Approximate distance to the Proposed Development	Habitats Site description	Summary of qualifying features
			both river and sea lamprey between coastal waters and their spawning areas.
Humber Estuary SAC	The Proposed Development lies approximately 125 km from the SAC.	The Humber is the second largest coastal plain Estuary in the UK, and the largest coastal plain estuary on the east coast of Britain. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent. The range of salinity, substrate and exposure to wave action influences the estuarine habitats and the range of species that utilise them; these include a breeding bird assemblage, winter and passage waterfowl, river and sea lamprey, grey seals, vascular plants and invertebrates.	Annex I habitats that are a primary reason for selection of this site: • Estuaries; and • Mudflats and sandflats not covered by seawater at low tide. Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: • Atlantic salt meadows <i>Glaucopuccinellietalia maritima</i>; • Coastal lagoons; • Dunes with <i>Hippophae rhamnoides</i>; • Embryonic shifting dunes; • Fixed dunes with herbaceous vegetation ('grey dunes'); • <i>Salicornia</i> and other annuals colonising mud and sand; • Sandbanks which are slightly covered by sea water all the time; and • Shifting dunes along the shoreline with <i>Ammophila arenaria</i> ('white dunes').

Name	Approximate distance to the Proposed Development	Habitats Site description	Summary of qualifying features
			Annex II species present as a qualifying feature, but not a primary reason for site selection: • Grey seal; • River lamprey; and • Sea lamprey.
Ensor's Pool SAC	The Proposed Development lies approximately 1.1 km from the SAC.	Ensor's Pool was notified as an SAC in 2001 for its large and healthy population of white-clawed crayfish, <i>Austropotamobius pallipes</i> (approximately 50,000 individuals). It was previously thought that this population had been eradicated by crayfish plague; however, it was shown in 2022 to remain present, albeit depleted. The site lies immediately south-west of Nuneaton between Heath End Road to the north and Harefield Lane to the south. It comprises an abandoned clay pit measuring 3.5 ha in size, with a perimeter of approximately 770 m and an average depth of 8 m. A dye tracing exercise of the pool by the Environment Agency has confirmed Ensor's Pool is groundwater fed and is not hydraulically linked to nearby ordinary watercourses. The pool is surrounded by marginal vegetation of hard rush <i>Juncus inflexus</i>, common spike-rush <i>Eleocharis palustris</i>,	Annex II species that are a primary reason for selection of this site: • White-clawed (or Atlantic stream) crayfish <i>Austropotamobius pallipes</i>.

Name	Approximate distance to the Proposed Development	Habitats Site description	Summary of qualifying features
		water horsetail <i>Equisetum fluviatile</i> and lesser bulrush <i>Typha angustifolia</i> . Water plants include spiked water-milfoil <i>Spicatum</i> sp. and broadleaved pondweed <i>Potamogeton natans</i> . Areas of scrub and grassland are also present.	
River Mease SAC	The Proposed Development lies approximately 12.9 km from the SAC.	The River Mease SAC represents a relatively natural lowland river which contains a diverse range of physical in-channel features, including riffles, pools, slacks, vegetated channel margins and bankside tree cover. It provides suitable conditions to sustain populations of spined loach and bullhead. The river is also considered to support a significant presence of water-crowfoot <i>Ranunculus fluitans</i> and water starwort <i>Callitriche</i> spp.	Annex I habitats that are a primary reason for selection of this site: • Water courses of plain to montane levels with the <i>Ranunculus fluitans</i> and <i>Callitriche-Batrachion</i> vegetation. Annex II species present as a qualifying feature, but not a primary reason for site selection: • Spined loach (<i>Cobitis taenia</i>); • Bullhead (<i>Cottus gobio</i>); • White-clawed (or Atlantic stream) crayfish; and • Otter.
Upper Nene Gravel Pits SPA	The Proposed Development lies approximately 7.1 km from the SPA.	The Upper Nene Valley Gravel Pits SPA comprises a chain of exhausted sand and gravel pits extending for approximately 35 km along the alluvial deposits of the River Nene in Northamptonshire. The pits form an extensive series of shallow and open waters which occur in association with a wide range of habitats including reed swamp, marsh,	The SPA site qualifies under Article 4.1 by regularly supporting the following Annex 1 species in the non-breeding season: • Bittern <i>Botaurus stellaris</i> (wintering); • Gadwall <i>Anas strepera</i> (wintering); and • Golden plover <i>Pluvialis apricaria</i> (wintering).

Name	Approximate distance to the Proposed Development	Habitats Site description	Summary of qualifying features
		wet ditches, rough grassland and scattered woodland. The habitats within the SPA collectively form one of the most important inland localities in England for waterbirds in the non-breeding period and regularly support peak numbers of waterbirds in excess of 20,000 individuals, including significant populations of bittern, golden plover and gadwall.	Assemblage qualification: The SPA site qualifies under article 4.2 of the Birds Directive (79/409/EEC) as it is used regularly by over 20,000 waterbirds (waterbirds as defined by the Ramsar Convention) in any season such as wigeon <i>Anas penelope</i> , mallard <i>Anas platyrhynchos</i> , shoveler <i>Anas clypeata</i> , pochard <i>Aythya farina</i> , tufted duck <i>Aythya fuligula</i> , great-crested grebe <i>Podiceps cristatus</i> , mute swan <i>Cygnus olor</i> , cormorant <i>Phalacrocorax carbo</i> , lapwing <i>Vanellus vanellus</i> and coot <i>Fulica atra</i> .
Upper Nene Gravel Pits Ramsar	The Proposed Development lies approximately 7.1 km from the Ramsar.	See previous row.	The Ramsar site is designated for: Ramsar criterion 5: The site regularly supports 20,000 or more waterbirds: In the non-breeding season, the site regularly supports 23,821 individual waterbirds (5 year peak mean 1999/2000 – 2003/04). Ramsar criterion 6: The site regularly supports 1% of the individuals in the populations of the following species or subspecies of waterbird in any season: • Mute swan <i>Cygnus olor</i> (wintering); and • Gadwall <i>Anas strepera</i> (wintering).
Chilterns Beechwoods SAC	The Proposed Development lies	The Chilterns Beechwoods SAC is an extensive site covering nearly 1,300 ha and constitutes several component parts within	Annex I habitats that are a primary reason for selection of this site: • <i>Asperulo-Fagetum</i> beech forests

Name	Approximate distance to the Proposed Development	Habitats Site description	Summary of qualifying features
	approximately 3.8 km from the SAC.	Dacorum, Buckinghamshire, South Oxfordshire, and Windsor and Maidenhead. It is protected for its beech forests, semi-natural dry grasslands and scrub, and its population of stag beetles.	- Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (*important orchid sites) Annex II species present as a qualifying feature, but not a primary reason for site selection: - Stag Beetle <i>Lucanus cervus</i>

Table 5: Conservation objectives and threats/pressures to the integrity of relevant Habitats Sites.

Site name	Conservation Objectives	Threats/pressures to site integrity ³
Humber Estuary SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring: - The extent and distribution of the habitats of the qualifying features; - The structure and function of the habitats of the qualifying features; - The supporting processes on which the habitats of the qualifying features rely; - The population of each of the qualifying features; and	The following threats/pressures to the site integrity of the Humber Estuary SPA and SAC have been identified in Natural England's Site Improvement Plan (Ref. 20): Water pollution; - Coastal squeeze; Changes in species distributions; - Undergrazing; - Invasive species; Natural changes to site conditions; - Public Pressure Access/Disturbance; - Fisheries: Commercial marine and estuarine; - Direct land take from development;

³ Threats/pressures in bold are considered of potential relevance to the Proposed Development.

Site name	Conservation Objectives	Threats/pressures to site integrity ³
	The distribution of the qualifying features within the site.	- Air Pollution: impact of atmospheric nitrogen deposition; and - Direct impact from third-party.
Humber Estuary SAC	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring: - The extent and distribution of qualifying natural habitats and habitats of qualifying species; - The structure and function (including typical species) of qualifying natural habitats; - The structure and function of the habitats of qualifying species; - The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely; - The populations of qualifying species; and - The distribution of qualifying species within the site.	See previous row.
Ensor's Pool SAC	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; - The extent and distribution of qualifying natural habitats of qualifying species - The structure and function of qualifying species - The structure and function of the habitats of qualifying species - The supporting processes on which the habitats of qualifying species rely	The following threats/pressures to the site integrity of the Ensor's Pool SAC have been identified in Natural England's Site Improvement Plan (Ref. 21): Changes in species distribution; - Recreational pressure; and Changes in groundwater flows.

Site name	Conservation Objectives	Threats/pressures to site integrity ³
	• The populations of qualifying species, and, • The distribution of qualifying species within the site.	
River Mease SAC	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; • The extent and distribution of qualifying natural habitats and habitats of qualifying species, • The structure and function (including typical species) of qualifying natural habitats, • The structure and function of the habitats of qualifying species, • The supporting processes on which qualifying natural habitats, and the habitats of qualifying species rely, • The populations of qualifying species, and, • The distribution of qualifying species within the site.	The following threats/pressures to the site integrity of the River Mease SAC have been identified in Natural England's Site Improvement Plan (Ref. 22): • Water pollution; • Drainage; • Inappropriate weirs and dams and other structures within, and adjacent to, the river corridor, thus blocking movement of fish or otter; • Invasive species; • Siltation; and, • Water abstraction (in the context of reduced discharge from Minworth and reduced flows in the River Tame).
Upper Nene Gravel Pits SPA	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring; • The extent and distribution of the habitats of the qualifying features, • The structure and function of the habitats of the qualifying features, • The supporting processes on which the habitats of the qualifying features rely, • The population of each of the qualifying features, and	The following threats/pressures to the site integrity of the Upper Nene Gravel Pits SPA have been identified in Natural England's Site Improvement Plan (Ref. 23): • Public access / disturbance; • Planning permission: general; • Fisheries: Freshwater; and • Change in land management.

Site name	Conservation Objectives	Threats/pressures to site integrity ³
	The distribution of the qualifying features within the site.	
Chilterns Beechwoods SAC	Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring; - The extent and distribution of qualifying natural habitats and habitats of qualifying species, - The structure and function (including typical species) of qualifying natural habitats, - The structure and function of the habitats of qualifying species, - The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely, - The populations of qualifying species, and, - The distribution of qualifying species within the site.	The following threats/pressures to the site integrity of the Chilterns Beechwoods SAC have been identified in Natural England's Site Improvement Plan (Ref. 24): - Forestry and woodland management; - Deer; - Change in species distributions; - Invasive species; - Disease; - Public access / disturbance; and Air pollution: Impact of atmospheric nitrogen deposition.

5. Background to Linking Impact Pathways

- 5.1.1 This section provides detailed background on the impact pathways arising from the Proposed Development in the context of the Habitats Sites that fall within its Zol. It also identifies those Habitats Sites that can be scoped out from further assessment, setting out a clear rationale for each case.

5.2 Water Quantity, Level and Flow

- 5.2.1 The water level, its flow rates and the mixing conditions are important determinants of the conditions present within Habitats Sites and the state of their qualifying features. Hydrological processes are critical in influencing habitat characteristics in coastal waters, including parameters such as current velocity, water depth, dissolved oxygen (DO) concentrations, salinity and water temperature. In turn these parameters determine the short- and long-term viability of plant and animal species, as well as overall ecosystem composition. Changes to the water flow rate within an estuary can be associated with a multitude of knock-on impacts, including substratum loss, smothering and changes in wave exposure.
- 5.2.2 The unique nature of wetlands combines shallow water and conditions that are ideal for the growth of organisms at the basal level of food webs, which feed many species of birds, mammals, fish and amphibians. Overwintering, migrating and breeding wetland bird species are particularly reliant on these food sources, as they need to build up enough nutritional reserves to sustain their long migration routes or feed their hatched chicks.
- 5.2.3 The proliferation of impermeable surfaces increases the volume and speed of surface water runoff. Traditional drainage systems often cannot cope with the volume of runoff, particularly during intense rainfall events, resulting in downstream flooding of ecological receptor sites.
- 5.2.4 Overall, the available baseline information suggests that the following Habitats Sites within the Zol of the Proposed Development are sensitive to potential hydrological changes:
- a. Chilterns Beechwoods SAC;
 - b. Ensor's Pool SAC;
 - c. Upper Nene Gravel Pits SPA/Ramsar; and
 - d. Humber Estuary SAC/SPA/Ramsar.
- 5.2.5 Of these Habitats Sites, only the Upper Nene Gravel Pits SPA/Ramsar and Humber Estuary SAC/SPA/Ramsar are scoped in for further assessment, while the Chilterns Beechwoods SAC and Ensor's Pool SAC are all scoped out. The rationales for scoping out the latter two Habitats Sites are set out below.

- 5.2.6 The Chilterns Beechwoods SAC is designated for a range of terrestrial habitats (i.e. semi-natural dry grasslands and scrubland facies, *Asperulo-Fagetum* beech forests) and stag beetle. While these qualifying features all depend on an adequate water supply, none are considered to rely on hydrological linkages with freshwater bodies such as the GUC. The beech forest is the only qualifying feature for which Natural England's SACO for the SAC lists hydrology as an attribute. Beech trees are shallow-rooted, which makes them potentially sensitive to increases and decreases in water level. While it is noted that the Proposed Development will discharge a maximum of 115 Ml/d of treated freshwater into the Coventry, Oxford and Grand Union Canals, this same volume of water will be abstracted from the GUC upstream from the SAC. Therefore, there will be no net increase or decrease in the GUC's overall flow volumes due to the Proposed Development. Given this and the absence of connectivity to the GUC, the Chilterns Beechwoods SAC is scoped out from further assessment in relation to this impact pathway.
- 5.2.7 The Ensor's Pool SAC comprises a 3.79 ha large, abandoned clay pit with an average depth of 8 m. A dye tracing exercise of the pool by the Environment Agency has confirmed Ensor's Pool is groundwater fed and is not hydraulically linked to nearby ordinary watercourses. Therefore, while white-clawed crayfish would primarily be sensitive to a decrease in water level within the SAC, the Proposed Development involves the discharge of additional freshwater into the Coventry, Oxford and Grand Union Canals and, therefore, will not result in reduced water levels in any hydrologically linked Habitats Sites. Furthermore, the closest part of the Proposed Development (the Coventry Canal at approximately 1.1 km distance) lies within a different groundwater body, such that there will also be no water level impacts through increased groundwater flow. Due to this, the Ensor's Pool SAC is excluded from further assessment in relation to this impact pathway.

5.3 Water Quality

- 5.3.1 The quality of the water that feeds a Habitats Site is an important determinant of the condition of the habitats and species it supports. Poor water quality can have a range of environmental impacts:
- 5.3.2 Some pesticides, industrial chemicals, and components of discharges from Wastewater Recycling Centres are suspected to interfere with the functioning of the endocrine system of aquatic life, possibly having negative effects on reproductive rates. Likewise, chemicals such as cypermethrin and mancozeb have been investigated during the RAPID process due to potentially altered concentrations in the River Tame and corresponding effects on the olfactory function of migratory fish species. Further water quality modelling will inform this ongoing assessment for the DCO application.

- 5.3.3 At high levels, toxic chemicals and metals can result in immediate death of aquatic life, and detrimental effects are also possible at lower levels, including increased vulnerability to disease and changes in behaviour. The anticipated changes in water quality in the Rivers Tame and Trent as a result of the Proposed Development have been shown to be relatively minor due to the reduction in discharge to the River Tame and changes in dilution factors. However, water quality monitoring and modelling are ongoing throughout the preparation of the DCO application and will inform the developing HRA.
- 5.3.4 Construction activities that involve ground excavations and the stripping of topsoil are associated with a high risk of sediment release in surface runoff. Excessive sedimentation can smother aquatic habitats and plants, increase turbidity and accelerate eutrophication. Construction activities are not proposed in close proximity to the River Tame, and therefore this effect is likely to be minor. However, construction activities along the canals may result in sediment input and changes in water quality to receiving water bodies, for example where there are overflows from the canals via waste weirs.
- 5.3.5 Eutrophication, the enrichment of water with nutrients, increases plant growth and can result in oxygen depletion. Algal blooms, which commonly result from eutrophication, increase turbidity and decrease light penetration. The decomposition of organic wastes that often accompanies eutrophication deoxygenates water further, augmenting the oxygen depleting effects of eutrophication. In freshwater ecosystems, plant growth is primarily determined by phosphorus (P) concentrations, which are determined by a wide range of sources, including treated sewage effluent from WwRC and urban surfaces such as roads. Water quality monitoring and modelling will inform the assessment of potential changes in nutrient balance, and other water quality parameters, in water bodies within the Zol of the Proposed Development, including Habitats Sites.
- 5.3.6 Under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Ref. 25), it is legally required to maintain and/or improve the ecological and chemical status of the water environment, which includes rivers, lakes, wetlands, groundwater, estuaries and coastal marine habitats. A preliminary WFD Assessment has been prepared as part of the PEI Report (see **Appendix 22-PD-4: Water Framework Directive** in PEI Report **Volume 4**).
- 5.3.7 The magnitude of water quality impacts primarily depends on the appropriate treatment of process water and/or surface runoff. Furthermore, the severity of potential construction and operational water quality impacts is partially determined by the distance between development sites and ecological receptor sites. In this instance, the Scheme does not immediately adjoin any aquatic Habitats Sites with sensitivity to water pollution, but it is

hydrologically connected to the Humber Estuary SAC/SPA/Ramsar via the Rivers Tame and Trent.

5.3.8 Overall, the following Habitats Sites within the Zol of the Proposed Development are sensitive to potential water quality impacts:

- a. Chilterns Beechwoods SAC;
- b. Ensor's Pool SAC;
- c. River Mease SAC;
- d. Upper Nene Gravel Pits SPA/Ramsar; and
- e. Humber Estuary SAC/SPA/Ramsar.

5.3.9 Of these Habitats Sites, only the Upper Nene Gravel Pits SPA/Ramsar and Humber Estuary SAC/SPA/Ramsar are scoped in for further assessment, while the Chilterns Beechwoods SAC, Ensor's Pool SAC and River Mease SAC are all scoped out. The rationales for scoping out the latter three Habitats Sites are set out below.

5.3.10 As highlighted in the previous section, the Asperulo-Fagetum beech forest in the Chilterns Beechwoods SAC is potentially sensitive to hydrological changes, including those that relate to water quality. However, there are no known hydrological links between the GUC and the SAC, indicating that there will be no water quality impact of the Proposed Development. Furthermore, even if the SAC was hydrologically connected to the GUC, any pollutants deriving from the in-canal construction works (Part 2 of the Proposed Development) or operation of the AWTP and underground pipeline to Atherstone (Parts 1a and 1b of the Proposed Development) would likely be sufficiently attenuated and/or diluted due to the long flowpaths in the canal network. Therefore, there will be no water quality impacts of the Proposed Development on this SAC. The Chilterns Beechwoods SAC is scoped out from further assessment in relation to this impact pathway.

5.3.11 While the Ensor's Pool SAC is sensitive to water quality changes in principle, the previous section highlighted that there are no surface water or groundwater hydrological connections between the Proposed Development and the abandoned clay pit. Therefore, there is no potential for the construction works and operation of the Proposed Development to result in water quality impacts to the SAC. Due to this, the Ensor's Pool SAC is scoped out from further assessment in relation to this impact pathway.

5.3.12 The qualifying habitats and species in the River Mease SAC are sensitive to negative changes in water quality. The SIP for the SAC highlights that the major water quality concern is present in relation to elevated phosphorus concentrations, which lead to eutrophication and excessive algal growth. While there is limited groundwater connectivity between the River Tame and the SAC, it is considered that the slow percolation of groundwater through

the aquifer would remove any pollutants through natural filtration processes. Therefore, it is considered that there will be no water quality impacts of the Proposed Development on the SAC. The River Mease SAC is scoped out from further assessment in relation to this impact pathway.

5.4 Noise and Visual Disturbance (in Functionally Linked Habitat)

- 5.4.1 Development can result in noise or visual disturbance of qualifying species in Habitats Sites, during the construction and operational (including maintenance) phases. For example, noise and visual disturbance arising from construction may result in temporary behavioural changes in qualifying otter, such as disturbance in holts and displacement from specific stretches of the river. Male otter are known to have particularly extensive home ranges of between 12-80 km (Ref. 26). Furthermore, construction activities that are carried out in-river or adjacent to riverbanks have the potential to result in vibration disturbance to qualifying fish via increases in particle motion. Due to the distance of the Proposed Development to the relevant Habitats Sites considered here (i.e. the River Mease SAC and Humber Estuary SAC), there will be no disturbance potential for qualifying species within the designated site boundary. However, given the hydrological linkage between parts of the Proposed Development and these Habitats Sites, and the highly mobile nature of otter and lamprey, these animals are anticipated to use the entire continuum of watercourses linking the designated site boundaries with the aquatic environment surrounding the Proposed Development. Therefore, construction activities could result in material disturbance to qualifying otter and lamprey in the construction phase. Disturbance from site usage by operational site staff, road traffic and operational lighting might also arise. Generally, three of the most important factors determining the magnitude of disturbance from developments on ecological receptors are considered to be individual species sensitivity, proximity of the disturbance source and timing/duration of the disturbance.
- 5.4.2 It is noted that river lamprey and sea lamprey differ in their core migratory periods, the times during which they are most sensitive to vibration impacts. Following metamorphosis, both lamprey species undertake their seaward migration from early autumn to late winter (September to February). The return of reproductively active river lamprey to upstream spawning locations occurs between October and December, whereas upstream movement of sea lamprey takes place in April and May. Any development proposal should consider the most sensitive periods for each of the lamprey species when progressing towards the detailed design stage.
- 5.4.3 AECOM undertook a literature review of the vibration disturbance risks associated with trenchless construction methods, such as HDD. This indicates that while there is some evidence for behavioural impacts and

physical injury from underwater noise generated by specific construction activities (typically from pile driving, dredging and seismic surveying – construction activities with much larger noise profiles that will not be undertaken for the Proposed Development), there is little to no evidence of harm from substrate vibration. Based on the likely acoustical energies associated with trenchless methods it is highly unlikely that any material substrate vibration or associated noise disturbance would occur in adjacent water columns. Trenchless techniques are also temporary and short-term, with the entire construction process typically completed within approximately one week. Notwithstanding this, trenchless methods should be considered in HRAs as a precautionary measure.

5.4.4 Overall, the following Habitats Sites within the ZOI of the Proposed Development are sensitive to potential noise and visual disturbance (both of which are scoped in for further assessment):

- a. Humber Estuary SAC; and
- b. River Mease SAC.

5.5 Atmospheric Pollution

5.5.1 Construction activities required for the Proposed Development have the potential to affect the air quality in the surrounding environment, including sensitive Habitats Sites. This is primarily expected due to pollutants contained within exhaust emissions of construction vehicles and mechanised plant.

5.5.2 The main pollutants of concern for Habitats Sites are nitrogen oxides (NO_x), ammonia (NH₃) and sulphur dioxide (SO₂) – see **Table 6**. NH₃ can have a directly toxic effect upon vegetation, particularly at close distances to the source such as near road verges (Ref. 27). NO_x can also be toxic to vegetation at very high concentrations (far above the annual average Critical Level). Furthermore, high levels of NO_x and NH₃ are likely to increase the total nitrogen (N) deposition, potentially leading to deleterious knock-on effects in recipient ecosystems. An increase in N deposition from the atmosphere is widely known to enhance soil fertility, leading to eutrophication. This often has adverse effects on plant community composition and the overall quality of semi-natural, nitrogen-limited terrestrial and aquatic habitats (Ref. 28 and Ref. 29).

Table 6: Main sources and effects of air pollution on habitats and species

Pollutant	Source	Effects on habitats and species
SO ₂	The main sources of SO ₂ are electricity generation, and	Wet and dry deposition of SO ₂ acidifies soils and freshwater and

Pollutant	Source	Effects on habitats and species
	industrial and domestic fuel combustion. However, total SO₂ emissions in the UK have decreased substantially since the 1980s. Another origin of SO₂ is the shipping industry and high atmospheric concentrations of SO₂ have been documented in busy ports. In future years shipping is likely to become one of the most important contributors to SO₂ emissions in the UK.	may alter the composition of plant and animal communities. The magnitude of effects depends on levels of deposition, the buffering capacity of soils and the sensitivity of impacted species. However, SO₂ background levels have fallen considerably since the 1970s and are now not regarded a threat to plant communities. For example, decreases in SO₂ concentrations have been linked to returning lichen species and improved tree health in London.
Acid deposition	Leads to acidification of soils and freshwater via atmospheric deposition of SO₂, NO_x, NH₃ and hydrochloric acid (HCl). Acid deposition from rain has declined by 85% in the last 20 years, with most of this contributed by lower sulphate levels. Although future trends in SO₂ emissions and subsequent deposition to terrestrial and aquatic ecosystems will continue to decline, increased N emissions may cancel out any gains produced by reduced SO₂ levels.	Gaseous precursors (e.g., SO₂) can cause direct damage to sensitive vegetation, such as lichen, upon deposition. Can affect habitats and species through both wet (acid rain) and dry deposition. The effects of acidification include lowering of soil pH, leaf chlorosis, reduced decomposition rates, and compromised reproduction in birds/plants. Not all sites are equally susceptible to acidification. This varies depending on soil type, bed rock geology, weathering rate and buffering capacity. For example, sites with an underlying geology of granite, gneiss and quartz rich rocks tend to be more susceptible.
Ammonia (NH₃)	Ammonia is a reactive, soluble alkaline gas that is released following decomposition and volatilisation of animal wastes and from some chemical processes and vehicle exhausts. It is a naturally occurring trace gas, but ammonia concentrations are directly	The negative effect of NH₄⁺ may occur via direct toxicity when uptake exceeds detoxification capacity and via N accumulation. Its main adverse effect is eutrophication, leading to species assemblages that are dominated by fast-growing and tall species. For example, a shift in

Pollutant	Source	Effects on habitats and species
	related to the distribution of livestock. Ammonia reacts with acid pollutants such as the products of SO₂ and NO_x emissions to produce fine ammonium (NH₄⁺) – containing aerosol. Due to its significantly longer lifetime, NH₄⁺ may be transferred much longer distances (and can therefore be a significant trans-boundary issue). While ammonia deposition may be estimated from its atmospheric concentration, the deposition rates are strongly influenced by meteorology and ecosystem type.	dominance from heath species (lichens, mosses) to grasses is often seen. As emissions mostly occur at ground level in the rural environment and NH₃ is rapidly deposited, some of the most acute problems of NH₃ deposition are for small relict nature reserves located in intensive agricultural landscapes.
NO_x	Nitrogen oxides are mostly produced in combustion processes. Half of NO_x emissions in the UK derive from motor vehicles, one quarter from power stations and the rest from other industrial and domestic combustion processes.	Direct toxicity effects of gaseous nitrates are likely to be important in areas close to the source (e.g., roadside verges). A critical level of NO_x for all vegetation types has been set to 30 µg/m³ (micrograms per cubic metre). Deposition of nitrogen compounds (nitrates (NO₃), NO₂ and nitric acid (HNO₃)) contributes to the total N deposition and may lead to both soil and freshwater acidification. In addition, NO_x contributes to the eutrophication of soils and water, altering the species composition of plant communities at the expense of sensitive species.
N deposition	The pollutants that contribute to the total nitrogen deposition derive mainly from oxidized (e.g., NO_x) or reduced (e.g., NH₃) N emissions (described separately above). While oxidized nitrogen mainly originates from major conurbations or highways, reduced nitrogen mostly derives from farming practices.	All plants require nitrogen compounds to grow, but too much overall N is regarded as the major driver of biodiversity change globally. Species-rich plant communities with high proportions of slow-growing perennial species and bryophytes are most at risk from N eutrophication. This is because

Pollutant	Source	Effects on habitats and species
	The N pollutants together are a large contributor to acidification (see above).	many semi-natural plants cannot assimilate the surplus N as well as many graminoid (grass) species. N deposition can also increase the risk of damage from abiotic factors, e.g., drought and frost.
Ozone (O₃)	A secondary pollutant generated by photochemical reactions involving NO_x, volatile organic compounds (VOCs) and sunlight. These precursors are mainly released by the combustion of fossil fuels (as discussed above). Increasing anthropogenic emissions of ozone precursors in the UK have led to an increased number of days when ozone levels rise above 40 ppb (parts per billion) ('episodes' or 'smog'). Reducing ozone pollution is believed to require action at international level to reduce levels of the precursors that form ozone.	Concentrations of O₃ above 40 ppb can be toxic to both humans and wildlife and can affect buildings. High O₃ concentrations are widely documented to cause damage to vegetation, including visible leaf damage, reduction in floral biomass, reduction in crop yield (e.g., cereal grains, tomato, potato), reduction in the number of flowers, decrease in forest production and altered species composition in semi-natural plant communities.

Source: Air Pollution Information System (www.apis.ac.uk)

- 5.5.3 SO₂ emissions overwhelmingly derive from power stations and industrial processes that require the combustion of coal and oil, as well as shipping (particularly on a local scale). There will be no material release of SO₂ in the construction or operational phases of the Proposed Development. Therefore, this atmospheric pollutant is not considered further in this HRA.
- 5.5.4 NO_x emissions are dominated by the output of vehicle exhausts (more than half of all emissions) and some vehicles also emit NH₃. The main air quality impact of the Proposed Development is likely to occur in the construction phase, when construction traffic will lead to the temporary emission of NO_x, NH₃ and an overall increase in total N deposition. Furthermore, some construction plant and machinery are also associated with NO_x emissions, such as diesel generators. According to the World Health Organisation (WHO), the Critical Level for NO_x for the protection of vegetation is 30µgm⁻³ (micrograms per cubic metre) and the Critical Level for NH₃ when lower plants are present is 1µgm⁻³ (Ref. 30). In addition, ecological studies have

determined Critical Loads (CLs)⁴ for atmospheric N deposition (NO_x combined with NH₃).

- 5.5.5 The Department of Transport's Transport Analysis Guidance (Ref. 19) states that beyond 200 m, the contribution of vehicle emissions from the roadside to local pollution levels is insignificant (refer to **Plate 3**). This is the distance that is used in this HRA to screen for potential atmospheric pollution impacts associated with the Proposed Development.

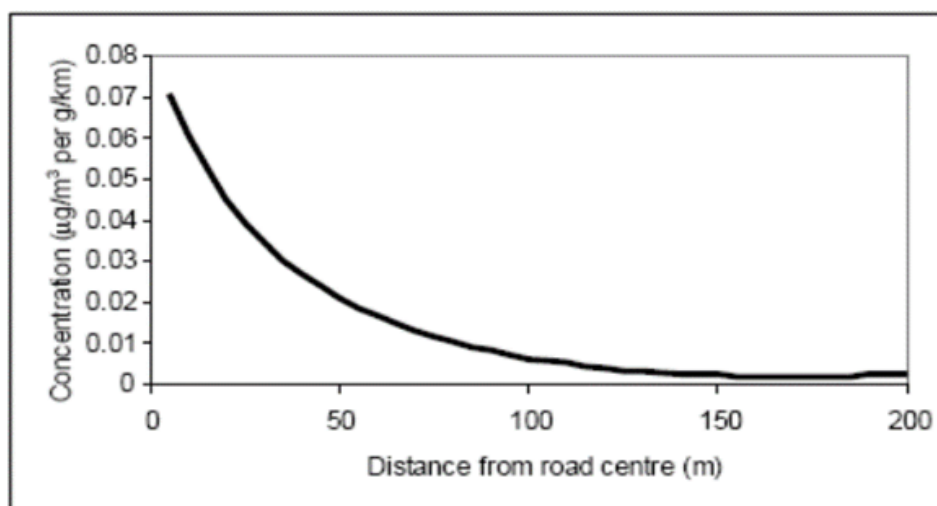


Plate 3: Traffic contribution to concentrations of pollutants at different distances from a road

- 5.5.6 The Chilterns Beechwoods SAC is currently the only habitats site within the Zol of the Proposed Development, which is sensitive to atmospheric pollution, and is therefore scoped in for further assessment.

Dust Deposition (in Functionally Linked Habitat)

- 5.5.7 Construction activities can generate dust emissions from operating machinery that can cause localised smothering of vegetation or potential health issues in fauna. The effects of dust will depend on the prevailing wind direction, and the transport distance is related to particle size. Dust particle size and chemical composition is important as smaller particles can enter or block stomata and thus interfere with gas exchange, while sufficient coverage may prevent light penetration to the chloroplasts.
- 5.5.8 Fauna is exposed to air pollutants via three pathways: 1) inhalation of gases or small particles; 2) ingestion of particles suspended in food or water; or, 3) absorption of gases through the skin. It is likely that birds are even more

⁴ The critical load is the rate of deposition beyond which research indicates that adverse effects can reasonably be expected to occur.

susceptible to gaseous pollutant injury than mammals due to their higher respiratory rates.

- 5.5.9 For the purposes of screening, according to guidance from the Institute of Air Quality Management (IAQM) (Ref. 18), with respect to possible effects due to dust, "...an assessment will normally be required where there is...an 'ecological receptor' within: 50 m of the boundary of the site; or 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s)". In their advice regarding this HRA, Natural England indicated that the potential for dust impacts should be considered up to 200 m from dust-generating activities.
- 5.5.10 Overall, the following Habitats Sites within the Zol of the Proposed Development are sensitive to dust deposition (both of which are scoped in for further assessment):
- a. Humber Estuary SAC; and
 - b. River Mease SAC.

6. HRA Stage 1: Screening for Likely Significant Effects

6.1 Introduction

- 6.1.1 This section evaluates whether the Proposed Development will result in LSEs on the qualifying features of the Humber Estuary SPA/Ramsar/SAC, River Mease SAC, Upper Nene Gravel Pits SPA/Ramsar and Chilterns Beechwoods SAC. It only considers impact pathways for which any or all of these Habitats Sites have been identified to lie within the Zol of the Proposed Development.

6.2 Construction Phase

Water Quality

Humber Estuary SPA/Ramsar/SAC

- 6.2.1 As highlighted in section 5, the Humber Estuary SPA / Ramsar / SAC is sensitive to any accidental release of toxic and non-toxic aquatic pollutants, including fuels, oils, paints, solvents and sediment. For example, wintering birds in the Humber Estuary SPA / Ramsar are indirectly sensitive to water quality deterioration through negative impacts on their food web. The structure of the invertebrate and macrophyte communities that these birds forage on can significantly shift and, if sufficiently large, result in population-level effects. However, at respective straight-line distances of approximately 136 km and 125 km between the Humber Estuary SPA and Ramsar, and the Proposed Development (and significantly further when considering actual

flowpath distance), it is considered that there is no potential for pollutants reaching the SPA / Ramsar (nor any functionally linked riverside habitats upstream that may be used by qualifying birds, which are associated with maximum foraging ranges of up to 20 km from the SPA / Ramsar boundary). Considering the long flowpath distance, any pollutants would be sufficiently diluted and / or attenuated long before reaching habitats that are used by qualifying birds. Therefore, there will be no LSEs of the Proposed Development on the Humber Estuary SPA / Ramsar regarding construction phase water quality impacts. This impact pathway is screened out from further appraisal in an AA.

- 6.2.2 At a straight-line distance of 125 km, the Humber Estuary SAC also lies sufficiently distant from the Proposed Development for there to be no direct construction-related impacts on the designated site. However, river lamprey and sea lamprey, both anadromous qualifying species of the SAC, are known to undertake annual migrations to their upstream spawning grounds in tributaries of the estuary. Toxic and non-toxic aquatic pollutants have the potential to affect lamprey both directly and indirectly. The freshwater body that lies closest to the Proposed Development is the River Tame, which is hydrologically connected to the Humber Estuary SAC via the River Trent. While it is noted that there are no existing records of lamprey in the upstream reaches of the River Tame due to existing in-river barriers (see discussion on water quantity, level and flow impacts in the operational phase), possible presence of lamprey in the river are considered here as a precaution. It is also noted that both Natural England and Environment Agency have identified the restoration of habitat connectivity as a primary target, such that lamprey may be present here in the future.
- 6.2.3 The new AWTP (Part 1a) and new pipeline connecting the AWTP to the Outfall to the Coventry Canal (Part 1b) are the only elements of the Proposed Development with a hydrological linkage to the River Tame. For example, at its closest, the anticipated footprint of and working area for the AWTP lies only approximately 191 m to the north of the River Tame, which is within a potential impact distance for surface runoff and / or pollutants released to local drains and ditches. Construction of the Minworth to Atherstone Pipeline will be undertaken in proximity to the River Tame or its tributaries at various locations, in particular the area to the north and north-east of Lea Marston, and south Hurley. The construction methodology for the AWTP and Minworth to Atherstone Pipeline encompass a range of elements that pose potential risks to water quality.
- 6.2.4 The following construction elements for Part 1a of the Proposed Development have potential for the release of aquatic pollutants:
- a. Trench excavation for the inlet pipe connecting Minworth WwRC with the AWTP;

- b. Pouring of concrete foundations to accommodate the process elements of the AWTP; and
- c. Excavations to facilitate reinforcement fixing and shuttering.

6.2.5 The following construction stages for Part 1b of the Proposed Development have the potential for the release of aquatic pollutants:

- a. Open-cut construction methods for the pipeline installation;
- b. Stockpiling of arising on the side of the pipeline working corridor;
- c. Plant and vehicular access on the haul road along the working corridor;
- d. Backfilling of the trench with suitable material;
- e. Removal of unsuitable or surplus materials by Heavy Goods Vehicles (HGVs); and
- f. Crossing of the River Tame via trenchless techniques.

6.2.6 While there is a potential risk of Part 1a and Part 1b of the Proposed Development to release pollutants into the aquatic environment (including the River Tame), this will need to be prevented in order to comply with environmental legislation. For example, the Environmental Damage (Prevention and Remediation) (England) Regulations 2015 and the Environmental Permitting (England and Wales) Regulations 2016 make it illegal to pollute watercourses, both deliberately and accidentally, irrespective of whether hydrologically linked Habitats Sites are present. This makes it permissible to take any proposed water quality protection measures into account at the LSEs screening stage. These measures are typically set out in an Outline Construction Environmental Management Plan (CEMP) accompanying development proposals. An Outline CEMP for the Proposed Development is being prepared to accompany the statutory consultation for the PEI Report. As this Outline CEMP is further developed post consultation full details of all water quality protection measures will be added into the Report to Inform the HRA.

6.2.7 Overall, there is a legal requirement to protect water quality and adequate measures will need to be secured for the DCO application. The Outline CEMP will be submitted with the DCO Application, however, until this has been produced and water quality protection measures have been reviewed, **LSEs of the Proposed Development on the Humber Estuary SAC regarding water quality, both alone and in-combination, cannot be excluded. Currently, this impact pathway is screened in for further appraisal in an AA.** Furthermore, water quality will continue to be an important consideration as the Proposed Development progresses towards the design stage. This will include water quality modelling and Water Framework Directive (WFD) assessment.

Upper Nene Valley Gravel Pits SPA/Ramsar

- 6.2.8 The Upper Nene Valley Gravel Pits SPA comprises a series of exhausted sand and gravel pits extending along alluvial deposits of the River Nene. These gravel pits comprise one of the most important inland freshwater habitats in England for wintering waterbirds. The SPA is designated for non-breeding bittern, gadwall, golden plover and its overarching waterbird assemblage. According to Natural England's SACO for the SPA, all qualifying species are sensitive to a decline in water quality, which would be primarily mediated through indirect impacts on their foraging resources. Similar potential water quality related impacts on the foraging resources apply to the qualifying species of the Upper Nene Valley Gravel Pits Ramsar (i.e. gadwall and mute swan).
- 6.2.9 Potential water quality impacts of the Proposed Development in the construction phase would primarily stem from delivery of the Outfall to the Coventry Canal and in-channel works required in the Coventry, Oxford and Grand Union Canals (Part 2). The following elements of construction works required for Part 2 of the Proposed Development all have the potential to reduce water quality through the release of toxic and non-toxic contaminants:
- a. Construction of pumped and gravity bypasses to bypass locks;
 - b. Potential modification to some existing canal bridges to ensure safe navigation/headroom clearance;
 - c. Raising of sections of canal bank levels to maintain a minimum freeboard; and
 - d. The construction of transfer locks breaks the flow of water and controls the flow and prevent one section of canal taking large amounts of water from another section of canal.
- 6.2.10 At its closest, the Upper Nene Gravel Pits SPA/Ramsar lies approximately 8.3 km east of the GUC. The Waterbody Connections Report completed during the RAPID process indicates that the GUC is in hydrological connection with the River Nene at Gayton Junction via its Northampton Arm. All construction elements for Part 2 of the Proposed Development listed above are undertaken upstream of Gayton Junction, such that there is a potential for negative water quality impacts in the construction phase. Furthermore, Daventry Reservoir is also connected to the Upper Nene Gravel Pits SPA/Ramsar via a different stretch of the GUC, which subsequently feeds into the River Nene (although at a flowpath distance of 30.8 km to the closest part of the SPA/Ramsar). Both hydrological connections between Part 2 of the Proposed Development and the Upper Nene Gravel Pits SPA/Ramsar occur over considerable distances, which imply that any aquatic pollutants would be subject to attenuation and dilution processes before reaching the designated site boundary. As discussed in

relation to the Humber Estuary SPA/Ramsar/SAC, there are legislative drivers in place that protect environmental water quality regardless of the presence of Habitats Sites. Ensuring that the wider water quality is protected, will be achieved through the WFD assessment (and the 'mitigation' contained therein). The Outline Construction Environmental Management Plan (CEMP) accompanying the DCO application will detail the measures required to protect the water quality in the GUC and any hydrologically linked waterbodies.

6.2.11 Furthermore, there are several further factors that will minimise the potential water quality impacts of the Proposed Development on the Upper Nene Valley Gravel Pits SPA/Ramsar in the construction phase:

- a. AfW and the Canal & River Trust have confirmed that a sluice and lockage system is operational at Gayton Junction, which limits the overspill of water from GUC (which would include any water carrying pollutants from Part 2 construction works);
- b. The Proposed Development will comprise modifications to 17 waste weirs. These are not required as mitigation for impacts on the SPA/Ramsar site but are necessary to accommodate increased flows and prevent overspill of water from the main body of the GUC even under surge flows (this is to ensure that any additional flows are directed downstream to the chosen abstraction point; an integral element of the project); and
- c. Gayton Junction provides a barrier preventing flows from entering the Northampton Arm. Therefore, it is considered that there is little potential for pollutant-containing water to enter the Northampton Arm in the construction phase (when the Proposed Development will not yet be operational and hydrological flows will remain unchanged).

6.2.12 Considering the above, it is concluded that there will be no LSEs of the Proposed Development on the Upper Nene Gravel Pits SPA/Ramsar regarding water quality in the construction phase. This impact pathway is screened out from further appraisal in an AA.

6.2.13 As the environmental assessments progress towards DCO submission, further steps to ensure that additional flows in the GUC will be directed southwards and prevented from entering the Northampton Arm (which would work against the objectives of the project) may be identified. Such measures would have the added benefit of ensuring that no construction phase pollutants enter this channel. The Report to Inform the HRA accompanying the DCO application will be updated with any relevant additional measures as they emerge.

Noise and Visual Disturbance (in Functionally Linked Habitat)

River Mease SAC

- 6.2.14 The River Mease SAC is partly designated for otter, which utilise a wide range of habitats, such as vegetated riverbanks, reedbeds and woodlands (the latter typically where these encompass water features. As highlighted in the previous section, otter (and particularly males) have extensive home ranges that may encompass hydrologically connected waterbodies up to 80 km from designated site boundaries. Part 1b Minworth to Atherstone Pipeline traverses the River Tame which has its confluence with the River Trent to the east of Alrewas, immediately west of the confluence of the River Mease with the River Trent. The travel distance along the riverbank to the closest part of the Proposed Development is approximately 31.7 km, which falls within the likely commuting distance of otter from the River Mease SAC. Furthermore, the Coventry Canal (connected to Part 2 of the Proposed Development) crosses the River Tame at Fazeley, suggesting that otter from the SAC may readily move to parts of the canal network where construction works will be required.
- 6.2.15 **Chapter 13: Terrestrial Ecology** in PEI Report **Volume 2** highlights in relation to Part 1a Minworth AWTP that otter have been recorded on the River Tame, and the Birmingham and Fazeley Canal. In relation to the Minworth to Atherstone Pipeline (Part 1b of the Proposed Development) it mentions that otter have been recorded at Kingsbury and Ladywalk Local Wildlife Site (LWS). These data suggest that otter routinely occur within and adjacent to watercourses in close proximity to the Proposed Development. Furthermore, the desk study undertaken for the PEI Report shows over 50 records of otter in the Coventry, Oxford and Grand Union Canals.
- 6.2.16 Given the hydrological linkage with, and the relative proximity of, the Proposed Development to the River Mease SAC, potential noise and visual disturbance impacts in the construction phase cannot be excluded at the time of writing this HRA Screening report. It is considered that the highest noise and visual disturbance potential in the construction phase would arise from the following elements of the Proposed Development:
- a. Part 1a Minworth to Atherstone Pipeline – the trenchless crossing of the River Tame and associated riverbanks at Lea Marston. It is noted that proposed the entry and exit pits for trenchless techniques in this area are set relatively far back from the River Tame (approximately 100 m for the pit on the western side of the river), making material noise disturbance to otter less likely. Notwithstanding this, a residual potential for noise disturbance would still exist, particularly where sensitive habitat features are present; and

- b. Part 2 Works to the Coventry, Oxford and Grand Union Canals – any of the construction works currently considered to take place along the canal banks, including construction of the pumped and gravity bypasses, modifications to existing bridges and potential raising of sections of canal bank levels. Given the distances of the Proposed Development to the River Mease SAC, it is considered that only the upper stretches of the canal system (i.e. the Coventry Canal) are likely to be used by qualifying individuals from the SAC. With the likelihood of individuals using functionally linked habitat beyond the boundary of the SAC decreasing with commuting distance, it is highly unlikely that construction works in the Oxford Canal and GUC have the potential to result in material population-level disturbance on the SAC otter population.

6.2.17 Additional field surveys, including otter surveys, to strengthen the evidence base are being undertaken as part of the EIA. These surveys will have particular regard to more sensitive habitat features required by otter, such as couches and holts (both used for resting) and natal dens (used for rearing offspring). Any relevant data that emerge from these surveys will be referenced in the Report to Inform the HRA accompanying the DCO application. In the event that particular sensitive otter habitat features are present within or close to the anticipated working areas and/or construction activities with high noise profiles are deployed (noting that impact piling, one of the construction activities with the highest disturbance potential, will not be required for Part 1b and Part 2 of the Proposed Development), bespoke noise modelling may be required to conclude no LSEs on the SAC. **At the time of writing of this HRA Screening Report, LSEs of the Proposed Development on the River Mease SAC regarding construction-related noise and visual disturbance to otter cannot be excluded.**

Humber Estuary SAC

6.2.18 Qualifying fish from the Humber Estuary SAC can be disturbed by underwater sound which can either be impulsive or continuous in nature and can cause a variety of impacts to fish, ranging from severe physical injury (e.g., rupture of the swim bladder), physical damage to the auditory system (e.g., temporary shifts in hearing thresholds) to behavioural changes, such as disruption of upstream migratory behaviours. The Humber Estuary SAC is partly designated for anadromous species, including river lamprey and sea lamprey. All lamprey species lack swim bladders and are considered to be low hearing sensitivity fish. Generally, they are less susceptible to barotrauma because they detect particle motion rather than sound pressure. Notwithstanding this, potential noise disturbance impacts must nonetheless be duly considered.

- 6.2.19 While most sections of the Minworth to Atherstone Pipeline will be constructed using open-cut trenching, trenchless construction methods (for example Horizontal Directional Drilling [HDD] or pipe jacking) will be required where major watercourse crossings are involved. The River Tame, east of Lea Marston will be crossed via trenchless techniques. Depending on its distance to the riverbanks, noise and vibration-generating equipment deployed at the trenchless crossing would have the potential to disturb the water column in the River Tame through vibration. The River Tame is hydrologically connected to the Humber Estuary SAC via the River Trent, such that qualifying lamprey could be present in the vicinity of the River Tame crossing. However, as described in more detail in section 6.3, there are several weirs downstream from the Proposed Development that are known to be complete movement barriers to all fish species (including lampreys). Furthermore, there are no recent records of river and sea lampreys in the River Tame, supporting the notion that these fish are unable to reach the upper reaches of the River Tame. **Therefore, it is concluded that the Proposed Development will not result in LSEs on the Humber Estuary SAC regarding construction-related noise disturbance. This impact pathway is screened out from a more detailed appraisal in an AA as part of the Report to Inform the HRA for the DCO application.**

Atmospheric Pollution (Nitrogen Deposition)

Chilterns Beechwoods SAC

- 6.2.20 The Chilterns Beechwoods SAC lies approximately 10 km to the south of the Proposed Development (with Part 3, Part 4a and Part 4b lying closest to the SAC). Natural England's SIP for the SAC specifies atmospheric pollution as one of the main pressures that apply to the site, with nitrogen deposition exceeding the CLs for ecosystem protection and some component parts being classified as 'unfavourable recovering.' APIS stipulates N CLs for all Habitats Sites in the UK, including the Chilterns Beechwoods SAC. The qualifying habitat that is most sensitive to nitrogen deposition is the *Juniperus communis* formations on heaths or calcareous grasslands (5-15 kg N/ha/yr). Furthermore, both the *Asperulo-Fagetum* beech forest and stag beetle also have relatively low N CL ranges (10-15 kg N/ha/yr).
- 6.2.21 The highest vehicle flows generated by the Proposed Development will occur in the construction phase. IAQM guidance sets out criteria that identify the need for more detailed air quality assessments in relation to planned developments; i.e. the volume of Heavy Goods Vehicles (HGVs) that may result in negative ecosystem-level effects. Generally, it advises that detailed air quality modelling is needed where a development generates more than 100 AADT HGV movements in the construction phases. Any air quality impacts of construction traffic also depend on its spatial distribution, which is typically modelled as the Affected Road Network (ARN). It is considered that

construction traffic can only result in material impacts where it occurs within 200 m of sensitive qualifying features in Habitats Sites. A review of habitat mapping on MAGIC indicates that only one component of the SAC (the Tring Woodlands SSSI) lies within 200 m of a major road (A41). However, when it comes to scheme-level impacts, minor roads may also be influential particularly in close proximity to the development where construction traffic may converge on smaller traffic arteries.

- 6.2.22 **Appendix 3-PD-1** in PEI Report **Volume 4** summarises the indicative volumes of HGVs and LGVs required in the construction phase of Parts 4a and 4b of the Proposed Development. For Part 4a of the Proposed Development, 5,100 HGV movements are forecast over the construction period, equating to an HGV AADT of 6 movements. The transport of workforce and staff for Part 4a is forecast to be less than 5 Light Goods Vehicle (LGV) AADT movements. The volume of construction traffic is anticipated to be similarly low for Part 4b of the Proposed Development, with an HGV AADT of 1 (i.e. two movements). Since only one group of five workers will work at each location in Part 4b of the Proposed Development, the volume of LGVs is also expected to be low (although the precise number of teams working concurrently is still to be confirmed). The forecast volumes of HGV / LGV AADT associated with Part 3 of the Proposed Development, its other section that lies relatively close to the Chilterns Beechwoods SAC, is still to be confirmed. Given these very low early forecast construction traffic volumes, which fall far below the 100 AADT HGV screening threshold, it is likely that the Proposed Development will not result in material atmospheric pollution impacts on the SAC.
- 6.2.23 At this early stage in the planning of the Proposed Development, the volume of construction traffic is still subject to revision / confirmation. Both of these parameters will become available as part of the EIA of the Proposed Development. **At the time of writing of this HRA, LSEs of the Proposed Development on the Chilterns Beechwoods SAC regarding atmospheric pollution in the construction stage cannot be excluded and a more detailed AA as part of the Report to Inform the HRA may be required.** The HRA accompanying the DCO application will be updated with further relevant evidence in relation to this impact pathway. If the threshold criteria for construction traffic were to be exceeded, more detailed air quality modelling would need to be discussed in an AA.

6.3 Operational Phase

Water Quantity, Level and Flow

Humber Estuary SPA/Ramsar/SAC

- 6.3.1 The sensitivity of aquatic habitats to changes in water quantity, level and flow was described in section 5 of this HRA Screening Report. Both the Humber

Estuary Habitats Sites and the River Mease SAC are hydrologically connected to the Proposed Development (in particular the Minworth AWTP) and were identified to lie within the Zol of the Proposed Development in section 4. The diversion of a maximum discharge volume of 115 MI/d from the Minworth WwRC to the AWTP will reduce overall flow volumes in the River Tame, which is hydrologically connected to the Humber Estuary Habitats Sites via the River Trent.

- 6.3.2 There are multiple mechanisms through which reduced flow volumes in the Humber Estuary SPA/Ramsar/SAC and functionally linked habitats could impact on the qualifying features of these Habitats Sites. For example, reduced flows may restrict upstream migration of anadromous qualifying migratory fish (i.e. river lamprey and sea lamprey) in the River Trent from the Humber Estuary SAC. Furthermore, a reduced freshwater input to the Humber Estuary via the River Trent and River Tame due to the operation of the Proposed Development may change the macroinvertebrate and macrophyte communities on which qualifying birds in the Humber Estuary SPA/Ramsar feed.
- 6.3.3 Hydrological and hydraulic modelling was undertaken during the RAPID process (and continues for DCO application), quantifying the potential impacts of freshwater diversion on river flow, level, velocity and wetted perimeter in both rivers and to enable a hydro-ecological impact assessment (see **Table 8 – Table 10** in Appendix B). In agreement with the Environment Agency the hydraulic models are limited to the non-tidal section of the River Trent (upstream of Cromwell Weir), with a further 77 km of the tidal River Trent downstream of that point. Therefore, to estimate total flow into the Humber Estuary, simulations from the non-tidal hydrological models combined with data from gauging stations of tributaries draining into the tidal part of the River Trent were used to estimate the total freshwater flow into the estuary. Estimates for total flow into the estuary were derived for the present day and for a climate change scenario (taking into account Severn Trent's Water Resources Management Plan [WRMP]) – this estimated assessment will be updated through further hydrological modelling through the preparation of the DCO application.
- 6.3.4 Utilisation profiles were modelled for the Proposed Development alone (maximum utilisation of 115 MI/d), as well as the in-combination impacts of the STT SRO (maximum utilisation of 115 MI/d) and the influence of Anglian Water's Lincolnshire Reservoir (LR) SRO (maximum utilisation of 300 MI/d). It is noted that the LR abstraction is now to be located in the tidal part of the Humber Estuary SPA / Ramsar / SAC, reducing its impact on freshwater flows into the estuary. Therefore, the modelling undertaken for the Proposed Development takes account of developments with likely in-combination effects on hydrological flows contributing freshwater to the Humber Estuary

Habitats Sites. By considering a climate change scenario, the modelling exercise is also future-proofed.

6.3.5 The following impacts on freshwater flow were estimated for three abstraction scenarios:

- a. Proposed Development alone: Estimated reduction in mean flow to the Humber Estuary of approximately 1.4% in the present and 1.5% in the climate change future;
- b. Proposed Development in-combination with the STT SRO: Estimated reduction in mean flow to the Humber Estuary of approximately 2.8% in the present and 3% in the climate change future; and
- c. Proposed Development in-combination with the STT SRO and the LR SRO: Estimated reduction in mean flow to the Humber Estuary of approximately 6.4% in the present and 6.8% in the climate change future.

6.3.6 However, further characteristics should be taken into account when considering the parallel maximum utilisation of all three developments⁵. For example, the Proposed Development has been designed to allow for a maximum flow of 115 megalitres per day (Ml/d) to be transferred, but during summer operations, the Proposed Development would generally operate at 60-80 Ml/d continuously throughout the summer. The transfer would be increased during severe drought operations or during prolonged emergencies affecting AfW's other supplies, where rates would be increased to between 80 and 115 Ml/d depending on conditions. Furthermore, maximum transfer will occur during the summer, when non-breeding qualifying birds in the Humber Estuary will be at their lowest (highest wintering bird numbers are present between September and March). Note that this is based on hydraulic modelling and modelling of forecast scheme utilisation undertaken previously, and this modelling is being updated to inform further assessment for the DCO. Minworth AWTP is only one of the freshwater sources supplying the STT SRO and its contribution will significantly vary during the year. The LR SRO is also partially fed by other freshwater sources, such as abstractions from the River Witham catchment. Therefore, it is unlikely that all three developments will be operating at their maximum capacity, and the assessment uses average use for determining

⁵ It is to be noted that hydrological modelling undertaken at Gate 4 will exclude the STT SRO (see paragraph 1.2.3), but modelling data were accurate at the time of writing the HRA Screening report. Given this, the presented data for scenarios b. and c. represent an over-estimation of the in-combination reductions in flow.

impacts on mean river flows. In conclusion, a mean flow reduction of <1% into the Humber is considered the most realistic environmental scenario.

- 6.3.7 Given the modelled mean reduction in freshwater inputs to the Humber from the River Trent of 0.56-1%, it is considered that there will only be a minimal, if any, impact on resident macroinvertebrate and macrophyte communities. Some of the typical estuarine species that are foraging resources of qualifying species in the Humber Estuarine SPA / Ramsar include spire snail *Ecrobia ventrose*, laver spire snail *Peringia ulvae*, oligochaete worms (e.g. *Baltidrilus costatus*), polychaete worms (e.g. *Nereis diversicolor*) and shrimp/prawn species (e.g. *Crangon crangon*, *Palaemonetes varians*, *Neomysis integer*). Macrophytes providing cover for wintering SPA / Ramsar birds typically comprise extensive areas of common reed *Phragmites australis*. All these biotic features occupying the Humber Estuary are routinely exposed to tidal washing and varying salinity gradients. Therefore, the relatively limited flow reductions imposed by the Proposed Development will not be sufficiently large to impact the resident communities in the Humber Estuary SPA / Ramsar.
- 6.3.8 It is noted that further hydrological modelling to affirm these conclusions will be undertaken as part of the EIA and the data will be discussed in the Report to inform the HRA for the DCO application. **Overall, as a precautionary measure and until the further hydrological modelling has been undertaken, it is concluded that LSEs of the Proposed Development on the Humber Estuary SPA / Ramsar / SAC regarding changes in water quantity, level and flow, both alone and in-combination, cannot be excluded.**
- 6.3.9 Both river and sea lamprey are anadromous fish that undertake annual migrations to their upstream spawning grounds. Generally, fish can only successfully migrate upstream if the prevailing water velocity is equal to or less than their swimming ability. Therefore, the flow velocity resulting from a development should not increase flow speeds beyond naturally occurring limits. The Proposed Development will result in a small reduction of flow velocities in the River Tame and River Trent, which is thus not considered to pose a significant risk to fish passage.
- 6.3.10 However, changes in water depth at the Holme Sluices fish pass could potentially affect the upstream passage of lamprey at this location. Therefore, the one remaining consideration is whether reduced water depths and / or wetted area at this and other locations could materially reduce the ability of river and sea lamprey to navigate between upstream spawning grounds and the Humber Estuary. **Table 7** summarises the impacts of the Proposed Development (including its contribution to the STT SRO) on weirs that lamprey from the Humber Estuary SAC have to pass on their upstream journeys.

Table 7: Impact of the Proposed Development on weirs in the River Tame and River Trent

Site (Upstream to Downstream)	Impact of Proposed Development
Site 3 – Lea Marston Weir (River Tame)	Positive impact on overall passability
Site 4 – Coton Weir (E) (River Tame)	No impact on overall passability
Site 5 – Coton Weir (Central) (River Tame)	No impact on overall passability
Site 6 – Coton Weir (W) (River Tame)	No impact on overall passability, with the weir being considered a complete barrier for all species and at all flows in the no-development scenario (limited by water depth)
Site 7 – A4097 Weir (River Tame)	Eels, lamprey and cyprinids – No impact on overall passability Salmon - Negative impact on salmon passage at Qmean flow conditions due to reduction in water depth Trout - Negative impact on trout passage at Qmean flow conditions due to reduction in water depth
Site 8 – Nether Whitacre Weir (River Tame)	Negative impact on fish passage (particularly salmon and trout) under Q95 and Qmean flow conditions due to reduction in water depth and associated increase in hydraulic head
Site 9 – Broad Meadow LNR Upstream Weir (River Tame)	No impact on overall passability, with the weir being considered a complete barrier for all species and at all flows in the no-development scenario (limited by water depth)
Site 10 – Broad Meadow LNR Downstream Weir (River Tame)	No impact on overall passability, with the weir being considered a complete barrier for all species and at all flows in the no-development scenario (limited by water depth)
Site 11 – Meadow Weir (River Tame)	Negative impact on trout passage at Qmean flows.
Site 12 – Newton Weir (River Trent)	Positive impact on salmon, trout and lamprey passage
Site 13 – Sawley Weir (River Trent)	No impact on overall passability
Site 14 – Thrumpton Weir (River Trent)	No impact on overall passability
Site 15 – Beeston Weir (River Trent)	No impact on overall passability along the weir or fish pass, with both already being considered complete barriers for all species and at all flows in the no-development scenario (limited by water depth)

Site (Upstream to Downstream)	Impact of Proposed Development
Site 16 – Holme Sluices Colwick (River Trent) <u>and</u> associated fish pass	Negative impact on fish passage (at the fish pass) by on average 2-3 days per year. Velocity conditions through the sluices are unsuitable for all species and at all flows in the no-development scenario. Therefore, no impact on fish passage.
Site 17 – Stoke (Bardolph) Weir (River Trent)	No impact on overall passability
Site 18 – Gunthorpe Weir (River Trent)	No impact on overall passability
Site 19 – Hazelford Weir (South) (River Trent)	No impact on overall passability
Site 20 – Hazelford Weir (North) (River Trent)	No impact on overall passability
Site 21 – Averham Weir (River Trent)	No impact on overall passability
Site 22 – Newark Weir (River Trent)	No impact on overall passability
Site 23 – Nether Lock Weir (River Trent)	No impact on overall passability
Site 24 – Cromwell Weir (River Trent)	No impact on overall fish passage along the weir or fish pass, with both already being considered complete barriers for all species and at all flows in the no-development scenario. However, the weir and fish pass remain passable under higher flow conditions, which will be unaffected by the Proposed Development, and river/sea lamprey are recorded upstream.

6.3.11 The only locations in the River Tame where fish passage may be affected by the Proposed Development are Site 7 (A4097 Weir), Site 8 (Nether Whitacre Weir) and Site 11 (Meadow Weir). However, passage would only be impacted under certain flow conditions for salmon and trout, neither of which are qualifying species of the Humber Estuary SAC. Furthermore, there are no known records of qualifying sea or river lamprey from the River Tame, indicating that these species do not migrate further upstream than the upper parts of the River Trent. Furthermore, it should be noted that the Proposed Development has a positive impact on fish passage at several weirs, including most notably Site 12 (Newton Weir). While this could in theory improve the overall connectivity of the River Trent for anadromous fish, these are currently constrained by impassable weirs further downstream (e.g. Site 15 – Beeston Weir and Site 24 – Cromwell Weir).

- 6.3.12 The Holme Sluices and fish pass assessment has concluded that the operation of the Proposed Development may, on average, result in a reduction of 2-3 days per year when the fish pass is navigable. The significance of this in relation to the Humber Estuary SAC will be assessed further in the Report to Inform the HRA in consultation with the Environment Agency and Natural England, supported by on-going hydraulic modelling. Updated modelling will include the updated Aquator model to assess the in-combination effects of AMP8 and AMP9 schemes. The LR SRO will now abstract from the tidal reach of the Humber Estuary SAC/SPA/Ramsar and will, therefore, not affect fish passage along the Rivers Trent or Tame in combination.
- 6.3.13 The role of Cromwell Weir, the weir that lies furthest downstream in the River Trent, warrants further discussion. In their SACO, Natural England specify a target to restore connectivity of estuarine habitats to hydrologically connected rivers and other freshwater features. This is to help ensure adequate larval dispersal and recruitment, maintain nursery grounds for mobile species and to allow migratory movements. The further advise that the 'distribution of river lamprey in the River Trent is severely limited by Cromwell Weir, which is considered as impassable to river lamprey' (with the same statement being made regarding sea lamprey). However, as highlighted above, lamprey are recorded upstream from Cromwell Weir, likely due to passability of the weir under high flow conditions. For purposes of the assessment, Cromwell Weir is therefore considered as passable and impacts of the Proposed Development on upstream weirs must be considered further. This is corroborated by a research study which found that 35.7% of released radio-tagged river lamprey were able to pass Cromwell Weir, but this was entirely due to elevated river levels which were some of the highest magnitude and longest duration in the past 21 years (Ref. 31).
- 6.3.14 In light of the evidence presented above, predominantly that a further investigation into the impacts of the Proposed Development at the Holme Sluices is needed, **it is considered that LSEs of the Proposed Development on the Humber Estuary SAC regarding fish passage, both alone and in-combination, cannot currently be excluded. Therefore, this impact pathway is screened in for a more detailed appraisal in an AA.**

Upper Nene Gravel Pits SPA/Ramsar

- 6.3.15 The Upper Nene Gravel Pits SPA/Ramsar is designated for wintering waterbirds that rely on suitable aquatic habitats for successful foraging. Maintaining an adequate water area or depth is considered to be critical for the fitness and survival for these species. For example, Natural England's SACO for the SPA specifies that 'birds such as bitterns are visual predators, with some having the ability to dive or feed from the surface. As they will rely on detecting their prey within the water to hunt, the depth of water at critical

times of year may be paramount for successful feeding...' Natural England's target for bittern is to maintain the overall depth of swamp and marginal water between 30-100 cm deep and within pools / dykes between 200-400 cm deep. Another target for water depth is set in relation to gadwall, which typically require an optimal standing water depth of <0.25 m deep.

- 6.3.16 The main potential impact of the Proposed Development on the water quantity, level and flow in the Upper Nene Gravel Pits SPA/Ramsar is associated with the operation of the Minworth AWTP (Part 1a), which will deliver a maximum of 115 MI/d of additional freshwater to the Coventry, Oxford and Grand Union Canals. As highlighted in the section investigating construction phase water quality impacts, there is a hydrological connection between the GUC and the River Nene at Gayton Junction via the Northampton Arm. Daventry Reservoir overflows into a section of the GUC under certain conditions, which then feeds into a tributary in the headwaters of the River Nene. Given these hydrological linkages, the operation of the Proposed Development could lead to an increased freshwater supply to the SPA/Ramsar. In turn this may increase certain habitat parameters (e.g. wetted area, water depth) beyond the optimal range of qualifying bird species.
- 6.3.17 The Proposed Development will provide a maximum of 115 MI/d of water. However, it is very likely that peak flows will only be required during certain parts of the year, with significant flow increases therefore occurring relatively infrequently. Peak flows are only likely to occur in the summer months, when qualifying birds will not be present in the Upper Nene Gravel Pits SPA/Ramsar.
- 6.3.18 Operation of the Daventry and Drayton Reservoirs (Part 3 of the Proposed Development) will somewhat counterbalance increased flows in the GUC. Use of these reservoirs is in addition to their primary purpose of providing water for navigation and is proposed to also augment flows in the GUC for downstream abstraction during times of hands-off flows in the River Trent. It is anticipated that there will be a semi-continuous water transfer from the GUC to both reservoirs. This implies that at least at certain times in the year (i.e. when there are no hands-off flow conditions in the River Trent), some of the additional flows in the canals will be taken out of the hydrological system for intermittent storage. While the storage and release of freshwater in the reservoirs could potentially impact flows in the River Nene headwaters, it is currently assumed that overflows from the reservoirs into the GUC will be maintained at their current levels utilising the existing overflow structures.
- 6.3.19 While a new discharge structure will be installed at the existing outflow from Daventry Reservoir to allow for drawdown capability, the involvement of the reservoirs and associated features will not change the overall additional flow volumes in the GUC due to the operation of the Proposed Development and

the fact that extensive measures will be put in place to contain these flows in the canal system. There will also be flow monitoring and level controls at the intake to the Braunston Pumping Station, new pipeline linking to and new discharge structures from the reservoirs. This will enable the careful release of stored freshwater back into the GUC at times of need and prevent any excessive flow conditions downstream from the reservoirs (which could potentially overspill into the Northampton Arm). As highlighted previously, all these aspects of the Proposed Development are integral to its effective operation (i.e. making all diverted flows available to AfW customers) and not included to specifically protect Habitats Sites.

- 6.3.20 The primary purpose of the Proposed Development is to make up to 115 Ml/d of highly treated recycled water available to the Coventry Canal for downstream abstraction for use by AfW customers. Therefore, the Proposed Development encompasses various measures to contain the additional flows in the canal network (which are integral measures to ensure that the Proposed Development fulfils its purpose). For example, relevant control and waste weirs will be modified to accommodate increased flows. At the majority of the weirs, the modifications will likely be restricted to fitting a new fixed weir plate to enable flow control when water levels in the canal are elevated. At 17 of the identified weirs more substantial works will be undertaken to achieve the required weir level raising of >100 mm. Overall, these measures will enable the retention of water within the canals. As highlighted in section 6.2, the lock system at Gayton Junction also enables the careful control of water influx to the Northampton Arm, ensuring that freshwater flows into the River Nene (and the Upper Nene Gravel Pits SPA/Ramsar) can be maintained at the required levels. An important consideration is also that there are 17 locks between where the Northampton Arm leaves the GUC and its confluence with the River Nene at South Bridge. This implies that any unwanted overspill from the GUC is highly likely to be contained within the system of locks without ever reaching the Upper Nene Gravel Pits SPA/Ramsar.
- 6.3.21 Overall, while the operation of the Proposed Development will certainly increase flow volumes in the GUC to varying degrees throughout the year, it is considered that this additional flow will be adequately maintained within the confines of the canal due to measures that are being delivered as integral components of the Proposed Development. **Therefore, there will be no LSEs of the Proposed Development on the Upper Nene Gravel Pits SPA/Ramsar regarding water quantity, level and flow in the operational phase.** This impact pathway is screened out of AA.

River Mease SAC

- 6.3.22 The River Mease SAC is designated for its water courses of plain to montane levels feature, as well as several aquatic (i.e. white-clawed

crayfish, spined loach and bullhead) and semi-aquatic (i.e. otter) species. The qualifying habitat and species are all, to varying degrees, sensitive to impacts on water quantity, level and flow. Natural England's SIP for the SAC references to threats/pressures related to prevailing flow conditions, which may impact on the integrity of the qualifying features. For example, it states that 'Cumulatively drains, fields under drainage and other discharges (e.g. 11 sewage treatment works, and roads as a conduit) within the catchment affect the naturalised flow pattern. As a consequence, the river appears more 'flashy' with water levels rising and falling with increased rapidity. It also specifies that the 11 sewage treatment works are providing a net surplus of water to the system overall, with the water balance for the catchment and its impact on flow patterns requiring further study. Importantly, the major flow-related problem appears to be the discharge of excess freshwater into the SAC.

- 6.3.23 A review of freshwater bodies on the Environment Agency Catchment Data Explorer indicates that there is no direct hydrological connection between the River Tame and the River Mease, with the SAC joining the River Trent downstream of its confluence with the River Tame. Therefore, the primary hydrological interaction between the River Tame and the SAC would be anticipated to occur as baseflow through geological strata underlying the two rivers. This is of potential importance, because the operation of the Proposed Development would divert a maximum of 115 Ml/d of freshwater from the River Tame when operating at its maximum capacity. This would increase to a maximum of 230 Ml/d when considering the in-combination effect of the STT SRO.
- 6.3.24 To affirm the hydrological relationship between the River Tame and River Mease SAC, a hydrological linkage study was undertaken during the RAPID process. The results of this study elucidate that superficial terrace deposits (highly permeable) directly underlie the River Mease, followed by the Gunthorpe Member (which comprises mudstone and is associated with very low permeability). It was determined that the superficial river terrace deposits have high hydraulic conductivity and would be supplementing in-river flows via baseflow. Modelled accretion data show that the River Mease SAC does not receive baseflow from the superficial deposits in the River Tame surface water catchment but are solely fed by the superficial aquifer in the River Mease catchment. Given this, it is concluded that the flow regime in the SAC would not be impacted by the reduced freshwater discharge from Minworth WwRC due to the operation of the Proposed Development.
- 6.3.25 Moreover, even when the Proposed Development is operating at its maximum in-combination capacity, the projected reduction in flows in the River Trent near its confluence with the River Mease SAC (8.2 cm at Q95 and 5.2 cm at Q50) is highly unlikely to result in a material loss of

groundwater flow to the lower River Mease (and associated drawdown in water levels within the superficial deposits). Any such effect would be significantly smaller than those associated with seasonal variability, aquifer recharge, discharges and evaporative losses. For example, the maximum variation in water level across different seasons near the confluence between the River Trent and River Mease is in excess of 1 m. Water levels are recorded on the River Tame at Tamworth, upstream of where River Tame water levels may interact with the superficial aquifer considered to be in hydraulic continuity with the lower River Mease. The gauge shows a typical seasonal variation of approximately 0.3 m, with occasional brief peaks in excess of 1 m higher than the typical range.

- 6.3.26 It should also be noted that even if there was a material hydrological connection between the River Tame or River Trent, and the River Mease, at least some of the qualifying species in the River Mease SAC show a preference for shallow waters. For example, Natural England's SACO specifies that optimal habitat conditions for white-clawed crayfish 'typically occur in relatively shallow, fast flowing reaches with coarse substrates.' A preference for shallow high-flow refugia is also reported for bullhead. Considering that surplus water discharges into the River Mease SAC are an important issue, a limited reduction in hydrological flows would likely have a beneficial impact on the ecological status of the river (noting that reduced flows in the River Mease SAC due to the Proposed Development are not anticipated; see previous paragraphs). In the context of reduced flows, it is noted that Natural England have an aspiration to restore naturalised flow levels in the River Mease which are compatible with its qualifying features. This is reflected in the SACO for the SAC, which specifies a target to 'Restore the natural flow regime of the river, with daily flows as close to what would be expected in the absence of abstractions and discharges (the naturalised flow).' Overall, in the unlikely event that the Proposed Development would contribute to a small reduction in flow in the River Mease, it is likely to make a very small contribution towards the aim of achieving reduced flows in the SAC.
- 6.3.27 Updated and refined hydrological modelling for the Proposed Development's anticipated impact on flows in the River Mease SAC will be undertaken as part of the EIA. **Until further evidence on potential hydrological implications is available, LSEs of the Proposed Development on the River Mease SAC regarding operational water quantity, level and flow impacts are not excluded as a precautionary measure. Currently, this impact pathway is screened in for a more detailed appraisal in an AA as part of the Report to Inform the HRA accompanying the DCO application.**

Water Quality

Upper Nene Gravel Pits SPA/Ramsar

- 6.3.28 As discussed in section 5.2, the qualifying wintering birds in the Upper Nene Gravel Pits SPA/Ramsar are indirectly sensitive to a deterioration in water quality. The operation of the Minworth AWTP (Part 1a of the Proposed Development) and the Minworth to Atherstone Pipeline (Part 1b of the Proposed Development) will release a maximum of 115 Ml/d of treated freshwater into the Coventry, Oxford and Grand Union Canals. There is a potential risk that the transfer of recycled water will result in a deterioration of water quality in the GUC, which is hydrologically connected to the River Nene and the SPA/Ramsar via its Northampton Arm at Gayton Junction. The Daventry Reservoir is also connected to the GUC and River Nene via an existing overflow. If additional water from Part 3 of the Proposed Development reaches the SPA/Ramsar (although this is considered unlikely; see section on water quantity, level and flow) it may impact upon the foraging resources of SPA/Ramsar birds.
- 6.3.29 To evaluate any potential operational water quality impacts of the Proposed Development, an H1 Surface Water Pollution Risk Screening Assessment for a range of determinants was undertaken by the Minworth SRO design consultants. This identified 14 water quality parameters which were confirmed as being potentially significant and liable to cause pollution. These determinants were scoped in for more detailed modelling. Following consultation with the EA, it was agreed that dissolved oxygen (DO) and temperature should also be included in the modelling exercise. The results obtained in this updated modelling are discussed below.
- 6.3.30 The initial water quality modelling exercise considered the 14 hazardous pollutants during operation of the Proposed Development without the additional treatment step that will occur in the AWTP. Under this scenario, the annual average Environmental Quality Standard (EQS) was failed for ten of the modelled pollutants (including cypermethrin, formaldehyde, hexabromocyclododecane, sulphide/hydrogen sulphide, mancozeb, nickel, 4-n-nonylphenol, perfluorooctane sulfonic acid, permethrin and zinc). Subsequently, the operational water quality impact of the Proposed Development was reassessed while accounting for the train of treatment processes that will occur in the AWTP, including flocculation/sedimentation, ozonation, Biological Activated Carbon filtration, adsorption using Granular Activated Carbon (or novel medium) and ultraviolet disinfection. Modelling data suggest that with the water treatment stages in the AWTP, a deterioration in annual average EQS would be prevented for nine of the investigated contaminants. For five of the hazardous contaminants, it cannot yet be determined whether a deterioration in water quality will be preventable, as these were below the limit of detection in the bench trials.

- 6.3.31 Regarding temperature, investigations undertaken as part of the RAPID process identify that, whilst the treated discharge at the Atherstone outfall may increase temperature in the Coventry Canal at certain times of the year more than others, this temperature change will remain within permissible limits (both across the year and in the summer period). Moreover, it should be noted that the temperature increase would be limited to the part of the Coventry Canal adjoining the outfall. Temperature will change with distance downstream in accordance with ambient weather conditions. Therefore, it is concluded that localised temperature impacts on resident ecosystems would have no implications for the Upper Nene Gravel Pits SPA/Ramsar.
- 6.3.32 The operational impacts of the Proposed Development on DO concentrations were modelled using the Fundamental Intermittent Standards (FIS) for sustainable cyprinid watercourses. The following scenarios considering discharge from the outfall without the water quality treatment stages at the AWTP were modelled:
- Month of August only – this sees the lowest DO concentration in the Coventry Canal and the second lowest DO in the Minworth recycled water;
 - Three months of June to August – most likely months in which the maximum transfer of 115 Ml/d of water will be discharged; and
 - Whole year.
- 6.3.33 DO is predicted to be maintained at current levels monitored in the canal due to the installation of an aeration structure at the Atherstone outfall. Therefore, there will be no impact on DO levels in the canals as a result of the operation of the Proposed Development.
- 6.3.34 Further modelling accounting for the following improvements to the water quality of the discharged water was then undertaken:
- Reduction of Biochemical Oxygen Demand (BOD) in the discharge to 2 mg/l, the quality achieved through the Minworth AWTP;
 - Increase in DO concentration in the discharge to 7.27 mg/l (the August mean background value recorded in the Coventry Canal) through re-aeration of water at the outfall structure at Atherstone; and
 - NH₃ concentrations in the discharge set to 0.02 mg/l in line with the concentration recorded in inflow to the AWTP.
- 6.3.35 Modelling data indicate that by deploying the above improvements, DO within the canal will be maintained at current levels, remaining above the most stringent FIS standard for all scenarios. However, it is noted that the potential for these water quality improvements to be delivered requires further consideration as part of the design development of the Proposed Development. While there is a theoretical risk that transferring recycled water from the AWTP to the Coventry, Oxford and Grand Union Canals will

cause deterioration of the water quality in the canal network, the quality of recycled water will have to be controlled in order to comply with the Environmental Damage (Prevention and Remediation) (England) Regulations 2015 and the Environmental Permitting (England and Wales) Regulations 2016.

- 6.3.36 Overall, the technical feasibility of water quality protection measures remains unclear and further modelling being undertaken for the DCO application (which includes a pilot-plant) is ongoing. **Therefore, LSEs of the Proposed Development on the Upper Nene Gravel Pits SPA/Ramsar regarding operational water quality impacts cannot currently be excluded. This impact pathway is screened in for more detailed appraisal in an AA at this stage.** However, the Report to Inform the HRA accompanying the DCO application will be updated using water quality modelling data to be undertaken as part of the EIA.

7. Preliminary Conclusions

- 7.1.1 This HRA Screening Report, which will form the scope of the Report to inform the HRA to accompany the DCO application, has assessed potential construction phase and operational phase impacts on several Habitats Sites, including the Humber Estuary SPA/Ramsar/SAC, Upper Nene Valley Gravel Pits SPA/Ramsar, River Mease SAC, Chilterns Beechwoods SAC and Ensor's Pool SAC. The following impact pathways were considered in relation to the Proposed Development:

- a. Water quality;
- b. Water quantity, level and flow;
- c. Noise and visual disturbance in functionally linked habitat; and
- d. Atmospheric pollution.

7.2 Construction Phase

Water Quality

- 7.2.1 While water quality impacts on the Humber Estuary SPA/Ramsar were screened out based on the long flowpath distance, qualifying fish from the Humber Estuary SAC (i.e. river lamprey and sea lamprey) may be present in functionally linked stretches of watercourses adjoining Part 1a and Part1b of the Proposed Development (mainly the River Tame). An Outline CEMP will be produced and submitted with the DCO application, which will outline the detailed measures taken to protect the quality of aquatic environments. Any relevant detail in the Outline CEMP will be discussed in the Report to inform the HRA of the DCO application. Until this has been produced and the list of water quality protection measures is available, **LSEs of the Proposed**

Development on the Humber Estuary SAC regarding water quality, both alone and in-combination, cannot be excluded as a precaution.

Currently, this impact pathway is screened in for further appraisal in an AA. It is to be noted that water quality protection measures are required to protect the environment irrespective of the presence of Habitats Sites and, therefore, can be considered at HRA Screening. It is considered that the Outline CEMP will encompass industry standard, evidence-based Best Practice measures, which will allow for a conclusion of no LSEs.

- 7.2.2 Potential water quality impacts of the Proposed Development in the construction phase, predominantly due to the delivery of Part 2, were also considered in relation to the Upper Nene Gravel Pits SPA/Ramsar. However, several factors were considered that would minimise any potential water quality impacts on the SPA/Ramsar, including the sluice and lockage system at Gayton Junction (which prevents overspill), modifications to 17 control and waste weirs (which will accommodate increased flows in the GUC even under surge flows) and the predicted limited maximum increase in flows in the GUC at Gayton Junction even under operational conditions. Furthermore, the Outline CEMP that will be produced at the ES stage in order to comply with environmental legislation will prevent any deterioration in water quality in the Upper Nene Gravel Pits SPA/Ramsar. In line with the conclusion reached for the Humber Estuary SAC, until the Outline CEMP is developed, **LSEs of the Proposed Development on the Upper Nene Gravel Pits SPA/Ramsar regarding water quality in the construction phase cannot be excluded as a precautionary measure.**

Noise and Visual Disturbance (in Functionally Linked Habitat)

- 7.2.3 At the time of writing this HRA Scoping Report, potential noise and visual disturbance impacts in the construction phase of the Proposed Development cannot be excluded. Otter have been recorded in several locations that are crossed by or adjoin the Proposed Development, which fall within the potential home range of this species from the River Mease SAC. Updated otter surveys will be undertaken for the ES stage of the Proposed Development. If survey data indicate that particularly sensitive otter habitat features (e.g. couches, resting holts or natal dens) are found in the vicinity of Part 1b and Part 2 of the Proposed Development, noise modelling and mitigation measures may be required for the Report to inform the HRA of the DCO application. Therefore, until updated otter surveys have been undertaken and any further evidence to inform the assessment of this impact pathway has been produced, LSEs of the Proposed Development on the River Mease SAC regarding construction-related noise and visual disturbance to otter cannot be excluded.

- 7.2.4 Potential vibration disturbance impacts of the HDD works at Crossing No.4 over the River Tame on river lamprey and sea lamprey originating from the Humber Estuary SAC were considered. However, there are several weirs downstream from the Proposed Development in the River Trent (which is hydrologically connected to the River Tame) that are known to be complete movement barriers to all fish species (including lampreys). **Therefore, it is concluded that the Proposed Development will not result in LSEs on the Humber Estuary SAC regarding construction-related noise disturbance. This impact pathway is screened out from a more detailed appraisal in an AA.**

Atmospheric Pollution

- 7.2.5 Atmospheric pollution impacts of the Proposed Development on the Chilterns Beechwoods SAC (approximately 3.8 km distant) in the construction phase were also appraised, with Part 3, Part 4a and Part 4b lying closest to this Habitats Site. There are major roads (e.g. the A41) within 200 m of the SAC, which could be used by construction traffic associated with the Proposed Development. As highlighted earlier, the volumes of HGV and LGV construction traffic, as currently estimated, fall far below the thresholds for triggering air quality modelling. However, the forecast traffic volumes are still subject to future revisions. These data will become available at the ES stage of the Proposed Development. **Therefore, until construction traffic volumes are confirmed, LSEs of the Proposed Development on the Chilterns Beechwoods SAC regarding atmospheric pollution in the construction stage cannot be excluded and a more detailed AA may be required.**

7.3 Operational Phase

Water Quantity, Level and Flow

- 7.3.1 The diversion of up to 115 Ml/d of freshwater from the Minworth WwRC will reduce freshwater input to the River Tame, River Trent and, ultimately, the Humber Estuary SPA/Ramsar/SAC. Potential operational implications of reduced freshwater flows on qualifying fish and wintering birds were considered, both within the designated site boundary and functionally linked habitats.
- 7.3.2 Regarding potential impacts on the foraging resources of SPA/Ramsar birds in the upper Humber Estuary, it was concluded that the anticipated mean reduction in freshwater inputs of 0.56 to 1% would only result in minimal (if any) effect on macrophyte and macroinvertebrate communities. This is because these assemblages are adapted to a wide range of salinity gradients due to frequent tidal washing. However, it is noted that further hydrological modelling to affirm these conclusions will be undertaken and

these data will be discussed in the Report to inform the HRA for the DCO application. Overall, as a precautionary measure and until the further hydrological modelling has been undertaken, **it is concluded that LSEs of the Proposed Development on the Humber Estuary SPA / Ramsar regarding changes in water quantity, level and flow, both alone and in-combination, cannot be excluded.**

- 7.3.3 The potential impacts of reduced flows on fish passage across the weirs were assessed in relation to the Humber Estuary SAC. It was determined that reduced flows in rivers may affect fish passage across several weirs (notably Holme Sluices) on certain days of the year. Updated hydrological modelling in relation to the identified barriers will be undertaken and considered in the Report to Inform the HRA accompanying the DCO application. **Due to this, LSEs of the Proposed Development on the Humber Estuary SAC regarding fish passage, both alone and in-combination, currently cannot be excluded.**
- 7.3.4 Regarding potential water quantity impacts in the Upper Nene Gravel Pits SPA/Ramsar, while the operation of the Proposed Development will certainly increase flow volumes in the GUC to varying degrees throughout the year, it is considered that this additional flow will be adequately maintained within the confines of the canal due to other elements that are integral to the Proposed Development. **Therefore, it is concluded that there will be no LSEs of the Proposed Development on the Upper Nene Gravel Pits SPA/Ramsar regarding water quantity, level and flow in the operational phase. This impact pathway is screened out of AA.**
- 7.3.5 Potential water quantity impacts from the Proposed Development in the River Mease SAC were considered. A study of the hydrological linkage between the River Mease SAC and the River Tame indicates that there is no hydrological baseflow between the two systems. Therefore, the flow regime within the SAC would not be impacted by the reduced freshwater discharge into the River Tame from the Minworth WwRC. Moreover, even when operating at its maximum capacity, the reduced flows in the River Trent due to the Proposed Development would be highly unlikely to result in a material loss of groundwater flow into the lower River Mease at its confluence with the River Trent. The further environmental assessment undertaken in support of the DCO application will provide updated and refined hydrological modelling for the Proposed Development's anticipated impact on flows in the River Mease SAC. Until further evidence on potential hydrological implications is available, **LSEs of the Proposed Development on the River Mease SAC regarding operational water quantity, level and flow impacts are not excluded as a precautionary measure. Currently, this impact pathway is screened in for a more detailed appraisal in an AA.**

Water Quality

- 7.3.6 Water quality modelling undertaken during the RAPID process assessed the potential for the Proposed Development to result in operational water quality impacts in the Upper Nene Gravel Pits SPA/Ramsar, particularly in relation to 14 identified hazardous pollutants, DO concentrations and temperature. The results from this assessment indicate that for five of the hazardous contaminants it cannot yet be determined whether a deterioration in water quality will be preventable. DO levels in the canal will be maintained at current levels due to the installation of an aeration structure at the Atherstone Outfall to the Coventry Canal. Overall, the technical feasibility of the required water quality protection measures (in relation to hazardous pollutants) remains unclear and further modelling will be undertaken at the pilot-plant stage. These further data will be considered in the Report to Inform the HRA accompanying the DCO application. **Therefore, LSEs of the Proposed Development on the Upper Nene Gravel Pits SPA/Ramsar regarding operational water quality impacts cannot currently be excluded. This impact pathway is screened in for more detailed appraisal in an AA at this stage.**

7.4 Next steps

- 7.4.1 Following consultation on the PEI Report and this HRA screening, the report will be updated to take account of comments received and further design information as the Proposed Development and the EIA continue to be developed for DCO application. Key stakeholders, including Natural England, will be consulted on the interim findings a full Report to Inform Appropriate Assessment, which will be submitted as part of the DCO.

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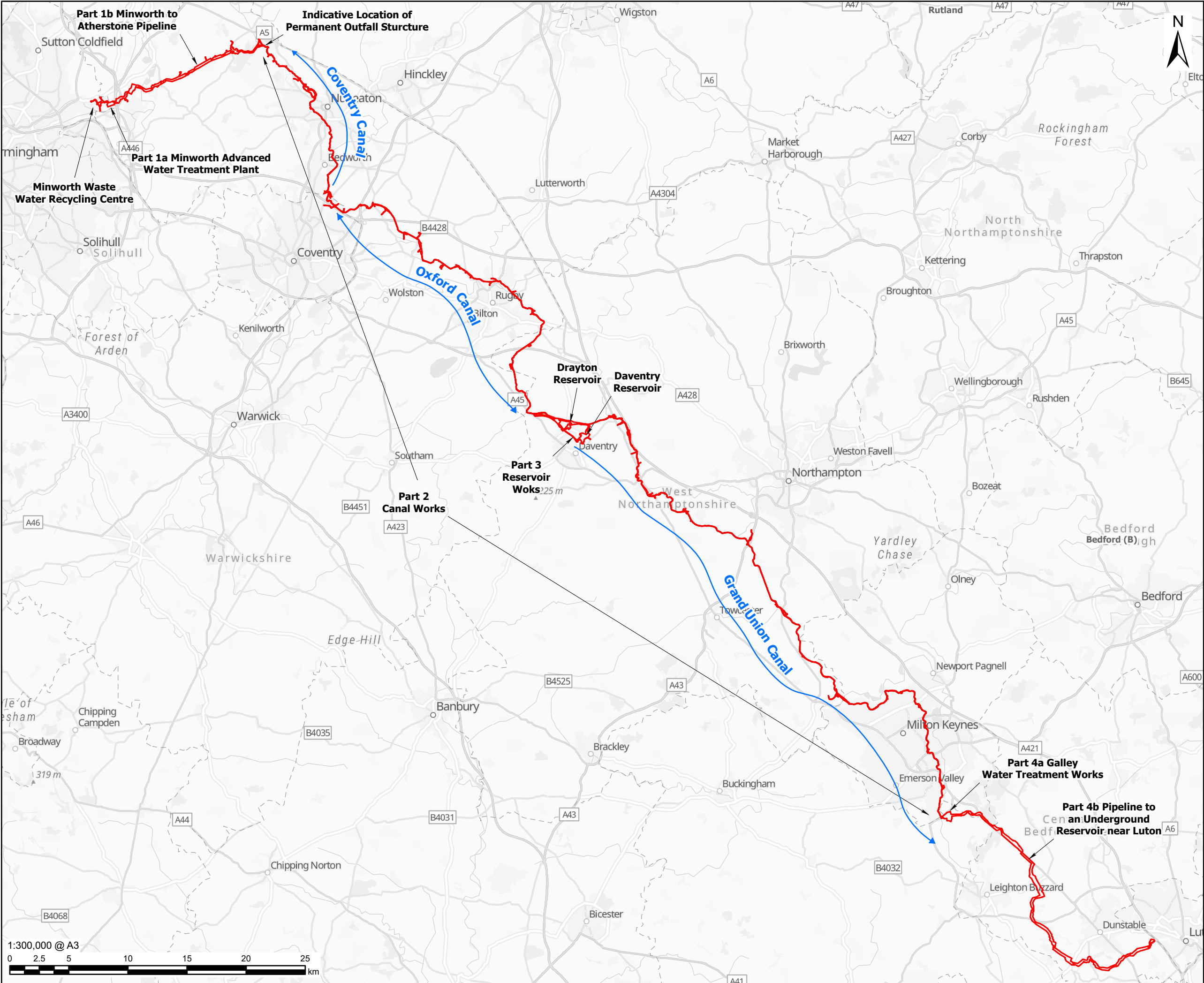
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Appendix A – Figures

Figure 13-A3-1: Proposed Development Overview



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Grand Union Canal Transfer

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LEGEND

Preliminary Order Limits

NOTES

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ISSUE PURPOSE

FINAL

PROJECT NUMBER

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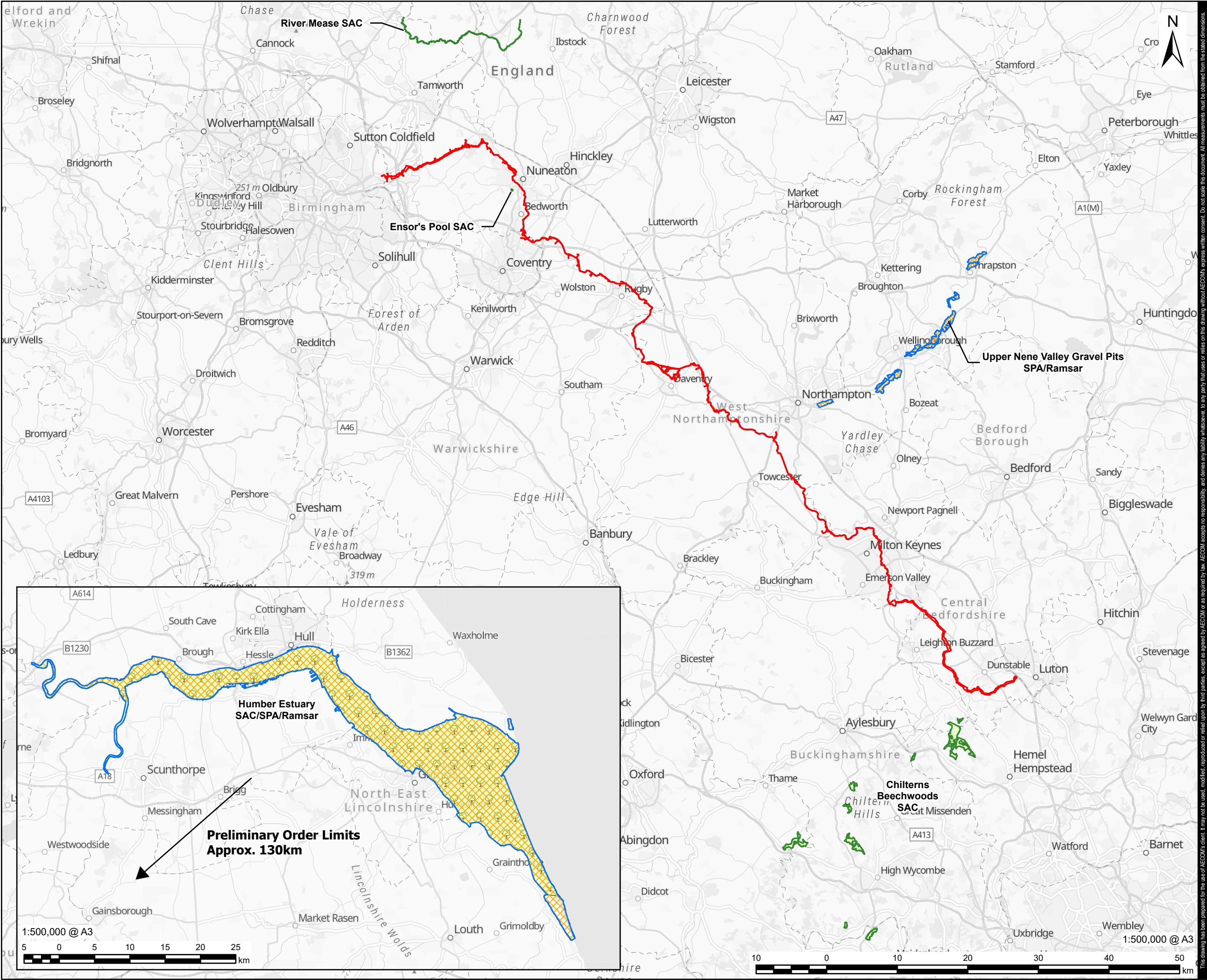
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Proposed Development Overview

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Figure 13-A3-1

Figure 13-A3-2: Location of the Proposed Development and Habitats Sites with Linking Impact Pathways



Appendix B – Results of Flow Impact Analysis

Table 8: Flow statistics by catchment

River	Gauging Station	Catchment Size (km ²)	Flow Statistics (m ³ /s)						Flow Statistics (ML/d)					
			Q5	Q10	Mean	Q50	Q70	Q95	Q5	Q10	Mean	Q50	Q70	Q95
Trent	North Muskham	8210 - Fig a	248.5	183	90.351	63.7	45.2	28.7	21470.40	15811.20	7806.33	5503.68	3905.28	2479.68
Idle	Mattersey	529 - Fig b	5.436	4.16	2.39	1.94	1.5	0.846	469.67	359.42	206.50	167.62	129.60	73.09
Ryton	Serlby Park	231 - Fig c	4.42	3.231	1.752	1.267	0.98	0.445	381.89	279.16	151.37	109.47	84.67	38.45
Torne	Auckley	135.5 - Fig d	2.25	1.58	0.898	0.663	0.522	0.33	194.40	136.51	77.59	57.28	45.10	28.51
TOTAL FLOW (historical records)			260.606	191.971	95.391	67.57	48.202	30.321	22516.36	16586.29	8241.78	5838.05	4164.65	2619.73
TOTAL FLOW (CC adjusted - RCP6.0-RCM08)			244.683	180.2416	89.84878	63.64418	46.22572	29.07784	21140.61	15572.87	7762.93	5498.86	3993.90	2512.33

Table 9: Percentage reduction in mean flow from Trent to Humber due to the Proposed Development and SROs – Present day flows

Max GUC of STT take		0.51%	0.69%	1.40%	1.97%	2.76%	4.39%	
Max LR take		1.33%	1.81%	3.64%	5.14%	7.20%	0.00%	LR observes Hands of Flow (HOF) condition so no abstraction below Q94
Max GUC+STT		1.02%	1.39%	2.79%	3.94%	5.52%	8.78%	
Max GUC+STT_LR		2.35%	3.20%	6.43%	9.08%	12.73%	8.78%	LR observes Hands of Flow (HOF) condition so no abstraction below Q94
Average GUC use (see GUC use tab)		0.19%	0.26%	0.53%	0.75%	1.05%	1.67%	
Average STT use (see STT tab)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Not available for historic flow (only climate change)
Average GUC+STT		N/A	N/A	N/A	N/A	N/A	N/A	Not available for historic flow (only climate change)

Table 10: Percentage reduction in mean flow from Trent to Humber due to the Proposed Development and SROs – Climate change flows

Max GUC of STT take		0.54%	0.74%	1.48%	2.09%	2.88%	4.58%	
Max LR take		1.42%	1.93%	3.86%	5.46%	7.51%	0.00%	LR observes Hands of Flow (HOF) condition so no abstraction below Q94
Max GUC+STT		1.09%	1.48%	2.96%	4.18%	5.76%	9.15%	
Max GUC+STT_LR		2.51%	3.40%	6.83%	9.64%	13.27%	9.15%	LR observes Hands of Flow (HOF) condition so no abstraction below Q94
Average GUC use (see GUC use tab)		0.21%	0.28%	0.56%	0.80%	1.09%	1.74%	
Average STT use (see STT tab)		0.15%	0.20%	0.41%	0.58%	0.80%	1.27%	
Average GUC+STT		0.36%	0.49%	0.97%	1.37%	1.89%	3.01%	