



**Thames to Affinity Transfer
Strategic Regional Option -
Habitats Regulations
Assessment**

RAPID Gate 1 submission Annex B2

May 2021

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Thames to Affinity Transfer Strategic Regional Option - Habitats Regulations Assessment

RAPID Gate 1 submission Annex B2

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Executive summary

This report presents the results of the initial Habitats Regulations Assessment (HRA) undertaken of the options considered for the Thames to Affinity Transfer (T2AT) Strategic Regional Option (SRO). The HRA assesses the potential impact of the options on designated sites in the UK's National Site Network, called Habitats Sites. This report supports Annex B1, the *Environment Assessment Report*, that accompanies the Gate 1 submission report to the Regulators' Alliance for Progressing Infrastructure Development for the T2AT options.

The content of this report is draft and relates to material [or data] which is still in the course of completion in travel to Gate 2 and should not be relied upon at this early stage of development. We continue to develop our thinking and our approach to the issues raised in the document in preparation for Gate 2

The aim of the T2AT SRO is to transfer available water from Thames Water and conveyance into the Affinity Water network, where it is treated and stored for distribution. Following an initial screening exercise where a long list of potential options for this scheme was reduced to a shorter list of options, seven distinct T2AT options were identified. These options include raw water pipelines, Water Treatment Work (WTW) facilities and treated water transfer pipelines. An eighth option, Mogden Reuse Indirect 3, is identical to Walton 2b and so has not been assessed separately. The screening process is described in Annex A1, the *Options Appraisal Screening Report*, of the Gate 1 submission.

The options for the Thames to Affinity Transfer have been subject to a HRA Stage 1 assessment. Subsequently, a HRA Stage 2 Appropriate Assessment (plan stage) has been undertaken where Likely Significant Effects or Uncertain Effects were identified at Stage 1.

The HRA Stage 1 Screening Assessment undertaken for Maidenhead, Teddington DRA and Lower Thames Reservoir Transfer 2a options identified Uncertain Effects on some Habitats Sites but the Stage 2 Appropriate Assessment did not identify any transmission pathways by which a Likely Significant Effect could reasonably occur. Therefore no adverse effects on the integrity of the Habitats Sites are considered likely.

The Appropriate Assessment undertaken for Sunnymeads 1, Sunnymeads 2a, Walton 2b and Beckton Reuse Indirect options identified transmission pathways, but concluded that no adverse effects on the integrity of the following Habitats Sites are likely if the following suggested mitigation measures are observed:

- Sunnymeads 1 and Sunnymeads 2a: There is a potential for adverse effects on the [redacted] SPA and the [redacted] Ramsar site as a result of their close proximity to the construction pipeline corridor and intake location, the site being located within the same river catchment as the intake location and as a result of disturbance (noise, light, dust pollution) during construction on qualifying species. Provided that the proposed mitigation measures are taken forward at the project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no adverse effects on the integrity of the Habitats Sites are foreseeable.
- Walton 2b: There is a potential for adverse effects on the [redacted] SPA and the [redacted] Ramsar site as a result of their close proximity to the construction pipeline corridor, the possibility the site may be hydrologically connected as the pipeline runs directly adjacent to a waterbody that forms part of the designation, and as a result of disturbance (noise, light, dust pollution) during construction on qualifying species. Provided that the proposed mitigation measures are taken forward at the

project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no adverse effects on the integrity of the Habitats Sites are foreseeable.

- Beckton Reuse Indirect: There is a potential for adverse effects on the [REDACTED] SPA and [REDACTED] Ramsar site as a result of their close proximity to the construction pipeline corridor and abstraction point on the [REDACTED] and as a result of disturbance (noise, light, dust pollution) during construction on qualifying species. Provided that the proposed mitigation measures are taken forward at the project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no adverse effects on the integrity of the Habitats Sites are foreseeable.

It should be noted that this report presents the results of the initial HRA assessment and should be considered a high-level assessment with respect to the preliminary nature of design details that is available at this early stage of the WRSE regional plan. The HRA will be updated to include a more conclusive HRA assessment at Gate 2. For similar reasons, an in-combination assessment to identify potential cumulative effects of T2AT with other non-related plans or projects would not be considered proportionate at this stage and has therefore not been conducted. The updated HRA conducted at Gate 2 will include an in-combination assessment of the options within T2AT, between different SROs and between any other external plans or projects that may put pressure on the same water resources. As T2AT develops, it is assumed that any potential significant effects on Habitats Sites due to individual options, or in-combination effects will be avoided as far as reasonably practicable.

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1 Introduction

1.1 Background

The Thames to Affinity Transfer (T2AT) Strategic Regional Option (SRO) project forms part of Affinity Water’s Water Resource Management Plan 2024 (WRMP24) and fits within Water Resources South East (WRSE) plans to improve the resilience of water resources across the South East of England

The project comprises abstraction of water from Thames Water and conveyance into the Affinity Water network, where it is treated and stored for distribution (distribution is not within the scope of this SRO). Following a screening process, seven distinct options are being developed for Gate 1 submission which consider multiple abstraction locations and sources, pipe routes, and new water treatment works (WTW). An eighth option, Mogden Reuse Indirect 3, is identical to Walton 2b and so has not been assessed separately

This report presents the results of the initial Habitats Regulations Assessment (HRA) (HRA Stage 2) undertaken of the seven distinct options considered for the SRO, in order to assess the potential impact of the options on European designated sites in the UK’s National Site Network. It should be considered a high-level HRA assessment, intended as a guide in developing the design of the options and their ultimate environmental assessments. The HRA will be updated to include a more conclusive assessment at Gate 2. This report supports the Environmental Assessment Report (EAR) that accompanies the Gate 1 submission to RAPID for the T2AT options.

1.2 Thames to Affinity Water Transfer Options

The outputs of the initial route options appraisal identified seven distinct constrained options for transferring water from the Thames Water region to the Affinity Water region (see Annex A1). These options include raw water pipelines, Water Treatment Works (WTW) facilities and treated water pipelines as shown in Table 1.1. A geographic overview of all the options is given in Figure A1, Appendix A.

Table 1 1: T2AT Options Overview

Option name	Option description
Sunnymeads 1	Abstraction of raw water at the existing Affinity Water [redacted] intake and conveyance to a new WTW at the existing [redacted] Service Reservoir (SR) site. Available storage capacity at the existing site will be utilised for this option
Sunnymeads 2a	Abstraction of raw water at the existing Affinity Water [redacted] intake and conveyance to a new WTW at [redacted] (2), near to the existing [redacted] WTW. The treated water is then conveyed to the existing [redacted] SR.
Walton 2b (and Mogden Reuse Indirect 3)	Abstraction of raw water at the existing Affinity Water [redacted] intake and conveyance to new [redacted] 2 WTW. The treated water is then conveyed to the existing [redacted] SR.
Maidenhead	Abstraction of raw water at a new [redacted] intake, conveyance to a new WTW at [redacted], and utilisation of available storage capacity at the existing [redacted] SR.
Teddington DRA	Abstraction of raw water at a new intake at [redacted], upstream of [redacted] and upstream of the proposed [redacted] DRA outfall (part of London Reuse SRO); conveyance to a new WTW at [redacted] and utilisation of the available storage capacity at [redacted]
Beckton Reuse Indirect	Indirect transfer of reuse water from [redacted] sewage treatment works to a new WTW near [redacted] The proposed abstraction point would be located on the [redacted], downstream of the outfall from the proposed Beckton Reuse option of the London Effluent Reuse SRO

Option name	Option description
Lower Thames Reservoir Transfer 2a	Water from Thames Water's [redacted] and [redacted] reservoirs is abstracted via a proposed connection into Affinity Water's existing [redacted] [redacted] at the existing [redacted] WTW site. This raw water is then diverted to the proposed [redacted] 2 WTW. The treated water is subsequently conveyed to the existing [redacted] SR.

1.3 The Purpose of the Habitats Regulation Assessment

A HRA includes several stages, as detailed in the Conservation of Habitats and Species Regulations 2017 (as amended), known as the Habitats Regulations, to determine if a plan or project may affect the protected features of a designated site before deciding whether to undertake, permit or authorise it. Changes to the Habitats Regulations came into force on 1 January 2021 introduced by the Conservation of Habitats and Species Amendment (EU Exit) Regulations 2019. The new regulations do not affect the assessment stages undertaken for this report.

A key result from the implementation of the Habitats Regulations is the designation and conservation of sites to maintain the favourable conservation status of protected habitats and species. These are listed in Annex I to the Habitats Directive, and the species listed in Annex II to that Directive as well as the threatened birds and regularly occurring migratory birds listed in the Annex I to the Birds Directive which naturally occur in the United Kingdom's territory. These sites are referred to as the National Site Network in the Habitats Regulations and refer to Special Areas of Conservation (SAC) and Special Protection Areas (SPA) (i.e. European sites in the UK). HRAs are also required as a matter of UK Government policy, for potential SPAs (pSPA), candidate SACs (cSAC) and Site of Community Importance (SCI). In England Ramsar sites and proposed Ramsar sites are also included in the assessment in accordance with the National Planning Policy Framework (NPPF). In accordance with the terminology used in government guidance for England on Appropriate Assessment and the NPPF, sites subjected to the HRA process can be collectively referred to as 'Habitats Sites'.

For any plan or project that could affect one or more Habitats Sites, the provisions of Part 6 of the Conservation of Habitats and Species Regulations 2017 (as amended) establish the procedure that a competent national authority must follow before agreeing to the implementation of a plan or project. The procedure requires such plans or projects to undergo a stepwise impact assessment against the Habitats Sites' conservation objectives.

The HRA process follows the stages detailed below:

- Stage 1 Screening - to check if the proposal is likely to have a significant effect on the site's conservation objectives. If so, the proposal needs to go through the appropriate assessment or derogation stages.
- Stage 2 Appropriate Assessment - to assess the likely significant effects of the proposal in more detail and identify ways to avoid or minimise any effects.
- Stage 3 Derogation - to consider if proposals that would have an adverse effect on a European site qualify for an exemption.

The competent authority can only agree to the plan or project if, based on the findings of the Appropriate Assessment, it has demonstrated the absence (rather than the presence) of an adverse effect on the integrity of the concerned Habitats Sites.

In exceptional circumstances, a plan or project having an adverse effect on the integrity of a Habitats Site can be approved under Part 6 of the Conservation of Habitats and Species Regulations 2017 (as amended) if it can be demonstrated that there is an absence of less damaging alternatives and the plan or project is necessary for imperative reasons of overriding

public interest. In such cases, adequate compensation measures must be secured to ensure that the overall coherence of the Habitats Site is maintained.

This document presents the outcomes of the initial Stage 1 and Stage 2 of the HRA.

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2 HRA Process for Gate 1 Submission

2.1 HRA Stage 1: Screening Principles

The purpose of the Screening Stage (Stage 1) of the HRA is to identify the Likely Significant Effects that arise from the interaction between actions of the T2AT options and sensitive receptors of a National Network Site through impact pathways.

For the purposes of this initial Gate 1 HRA submission, a significant effect is considered likely if a pathway is identified that cannot be excluded on the basis of objective information. A risk or a possibility of such an effect is enough to warrant the need for an Appropriate Assessment (Stage 2).

2.2 The WRSE Review and Updates to the Options

A HRA Stage 1 Screening exercise was undertaken by WRSE in January 2021 in-line with the methodology found in the WRSE Regional Plan Environmental Assessment Methodology Guidance, July 2020, and the output tables received from WRSE are contained in Appendix B. Since the WRSE submission, a route optimisation process was undertaken to enhance the design of the options such as abstraction locations and sources, pipe routes, etc. This resulted in adjusted pipeline routes for most options. The optimised options have therefore required to be reassessed at HRA Stage 1 Screening, thus the screening results presented in this report differ from the HRA Stage 1 screening which resulted from the WRSE process.

The updated screening results are presented in the relevant sections for each option in this report. The changes relating to each option are explained in the corresponding sections. The optimised routes are referred to as the 'Gate 1 submission options' to alleviate any confusion where it might arise in the report.

2.3 HRA Stage 2: Appropriate Assessment Approach

For options where potential 'Likely Significant Effects' or 'Uncertain Effects' were identified, an Appropriate Assessment is required. For the Gate 1 submission, the Appropriate Assessment aims to:

- Consider the impact of the project on the integrity of the Habitats Sites with respect to its structure and function; and
- Assess potential mitigation strategies where adverse effects on the integrity of a Habitats Site is identified.

Potential impacts may be direct or indirect and are dependent on the relationship between the source (proposed options' actions) and the receptor (the qualifying features of the Habitats Sites). The significance of an impact is relative to the sensitivity, existing condition and conservation status of the qualifying features of the site and the scale of the impact in space and time.

Potential effects on the qualifying features of the Habitats Sites are evaluated with respect to the scale, extent and nature of the impact, for example the area of habitat affected, changes in hydrodynamics, potential changes in species distribution, and the duration of the impact. Given the high level nature of the assessment at this plan stage it is not always possible to determine the exact scale and extent of the impact, when this is the case a precautionary approach is taken when evaluating the significance of the impact.

The process of HRA should provide all the necessary information for the competent authority to undertake an Appropriate Assessment in accordance with Part 6 of the Conservation of Habitats and Species Regulations 2017 (as amended). It should be noted that due to the early stages of the regional plan, the high-level nature of this HRA Gate 1 submission does not provide the level of assessment required to allow a comprehensive determination of the potential effect of the options on the integrity of the Habitats Sites identified. The integrity of a site is the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was designated. It is the intention that the HRA assessment will be updated at Gate 2 in the light of further details on the proposed options, and provide a conclusive assessment on the integrity of the Habitat Sites identified, thus providing the competent authority the appropriate level of information to undertake the assessment. The Gate 2 report will be sent for consultation with the relevant nature conservation authorities and the public. If the competent authority considers that residual adverse effects remain, the next stage of HRA (Assessment of Alternative Solutions) would be required.

It should be noted that at this stage an in combination assessment to identify potential cumulative effects of T2AT with other non related plans or projects has not been conducted. An in combination assessment would not be considered proportionate at this stage (at WRSE regional plan level), due to the early stages of the regional plan, and the preliminary nature of design details on T2AT and other SROs. An updated HRA will be conducted at Gate 2 to include an in combination assessment of the options within T2AT, between different SROs and between any other external plans or projects that may put pressure on the same water resources. As the T2AT scheme develops, it is assumed that any potential significant effects on Habitats Sites due to individual options, or in combination effects will be avoided as far as reasonably practicable.

2.4 HRA Methodology

This HRA Stage 2: Appropriate Assessment has been formulated using the following approach:

- Review the WRSE identified sites and confirm any additions or exclusions;
- Assessment of the construction and operation impacts of the T2AT options;
- Assessment of the Habitats Sites' characteristics and qualifying features; and
- Identification of the aspects of the proposed T2AT options that have the potential to significantly impact the conservation objectives of the Habitats Sites.

This assessment has been undertaken in accordance with the following guidance:

- GOV.UK (2019) *Appropriate Assessment - Guidance on the use of Habitats Regulations Assessment*. Published 22 July 2019¹.
- UK Water Industry Research (UKWIR, 2012) *Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans (12/WR/02/7)*²; and
- European Commission (EU, 2018) *Managing Natura 2000 sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*³.

¹ Available at: [Appropriate assessment - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/414141/AA-Guidance-2019.pdf)

² UKWIR (2012). Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans (12/WR/02/7) UK Water Industry Research (2012)

³ Available at: https://ec.europa.eu/environment/nature/natura2000/management/docs/art6/Provisions_Art_6_nov_2018_endocx.pdf

2.5 Potential Impacts Considered as part of the HRA

Following UKWIR (2012) guidance and given the nature of the proposed options the potential impacts considered in this assessment are summarised in Table 2.1. Proposed distances are also provided following the same guidance to ascertain if, where a pathway has been identified, the impact is likely to affect the habitats or species for which the Habitats Site has been qualified. It should be noted that, in some cases, it was appropriate to use a larger Zone of Influence (Zoi) than defined in Table 2 1 for example, where a new pipeline crosses a watercourse that runs into a Habitats Site, and where changes in water quality and quantity could affect habitats that are hydrologically connected.

Table 2.1: Potential Impacts Considered in the Appropriate Assessment

Broad categories of potential impacts on European sites (with examples)	Examples of operations resulting in impacts and proposed Zoi
<p>Physical loss Destruction (including offsite effects) e.g. removal of foraging habitat, smothering</p>	<p>Development of built infrastructure associated with the pipelines, access routes. Indirect effects from a reduction in flows e.g. drying out marginal habitat Physical loss is only likely to be significant where the boundary of the option extends within the boundary of the Habitats Site, or within an offsite area of known foraging, roosting, breeding habitat (that supports species for which a Habitats Site is designated).</p>
<p>Physical damage Habitat degradation Erosion Trampling Fragmentation Severance/barrier effects Edge effects</p>	<p>Development of built infrastructure associated with the option, e.g. reservoir embankments, water treatment plants, pipelines, pumping stations. Physical damage is only likely to be significant where the boundary of the option extends within or is directly adjacent to the boundary of the Habitats Site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a Habitats Site is designated)</p>
<p>Non-physical disturbance Noise Visual presence Light pollution Vibration</p>	<p>Noise from vehicular traffic during construction of the option. Plant and personnel involved in construction and operation of the option e.g. for maintenance Development of built infrastructure associated with the option, which includes artificial lighting. Effects from light pollution are only likely to be significant where the boundary of the option is within 500m of the boundary of the Habitats Site. Noise from construction traffic is only likely to be significant where the transport route to and from the option is within 500m of the boundary of the Habitats Site Noise visual /human presence are only likely to be significant where the boundary of the option is within 500m of the boundary of the Habitats Site or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a Habitats Site is designated).</p>
<p>Water table/ availability Drying Flooding/storm water Changes to surface water levels and flows Changes to groundwater level and flows</p>	<p>Change to water levels and flows due to water abstraction, storage and drainage interception associated with inland options. These effects are only likely to be significant where the boundary of the option extends within the same ground or surface water catchment as the Habitats Site. However, these effects are dependent on hydrological continuity between the option and the Habitats Site</p>
<p>Toxic contamination Water pollution Soil contamination Air pollution</p>	<p>Reduced dilution in downstream or receiving waterbodies due to changes in abstraction or reduced compensation flow releases to river systems. These effects are only likely to be significant where the boundary of the option extends within the same ground or surface water catchment as the Habitats Site. However, these effects are dependent on hydrological continuity between the option and the Habitats Site, and whether the option is up or down stream from the Habitats Site. Contamination of soil due to leaching of contaminated waters, ingress of dust/air emissions or pollution events. This effect is only</p>

Broad categories of potential impacts on European sites (with examples)

Examples of operations resulting in impacts and proposed Zol

	likely to be significant where the transport route to and from the option is within 200 metres of the boundary of the Habitats Site or where the boundary of the option extends within the same ground or surface water catchment as the Habitats Site Air emissions associated with vehicular traffic during construction and operation of options. This effect is only likely to be significant where the transport route to and from the option is within 200 metres of the boundary of the Habitats Site.
Biological Disturbances Direct mortality Changes to habitat availability Out-competition by non-native species Introduction of disease Introduction of invasive species	Potential for changes to habitat availability, e.g. reductions in wetted width of rivers leading to desiccation of macrophyte beds due to changes in abstraction or reduced compensation flow. This effect is only likely to be significant where the receiving water for the option is the Habitats Site or a tributary of the Habitats Site.
Physical loss Destruction (including offsite effects) e.g. foraging habitat, smothering	Development of built infrastructure associated with the pipelines, access routes. Physical loss is only likely to be significant where the boundary of the option extends within the boundary of the Habitats Site, or within an offsite area of known foraging, roosting, breeding habitat (that supports species for which a Habitats Site is designated)

Source: Adapted from: UK Water Industry Research (2012)⁴

2.6 Assumptions and Standard Best Practice Mitigation Measures

2.6.1 Overview

The high-level nature of this assessment undertaken at the concept design stage means that there is only an outline level of detail for all options considered, and as stated in the methodology, any option being taken forward to be implemented will be subject to a further Stage 2 Appropriate Assessment at Gate 2, when, in light of more information relating to the construction and design of the project, a more refined HRA assessment can be undertaken

Based on the current level of detail available for T2AT options, a number of assumed and established mitigation measures are proposed in the Stage 2 assessments provided in Chapter 3, with the assumption that if they are built into the design of the option, they will avoid or mitigate the effects identified in this initial HRA. These measures are defined as industry wide best practice measures to address common risks in the construction and development sectors and thus are proven to reduce the risk of the identified impacts in so far as is reasonably possible. These measures should be applied unless further development of the option results in them not being required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate. Note that these mitigation measures will be reviewed at Gate 2, taking into account any changes in best-practice as well as option specific survey information or baseline studies.

It is recommended that Affinity Water and Thames Water work closely with Natural England and the Habitats Site managers to agree the specific mitigation measures to be included in the Gate 2 HRA. The agreed mitigation measures will be expected to form part of planning conditions, development consent orders and/or conditions of relevant environmental permits, and their

⁴ UK WIR (2012) *Strategic Environmental Assessment and Habitats Regulations Assessment - Guidance for Water Resources Management Plans and Drought Plans (12/WR/02/7)* UK Water Industry Research, 2012

implementation managed through contractual obligations with supervision from an Environmental Clerk of Works.

2.6.2 Assumptions during Construction

The assumptions made on the mitigation measures for the scheme design, pollution control, biosecurity, disturbance, and the Construction and Environmental Management Plan (CEMP) are:

Scheme design

- Should design be altered, every opportunity for avoiding potential effects on Habitats Sites and flight paths of Habitats Sites interest features (e.g. through alternative pipeline routes, micro siting, etc.) should be taken.
- Construction of new pipeline at watercourse crossings, where the watercourse is in hydrological continuity with a Habitats Site will be carried out using directional drilling to avoid direct impacts on riverbed and permanent habitat loss.
- Pipeline routes will be sufficiently distant to watercourses and designated sites boundaries to offer a buffer limiting pathways through disturbance and pollution runoff

Pollution control

- Indirect construction related pollution is identified as one key pathway through which designated sites may be affected. There is numerous guidance on environment good practice measures during construction which can be relied on (at this level) to prevent significant adverse effects on a designated site occurring. The best-practice procedures detailed in the following documents should be followed for all construction works derived from this option, as a minimum standard:
 - CIRIA C741 *Environmental Good Practice on Site Guide* (Charles and Edwards, 2015)⁵
 - Environment Agency's Pollution Prevention Guidance Notes⁶ including PPG1: *General Guide to Prevention of Pollution* (May 2001); PPG5: *Works and maintenance in or near water* (October 2007), PPG6: *Pollution prevention guidance for working at construction and demolition sites* (April 2010); PPG21: *Pollution incident response planning* (March 2009); PPG22: *Dealing with spillages on highways* (June 2002);
- The installation of sediment traps near or in watercourses or the use of cofferdams should be specified at the project stage.

Biosecurity

- Biosecurity measures will be in place to ensure the management of invasive non native species on construction sites and during controlled activities. The following considerations will be given pre construction:
 - INNS risk assessment to be undertaken at site feasibility stage
Where INNS are identified, legal requirements and mitigation plan developed at early planning stage
 - INNS to be included on all site method statements including CESMP and any Ecological Protection Plans. INNS risk to be managed by Clerk of Works and INNS brief given to all site contractors
 - Where a species requires long-term management (such as Japanese knotweed), a specific INNS management plan will be developed

⁵ Charles P. and Edwards P (2015) *Environmental good practice on site guide*. CIRIA C741, 260p.

⁶ Note, the Environment Agency Pollution Prevention Guidance Notes have been withdrawn by the Government, although the principles within them are robust and still form a reasonable basis for pollution prevention measures

- The best practice procedures detailed in the following documents should be followed to reduce the spread of INNS for all construction works derived from these options, as a minimum standard:

CIRIA Manual C679 'Invasive species management for infrastructure managers and the construction industry'; The Knotweed Code of Practice – managing Japanese Knotweed on development sites (EA) (Environment Agency document).

Disturbance - noise

- Construction activities will be conducted in accordance with noise limits to avoid disturbance.
- Programme activities likely to result in disturbance to breeding birds outside of the bird breeding season, in the period April to mid-September inclusive;
- Programme activities likely to result in disturbance to wintering birds outside of the period October to March inclusive;
- Construction related noise disturbance can be further minimised by implementing best practice such as BS 5228 1:2009+A1:2014 (The British Standards Institute, 2008)⁷

Disturbance - light

- Lighting will be kept to a minimum to reduce disturbance. Should the works be undertaken at night and flood lighting required, lighting should be kept to a minimum, and hooded spotlights directed away from potential suitable habitat, to reduce disturbance while ensuring standards for health and safety;
- The potential impact of artificial light may be minimised through the implementation of best practice such as '*Guidance Notes for the Reduction of Obtrusive Light*' (Institute of Lighting Professionals, 2011)⁸

Construction and Environmental Management Plan

A Construction and Environmental Management Plan (CEMP) must be developed at the project stage, including measures to ensure that the risk of uncontrolled discharges from construction is reduced (including sediment management) and detailing an Emergency Response Plan in the event of a pollution incident. This plan must be prepared for all works and include measures listed above and additional ones identified during the project HRA.

2.6.3 Assumptions during Operation

New raw water intakes are assumed to be undertaken under licenced limits

The water treatment level will need to be appropriate to avoid the risk of spreading Invasive Non Native Species (INNS) and pathogens, this will be identified at the project stage informed by a baseline study. Refer to lead Annex B1, section 4 "*Invasive Non Native Species Risk Assessment*"

⁷ The British Standards Institute, 2008. BS 5228-1:2009+A1:2014. *Code of practice for noise and vibration control on construction and open sites. Noise*. BSI Standards Limited, London

⁸ Institution of Lighting Professionals (2020) Guidance note for the reduction of obtrusive light. Guidance Note1/20

3 T2AT HRA Assessments

3.1 Sunnymeads 1

3.1.1 Summary of the Option

The Sunnymeads 1 option conveys water from an existing intake at [REDACTED] to a proposed WTW at the existing [REDACTED] SR site. New pipeline infrastructure will be required to transport raw water for conveyance, and available storage capacity at the reservoir will be utilised for the option

The pipeline route passes largely through open areas in its middle section passing through a collection of open fields just south of the existing [REDACTED] WTW which reduces disruption to the local community and avoids additional utility diversions.

50MI/d or 100MI/d of raw water will be transferred. A geographic representation of the Sunnymeads 1 option is provided on Figure A2, Appendix A

3.1.2 HRA Stage 1 Screening of National Network Sites

The WRSE Stage 1 Screening assessment identified six Habitats Sites within the Zol of the option

As mentioned in Section 2.2, the option was optimised for the Gate 1 submission. Re-screening of the optimised option has ultimately identified the same six Habitats Sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. A Habitats Site must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible. The updated screening assessment for Sunnymeads 1 is given in Table 3.1 where there is potential for Likely Significant Effects or Uncertain Effects.

Table 3.1: Sunnymeads 1 Stage 1 Screening Assessment (rescreening based on Gate 1 submission option)

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
[REDACTED] SPA <ul style="list-style-type: none"> • Wintering Gadwall <i>Anas strepera</i> • Wintering Shoveler <i>Anas clypeata</i> 	0.5km from the intake location and [REDACTED] end of the pipeline route	Yes There is potential for adverse effects on this SPA as a result of its close proximity to the pipeline construction corridor and intake location at [REDACTED]. The site is within the same river catchment of the intake location and may be in hydrological continuity due to its proximity. Adverse effects as a result of construction-related disturbance (noise/light/dust pollution) on qualifying species should be considered
[REDACTED] Ramsar site <ul style="list-style-type: none"> • Criterion 6: regularly supports internationally important 	0.5km from the intake location and [REDACTED] end of the pipeline route	Yes There is potential for adverse effects on this Ramsar site as a result of its close proximity to the pipeline construction corridor and intake location at [REDACTED]. The site is within the same river catchment of the intake location and may be in hydrological continuity.

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
populations of Gadwall <i>Anas strepera</i> and Shoveler <i>Anas clypeata</i>		Adverse effects as a result of construction-related disturbance (noise/light/dust pollution) on qualifying species should be considered
<p>██████████ SAC</p> <ul style="list-style-type: none"> Annex I habitats Old acidophilous oak woodland with <i>Quercus robur</i> and Atlantic acidophilous beech forests with <i>Ilex</i> and <i>Taxus</i> Annex II species Violet click beetle <i>Limoniscus violaceus</i> 	<p>3km from the intake location and ██████████ end of the pipeline route</p> <p>██████████</p> <p>██████████</p> <p>██████████</p>	<p>No</p> <p>This SAC is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. Although both the SAC and the option might both be hydrologically connected to the River Thames, they are unlikely to be in hydrological connection with each other due to the direction of flow of associated minor rivers. Regardless, no impact on the River Thames has been identified in the WFD Level 1 assessments, therefore no changes to the water table are possible</p>
<p>██████████ SPA</p> <ul style="list-style-type: none"> Dartford Warbler <i>Sylvia undata</i> Nightjar <i>Caprimulgus europaeus</i> Woodlark <i>Lullula arborea</i> 	<p>9.5km south of the intake location and ██████████ end of the pipeline route.</p> <p>██████████</p> <p>██████████</p> <p>██████████</p>	<p>No</p> <p>This SPA is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. The SPA is unlikely to be in hydrological continuity with the option</p>
<p>██████████ SAC</p> <ul style="list-style-type: none"> Annex I habitat Northern Atlantic wet heaths with <i>Erica tetralix</i>, European dry heath and Depressions on peat substrates of the <i>Rhynchosporion</i> 	<p>9.5km south of the intake location and ██████████ end of the pipeline route. The SAC is the same location as ██████████ SPA at the closest point to the option.</p>	<p>No</p> <p>This SPA is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. The SPA is unlikely to be in hydrological continuity with the option</p>
<p>██████████ SAC</p> <ul style="list-style-type: none"> Annex I habitats: Atlantic acidophilous beech forest with <i>Ilex</i> and <i>Taxus</i> 	<p>8km west of the pipeline route</p>	<p>No</p> <p>This SAC is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. The SPA is unlikely to be in hydrological continuity with the option.</p>

3.1.3 Likely Impact Pathways and Potential Effects

Considering the type, size and scale of the Sunnymeads 1 option, the potential impacts (of construction and operational phases) are described below.

3.1.3.1 Construction

Sunnymeads 1 is a relatively simple option and requires the construction of approximately 25km of new pipeline from an existing intake on the River Thames at [REDACTED], through [REDACTED], to the existing [REDACTED] SR, located east of [REDACTED]. The route optimisation has sought to avoid Habitats Sites as much as possible but the intake location and some portions of the beginning of the pipeline construction corridor is located <0.5km from the [REDACTED] No. 1 Gravel Pit SSSI and which is part of the South West London SPA/Ramsar site, and the [REDACTED] Reservoir, which although not included in the SPA/Ramsar site, could be used as functional supporting habitat by the qualifying bird species. Given the close proximity of these waterbodies, construction activities associated with trenching and pipeline layout has the potential to result in disturbance of sensitive species due to noise, lighting, visual impact, vibration, etc. The qualifying bird species (namely Gadwall and Northern Shoveler) of the SPA and Ramsar site are wintering species and therefore sensitive to disturbance in the wintering period (October to March inclusive). Given the scale of the works, and the relatively short section of pipeline required in the vicinity of the site, most disturbance risks can almost certainly be avoided or controlled through the application of standard best-practice measures and mitigation. [REDACTED] No.1 is adequately screened from the works, given there is housing and woodland blocks in between, but the [REDACTED] Reservoir is much closer to the pipeline route and is relatively exposed in terms of visual impacts on bird species. As the Reservoir is not part of the Habitats Site, typical mitigation considered adequate to reduce disturbance effects from increased lighting, visual impact and vibration given in Section 2.6 should be considered adequate to ensure no adverse effects on qualifying species occurs.

The impact of noise disturbance however is a particular concern to the [REDACTED], as research indicates that there is a flight response in waterfowl above 70dBA (Cutts et al. 2009)⁹. It would be impossible to fully assess the magnitude of this impact at this stage as there is no detailed design and construction information available, but given the SPA/Ramsar site boundary is not immediately adjacent to the pipeline route, it is expected that noise-related disturbance can also be mitigated. As a precautionary approach, Natural England should be consulted in relation to the noise disturbance and the project stage HRA should include a valid noise assessment to ensure that noise levels do not breach agreed thresholds at the boundary of the designated site. If it was predicted that noise levels could not remain under the agreed thresholds, then construction works in the vicinity of the SPA/Ramsar site boundary should avoid the winter period altogether.

A number of river crossings will be required (5-10 in the current design) of the [REDACTED], [REDACTED], the [REDACTED] and [REDACTED] which all deposit to the River Thames. In the particular case of river crossings, in-channel works can result in temporary habitat degradation through, for example, runoff from accidental pollution events or dust emissions from construction-related activities. There is also potential for increased sedimentation and silting during construction. These impacts are only considered relevant to a HRA if the impacted watercourses are in hydrological continuity with a Habitats Site. It is likely that the gravel pits (including [REDACTED] No. 1) of the [REDACTED] SPA/Ramsar site are hydrologically connected with the water table however, given the nature of the sand and gravel aquifer in the area. Pipeline trenching in the vicinity of the waterbodies at the beginning of the

⁹ Cutts, N., Phelps, A. & Burdon, D. (2009). Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. The University of Hull, Hull

pipeline route therefore has the potential to result in changes to the water table in the vicinity of the designated waterbody. The design of the pipeline would therefore have to be carefully informed by hydrogeological investigations to ensure any excavation works were undertaken so as not to disrupt groundwater continuity to the Habitats Site. If the resulting hydrological investigations suggest that there will be any disruption to ground or surface water levels at river crossings or in the vicinity of the waterbodies, it is recommended that directional drilling is employed in lieu of pipeline trenching to avoid such impacts. If directional drilling is not possible at beginning of the pipeline corridor, it is recommended that the pipeline is rerouted to a sufficient distance from the Habitats Sites where groundwater continuity will not be affected. Dust emissions are unlikely to result in significant adverse effects given the geology of the area is predominantly sand and gravel (i.e. not very dusty) and is located a significant distance from the chalk aquifer in the Chilterns area of the Thames region. Appropriate mitigation will need to be included as the design develops to ensure dust emissions are regulated. With regards to accidental pollution events at river crossings, risks can almost certainly be avoided or controlled through the application of standard best-practice measures; mitigation and typical mitigation considered adequate to ensure water pollution control are given in Section 2.6.

Spread of invasive species may occur during construction where personnel, vehicles and equipment move between and within sites, as well as the excavation and disposal of materials (e.g. sediments and vegetation). The presence and increase in INNS can lead to loss of habitat and over time they can overtake native species affecting habitats and qualifying species they support. Apart from the hydrological connection identified at the [REDACTED] end of the pipeline route and the [REDACTED], there are no other Habitats Sites which are obviously hydrologically connected to the pipeline route. Furthermore, there are no Habitats Sites downstream on the River Thames which may be indirectly affected by any adverse effects in the inputting rivers as a result of construction at these crossings. Appropriate mitigation measures will be incorporated into the design of the option at the project stage regardless to ensure the spread of INNS is limited and no significant adverse effects occur.

Regarding the construction of the new WTW at the existing [REDACTED] reservoir site; this location is a rural setting with no surface waterbodies adjacent and is sufficiently removed from any Habitats Site (>10km) to consider impacts from excavation works affecting groundwater bodies to be not relevant to this HRA.

The key risks identified during construction are:

- Non physical disturbance – increased noise/visual/human presence may result in disturbance to qualifying bird species of the [REDACTED] SPA/Ramsar site at [REDACTED] Gravel Pit No 1 and (supporting waterbody) [REDACTED] Reservoir
- Toxic contamination – water pollution due to accidental pollution events at river crossings may result in habitat degradation or biological disturbance to the qualifying bird species of the [REDACTED] SPA/Ramsar site at [REDACTED] Gravel Pit No 1
- Non-toxic contamination – air pollution due to dust deposition may affect chemical balance of the water table and aquatic habitat of the [REDACTED] SPA/Ramsar site in the vicinity of [REDACTED] Gravel Pit No 1 and (supporting waterbody) [REDACTED] Reservoir.
- Changes to water table availability – ground water level and flows may be affected during excavation works and dewatering of the pipeline construction in the vicinity of the [REDACTED] SPA/Ramsar site at [REDACTED] Gravel Pit No.1.

3.1.3.2 Operation

The Sunnymeads 1 option will require increased abstraction of 50MI/d or 100MI/d from an existing licenced intake on the River Thames. The *Thames to Affinity Transfer SRO Secondary*

Screening report (Mott MacDonald 2020) suggests that the resource is reliable and has capacity to increase in line with the Thames River Catchment Management Strategy (CAMS) which states that 'For all consumptive abstractions of 2Ml/d or above, a Hands off Flow (HoF) of between Q30 and Q50 will be applied based on the perceived level of risk to the water body or downstream bodies.' It is therefore assumed that the increase in abstraction will be within the terms of the existing licence and ultimately protected by the Review of Consents process.

It is assumed that operation of the new WTW will transfer potable water directly into [REDACTED] SR where it will be pumped into the supply network and no inter-basin water transfers to surface or groundwater bodies will be required.

Raw water transfers always introduce a risk of spreading invasive species, for example by introducing pathogens and fish disease if present at the abstraction source. An INNS risk assessment tool was utilised for the purposes of the Gate 1 submission to score the risks associated with the operational phases of the T2AT options and is available in the Environment Assessment Report (EAR)¹⁰. The INNS assessment suggests that there will not be any significant increase in the risk of INNS transfer as a result of the operation of any of the T2AT options. The INNS risk would normally depend on the presence/absence of pathogens in the River Thames at the abstraction locations, but as all the T2AT options terminate at a WTW, the risk of future invasion is considered low overall as INNS will be eliminated during treatment. Regardless of the presence of INNS at source, there are currently no planned discharges from the proposed [REDACTED] WTW to waterbodies that are designated as Habitats Sites, or to waterbodies in hydrological continuity with Habitats Sites. Therefore, there is confidence that the risk of INNS spread to Habitats Sites as a result of operation of this and all T2AT options is low and therefore not considered further in this HRA assessment.

No key risks to Habitats Sites have been identified as a result of the operation of Sunnymeads 1.

3.1.3.3 Potential Effects on Designated Sites

The following Habitats Sites have been screened in as having the potential to result in Likely Significant Effects or Uncertain Effects as a result of the option, and therefore are subject to a HRA Stage 2: Appropriate Assessment:

- [REDACTED] SPA; and,
- [REDACTED] Ramsar site.

For the Appropriate Assessment, a review of the sensitivity of the qualifying features of these Habitats Sites in relation to the potential impacts identified from the option and the conservation objectives of the designated site is required. Table 3.3 lists the features for which each site is designated and identifies the Likely Significant Effects before and after mitigation measures are assumed. As the qualifying features for both the SPA and Ramsar site are the same in the case of [REDACTED], both the Habitats Sites have been assessed together. An assessment of each potential impact on the integrity of the sites are made, in view of the sites' structure, function and conservation objectives. Where adverse impacts are deemed significant, standard mitigation measures addressing some of these impacts are described in Section 2.6.

Full descriptions of the Habitats Sites including their conservation objectives and any current pressures or threats are given in Appendix C.

¹⁰ Mott MacDonald (2021) Thames to Affinity Transfer Strategic Resource Option – Annex B Environment Assessment Report RAPID Gate 1 submission

3.1.3.4 Sunnymeads 1 Appropriate Assessment

Considering the type, size and scale of the proposed Sunnymeads 1 option, the potential impacts (of construction and operational phases) are described in Table 3.2 below.

Table 3.2: Sunnymeads 1: Potential effects on designated sites and qualifying features

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹¹	Residual Effects (after mitigation)
<p>██████████ SPA</p> <p>██████████ Ramsar site</p>	<ul style="list-style-type: none"> Gadwall <i>Anas strepera</i> 710 individuals - wintering (5-year peak mean 1993/94 - 1997/98) 2.4 % NW Europe Shoveler <i>Anas clypeata</i> 853 individuals - wintering (5-year peak mean 1993/94 - 1997/98) 2.1 % NW/Central Europe 	<p>The ██████████ abstraction point and initial pipeline route is located within 500m of the ██████████ No.1 gravel pit belonging to the ██████████ SPA/Ramsar site and the ██████████ Reservoir, a supporting waterbody for the qualifying bird species.</p> <p>There is potential for the construction of the new pipeline corridor and trenching to result in:</p> <ul style="list-style-type: none"> Non-physical disturbance – increased noise/visual/human presence may result in disturbance to qualifying bird species Gadwall and Northern Shoveler at ██████████ Gravel Pit No. 1 and ██████████ Reservoir Toxic contamination – water pollution due to accidental pollution events (including spread of INNS) at hydrologically linked river crossings may result in habitat degradation or biological disturbance to the qualifying bird species at ██████████ Gravel Pit No. 1. Non-toxic contamination – air pollution due to dust deposition may affect chemical balance of the water table and aquatic habitat of the ██████████ SPA/Ramsar site in the vicinity of ██████████ Gravel Pit No. 1 and ██████████ Reservoir Changes to water table availability - ground water level and flows may be affected during excavation works and dewatering of the pipeline construction in the vicinity of ██████████ Gravel Pit No. 1. 	<ol style="list-style-type: none"> Standard best practice procedures should be followed during construction to limit construction-related disturbance and contamination including (but are not limited to) the following: <ul style="list-style-type: none"> CIRIA C741 Environmental good practice on site guide Environment Agency's PPGs (PPG1: General Guide to Prevention of Pollution; PPG5: Works and maintenance in or near water; PPG6: Pollution prevention guidance for working at construction and demolition sites). Best practice such as BS 5228-1:2009+A1:2014 (The British Standards Institute, 2008) to avoid significant effects due to noise. Best practice such as 'Guidance Notes for the Reduction of Obtrusive Light' (Institute of Lighting Professionals, 2011) to avoid significant effects due to increased light (if works are programmed at night). Industry best practice mitigation measures for dust suppression Works in the vicinity of ██████████ No.1 and ██████████ Reservoir to either be accompanied by a noise assessment and noise thresholds agreed with Natural England or works in this location to be undertaken outside the 	<p>Assuming all proposed mitigation is implemented it is considered there will not be a significant change in:</p> <ul style="list-style-type: none"> The extent and distribution of qualifying bird species; The structure and function of the habitats of qualifying species; and The supporting processes on which habitats of qualifying species rely. <p>No residual effects after mitigation are expected</p>

¹¹ Full references of guidance documents are given in Section 3.4. where they are first listed

Designated Site (Habitats Sites)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹¹	Residual Effects (after mitigation)
		<p>The impacts are considered to be temporary and localised and affecting only a small proportion of the designated site, which includes seven significant waterbodies.</p> <p>The identified effects have the potential to reduce the extent and distribution of the qualifying species as well as affecting the structure and function of their supporting habitats, compromising the integrity of the [REDACTED] SPA/Ramsar site.</p> <p>No pathways have been identified during operation that could lead to significant effects to the integrity of this SPA/Ramsar site.</p>	<p>wintering period. Adequate screening to avoid visual disturbance should also be employed.</p> <ol style="list-style-type: none"> 3. Works at river crossings or in the vicinity of the waterbodies to be informed by hydrological investigations to ensure no disruption to surface or groundwater continuity. If impact is identified, direction drilling to be employed at river crossings wherever possible, including where river is linked to the Habitats Site. 4. If directional drilling does not negate hydrological disruptions at the beginning of the pipeline corridor, the pipeline should be rerouted to a sufficient distance from the Habitats Sites where groundwater continuity will not be affected. 5. Good practice guidelines in relation to spread of INNS during construction (including unexpected pollution events) to be followed. 6. Development of a Construction and Environmental Management Plan which will include all the above proposed mitigation measures and any further measures identified at project stage. 	



3.1.4 Summary of Sunnymeads 1 Appropriate Assessment

No pathways by which a Likely Significant Effect could occur were identified in the HRA Stage 1: Screening assessment for this option for the following Habitats Sites in the Zol:

- [REDACTED] SAC;
- [REDACTED] SPA;
- [REDACTED] SAC; and
- [REDACTED] SAC.

No significant adverse effects on the integrity of the following Habitats Sites are expected, if the suggested mitigation measures in the HRA Stage 2: Appropriate Assessment are implemented:

- [REDACTED] SPA; and
- [REDACTED] Ramsar site.

In conclusion, provided that the proposed mitigation measures are taken forward at the project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no further stages in the HRA process will be necessary for Sunnymeads 1.

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3.2 Sunnymeads 2a

3.2.1 Summary of the Option

The Sunnymeads 2a option conveys raw water from the existing [redacted] intake to the proposed [redacted] 2 WTW, then conveys the treated water on to [redacted] SR. New pipeline infrastructure will be required to transport raw water from the intake to the proposed [redacted] 2 WTW. The treated water will then be conveyed to the existing [redacted] SR. Available storage capacity at the reservoir will be utilised for the option

The pipeline route passes largely through open areas in its middle section, passing through a collection of open fields just south of the existing [redacted] WTW which reduces disruption to the local community and avoids additional utility diversions.

50MI/d or 100MI/d of raw water will be transferred. A geographic representation of the Sunnymeads 2a option is provided on Figure A2, Appendix A.

3.2.2 HRA Stage 1 Screening of National Network Sites

The WRSE Stage 1 Screening assessment identified six Habitats Sites within the ZoI of the option.

As mentioned in Section 2.2, the option was optimised for the Gate 1 submission. Re-screening of the optimised option has ultimately identified the same six Habitats Sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. A Habitats Site must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible. The updated screening assessment for Sunnymeads 2a is given in Table 3.3 where there is potential for Likely Significant Effects or Uncertain Effects

Table 3.3: Sunnymeads 2a Stage 1 Screening Assessment (rescreened based on Gate 1 submission option)

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
[redacted] SPA <ul style="list-style-type: none"> • Wintering Gadwall <i>Anas strepera</i> • Wintering Shoveler <i>Anas clypeata</i> 	0.5km from the intake location and [redacted] end of the pipeline route	Yes There is potential for adverse effects on this SPA as a result of its close proximity to the pipeline construction corridor and intake location at [redacted]. The site is within the same river catchment of the intake location and may be in hydrological continuity due to its proximity. Adverse effects as a result of construction-related disturbance (noise/light/dust pollution) on qualifying species should be considered.
[redacted] Ramsar site <ul style="list-style-type: none"> • Criterion 6: regularly supports internationally important populations of Gadwall <i>Anas strepera</i> and 	0.5km from the intake location and [redacted] end of the pipeline route	Yes There is potential for adverse effects on this Ramsar site as a result of its close proximity to the pipeline construction corridor and intake location at [redacted]. The site is within the same river catchment of the intake location and may be in hydrological continuity. Adverse effects as a result of construction-related disturbance (noise/light/dust pollution) on qualifying species should be considered.

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
Shoveler <i>Anas clypeata</i>		
<p>██████████ SAC</p> <ul style="list-style-type: none"> Annex I habitats Old acidophilous oak woodland with <i>Quercus robur</i> and Atlantic acidophilous beech forests with <i>Ilex</i> and <i>Taxus</i> Annex II species Violet click beetle <i>Limoniscus violaceus</i> 	<p>3km from the intake location and ██████████ end of the pipeline route</p> <p>The SAC is on the opposite (southern) side of the River Thames.</p>	<p>No</p> <p>This SAC is suitably removed from the pipeline corridor so that construction related impacts are considered unlikely. Although both the SAC and the option are both hydrologically connected to the River Thames, they are unlikely to be in hydrological connection with each other due to the direction of flow of associated minor rivers. The dry woodland habitat present in the SAC is not considered a water-resource dependent interest and therefore not considered sensitive to minor changes in the water table.</p>
<p>██████████ SPA</p> <ul style="list-style-type: none"> Dartford Warbler <i>Sylvia undata</i> Nightjar <i>Caprimulgus europaeus</i> Woodlark <i>Lullula arborea</i> 	<p>9.5km south of the intake location and ██████████ end of the pipeline route.</p> <p>The SPA is on the opposite (southern) side of the River Thames</p>	<p>No</p> <p>This SPA is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. The SPA is unlikely to be in hydrological continuity with the option.</p>
<p>██████████ SAC</p> <ul style="list-style-type: none"> Annex I habitat Northern Atlantic wet heaths with <i>Erica tetralix</i>, European dry heath and Depressions on peat substrates of the <i>Rhynchosporion</i> 	<p>9.5km south of the intake location and ██████████ end of the pipeline route.</p> <p>The SAC is the same location as Thames Basin Heath SPA at the closest point to the option</p>	<p>No</p> <p>This SPA is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. The SPA is unlikely to be in hydrological continuity with the option.</p>
<p>██████████ SAC</p> <ul style="list-style-type: none"> Annex I habitats: Atlantic acidophilous beech forest with <i>Ilex</i> and <i>Taxus</i> 	<p>8km west of the pipeline route</p>	<p>No</p> <p>This SAC is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. The SPA is unlikely to be in hydrological continuity with the option.</p>

3.2.3 Likely Impact Pathways and Potential Effects

Considering the type, size and scale of the Sunnymeads 2a option, the potential impacts (of construction and operational phases) are described below

3.2.3.1 Construction

The Sunnymeads 2a option follows largely the same route as Sunnymeads 1, the only difference between the routes being approximately [REDACTED] of pipeline which diverges east from Sunnymeads 1 to the proposed [REDACTED] 2 WTW for treatment before joining back. Construction will require approximately [REDACTED] of new pipeline from an existing intake on the River Thames at [REDACTED], to [REDACTED] 2, located north of the existing [REDACTED] WTW. From [REDACTED] 2 the pipeline will extend over approximately [REDACTED], re joining the Sunnymeads 1 route to the existing [REDACTED] SR, located [REDACTED].

Inclusion of the new components does not result in any additional potential adverse effects on Habitats Sites that have not already been identified for Sunnymeads 1. The additional pipeline route and new WTW at [REDACTED] 2 are located in a rural setting bisected by the [REDACTED], sufficiently removed from any Habitats Site (>10km) to consider impacts from excavation works affecting surface or groundwater bodies to be not relevant to this HRA. Therefore, the HRA assessment given for Sunnymeads 1 in Section 3 above should be considered applicable to Sunnymeads 2a also. For completeness of this report, the likely impact pathways and potential effects are repeated here in the following sections for Sunnymeads 2a.

The route optimisation has sought to avoid Habitats Sites as much as possible, but the intake location and some portions of the beginning of the pipeline construction corridor is located <0.5km from the [REDACTED] No. 1 Gravel Pit SSSI and which is part of the South West London SPA/Ramsar site, and the [REDACTED] Reservoir, which although not included in the SPA/Ramsar site, could be used as functional supporting habitat by the qualifying bird species. Given the close proximity of these waterbodies, construction activities associated with trenching and pipeline layout has the potential to result in disturbance of sensitive species due to noise, lighting, visual impact, vibration, etc. The qualifying bird species (namely Gadwall and Northern Shoveler) of the SPA and Ramsar site are wintering species and therefore sensitive to disturbance in the wintering period (October to March inclusive). Given the scale of the works, and the relatively short section of pipeline required in the vicinity of the site, most disturbance risks can almost certainly be avoided or controlled through the application of standard best-practice measures and mitigation. [REDACTED] No 1 is adequately screened from the works, given there is housing and woodland blocks in between, but the [REDACTED] Reservoir is much closer to the pipeline route and is relatively exposed in terms of visual impacts on bird species. As the Reservoir is not part of the Habitats Site, typical mitigation considered adequate to reduce disturbance effects from increased lighting, visual impact and vibration given in Section 2.6 should be considered adequate to ensure no adverse effects on qualifying species occurs.

The impact of noise disturbance however is a particular concern to the [REDACTED] as research indicates that there is a flight response in waterfowl above 70dBA (Cutts et al 2009). It would be impossible to fully assess the magnitude of this impact at this stage as there is no detailed design and construction information available, but given the SPA/Ramsar site boundary is not immediately adjacent to the pipeline route, it is expected that noise related disturbance can also be mitigated. As a precautionary approach, Natural England should be consulted in relation to the noise disturbance and the project-stage HRA should include a valid noise assessment to ensure that noise levels do not breach agreed thresholds at the boundary of the designated site. If it was predicted that noise levels could not remain under the agreed thresholds, then construction works in the vicinity of the SPA/Ramsar site boundary should avoid the winter period altogether.

A number of river crossings will be required (5-10 in the current design) of the [REDACTED], [REDACTED], the [REDACTED] and [REDACTED] which all deposit to the River Thames. In the particular case of river crossings, in channel works can result in temporary habitat degradation through, for example, runoff from accidental pollution events or dust emissions from

construction-related activities. There is also potential for increased sedimentation and silting during construction. These impacts are only considered relevant to a HRA if the impacted watercourses are in hydrological continuity with a Habitats Site. It is likely that the gravel pits (including [REDACTED]) of the [REDACTED] SPA/Ramsar site are hydrologically connected with the water table however, given the nature of the sand and gravel aquifer in the area. Pipeline trenching in the vicinity of the waterbodies at the beginning of the pipeline route therefore has the potential to result in changes to the water table in the vicinity of the designated waterbody. The design of the pipeline would therefore have to be carefully informed by hydrogeological investigations to ensure any excavation works were undertaken so as not to disrupt groundwater continuity to the Habitats Site. If the resulting hydrological investigations suggest that there will be any disruption to ground or surface water levels at river crossings or in the vicinity of the waterbodies, it is recommended that directional drilling is employed in lieu of pipeline trenching to avoid such impacts. If directional drilling is not possible at beginning of the pipeline corridor, it is recommended that the pipeline is rerouted to a sufficient distance from the Habitats Sites where groundwater continuity will not be affected. Dust emissions are unlikely to result in significant adverse effects given the geology of the area is predominantly sand and gravel (i.e. not very dusty) and is located a significant distance from the chalk aquifer in the Chilterns area of the Thames region. Appropriate mitigation will need to be included as the design develops to ensure dust emissions are regulated. With regards accidental pollution events at river crossings, risks can almost certainly be avoided or controlled through the application of standard best-practice measures and mitigation and typical mitigation considered adequate to ensure water-pollution control are given in Section 2.6.

Spread of invasive species may occur during construction where workers move between and within sites. The presence and increase in INNS can lead to loss of habitat and over time they can overtake native species affecting habitats and qualifying species they support. Apart from the hydrological connection identified at the [REDACTED] end of the pipeline route and the [REDACTED], there are no other Habitats Sites which are obviously hydrologically connected to the pipeline route. Furthermore, there are no Habitats Sites downstream on the River Thames which may be indirectly affected by any adverse effects in the inputting rivers as a result of construction at these crossings. Appropriate mitigation measures will be incorporated into the design of the option at the project stage regardless to ensure to spread of INNS is limited and no significant adverse effects occur.

The key risks identified during construction are:

- Non-physical disturbance – increased noise/visual/human presence may result in disturbance to qualifying bird species of the [REDACTED] SPA/Ramsar site at [REDACTED] and (supporting waterbody) [REDACTED] Reservoir.
- Toxic contamination – water pollution due to accidental pollution events at river crossings may result in habitat degradation or biological disturbance to the qualifying bird species of the [REDACTED] SPA/Ramsar site at [REDACTED].
- Non toxic contamination – air pollution due to dust deposition may affect chemical balance of the water table and aquatic habitat of the [REDACTED] SPA/Ramsar site in the vicinity of [REDACTED] and (supporting waterbody) [REDACTED] Reservoir.
- Changes to water table availability – ground water level and flows may be affected during excavation works and dewatering of the pipeline construction in the vicinity of the [REDACTED] SPA/Ramsar site at [REDACTED].

3.2.3.2 Operation

The Sunnymeads 2a option will require increased abstraction of 50MI/d or 100MI/d from an existing licenced intake on the River Thames. The *Thames to Affinity Transfer SRO Secondary*

Screening report (Mott Macdonald 2020) suggests that the resource is reliable and has capacity to increase in line with the Thames River CAMS which states that 'For all consumptive abstractions of 2Ml/d or above, a HoF of between Q30 and Q50 will be applied based on the perceived level of risk to the water body or downstream bodies ' It is therefore assumed that the increase in abstraction will be within the terms of the existing licence and ultimately protected by the Review of Consents process.

As states for Sunnymeads 1, the INNS risk assessment reported on in the EAR¹² suggests that there will not be any significant increase in the risk of INNS transfer as a result of the operation of any of the T2AT options. This assessment does not identify any further INNS risks on Habitats Sites as a result of the operation of Sunnymeads 2a

Operation of the new WTW will transfer potable water directly into [REDACTED] SR where it will be pumped into the supply network and no inter basin water transfers to surface or groundwater bodies will be required

Therefore no key risks to Habitats Sites have been identified as a result of the operation of Sunnymeads 2a.

3 2 3 3 Potential Effects on Designated Sites

The following Habitats Sites have been screened in as having the potential to result in Likely Significant Effects or Uncertain Effects as a result of the option, and therefore are subject to a HRA Stage 2: Appropriate Assessment:

- [REDACTED] SPA; and,
- [REDACTED] Ramsar site

For the Appropriate Assessment, a review of the sensitivity of the qualifying features of these Habitats Sites in relation to the potential impacts from the option and the conservation objectives of the designated site is required. Section 3 2 3 4 lists the features for which each site is designated, and identifies the Likely Significant Effects before and after mitigation measures are assumed. As the qualifying features for both the SPA and Ramsar site are the same in the case of [REDACTED], both Habitats Sites have been assessed together. An assessment of each potential impact on the integrity of the sites are made, in view of the sites' structure, function and conservation objectives. Where adverse impacts are deemed significant, standard mitigation measures addressing some of these impacts are described in Section 2 6

Full descriptions of the Habitats Sites including their conservation objectives and any current pressures or threats are given in Appendix C.

¹² Mott MacDonald (2021) Thames to Affinity Transfer Strategic Resource Option – Annex B Environment Assessment Report RAPID Gate 1 submission Draft version

3.2.3.4 Sunnymeads 2a Appropriate Assessment

Considering the type, size and scale of the proposed Sunnymeads 2a option, the potential impacts (of construction and operational phases) are described in Table 3.4 below.

Table 3.4: Sunnymeads 2a: Potential effects on designated sites and qualifying features

Designated Site (Habitats Site)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹³	Residual Effects (after mitigation)
<p>██████████ SPA</p> <p>██████████ Ramsar site</p>	<ul style="list-style-type: none"> Gadwall <i>Anas strepera</i> 710 individuals - wintering (5-year peak mean 1993/94 - 1997/98) 2.4 % NW Europe Shoveler <i>Anas clypeata</i> 853 individuals - wintering (5-year peak mean 1993/94 - 1997/98) 2.1 % NW/Central Europe 	<p>The ██████████ abstraction point and initial pipeline route is located within ██████████ and the ██████████ Reservoir waterbodies belonging to the ██████████ SPA/Ramsar site.</p> <p>There is potential for the construction of the new pipeline corridor and trenching to result in:</p> <ul style="list-style-type: none"> Non-physical disturbance – increased noise/visual/human presence may result in disturbance to qualifying bird species Gadwall and Northern Shoveler at ██████████ and ██████████ Reservoir Toxic contamination – water pollution due to accidental pollution events (including spread of INNS) at hydrologically linked river crossings may result in habitat degradation or biological disturbance to the qualifying bird species at ██████████ Non-toxic contamination – air pollution due to dust deposition may affect chemical balance of the water table and aquatic habitat of the ██████████ SPA/Ramsar site in the vicinity of ██████████ and ██████████ Reservoir Changes to water table availability - ground water level and flows may be affected during excavation works and dewatering of the pipeline construction in the vicinity of ██████████. <p>The impacts are considered to be temporary and localised and affecting only a small proportion of the designated site, which includes seven significant waterbodies.</p>	<ol style="list-style-type: none"> Standard best practice procedures should be followed during construction to limit construction-related disturbance and contamination including (but not limited to) the following <ul style="list-style-type: none"> CIRIA C741 Environmental good practice on site guide Environment Agency's PPGs (PPG1: General Guide to Prevention of Pollution; PPG5: Works and maintenance in or near water; PPG6: Pollution prevention guidance for working at construction and demolition sites). Best practice such as BS 5228-1:2009+A1:2014 (The British Standards Institute, 2008) to avoid significant effects due to noise. Best practice such as 'Guidance Notes for the Reduction of Obtrusive Light' (Institute of Lighting Professionals, 2011) to avoid significant effects due to increased light (if works are programmed at night). Industry best practice mitigation measures for dust suppression Works in the vicinity of ██████████ and ██████████ to either be accompanied by a noise assessment and noise thresholds agreed with Natural England or works in this location to be undertaken outside the wintering period. 	<p>Assuming all proposed mitigation is implemented it is considered there will not be a significant change in:</p> <ul style="list-style-type: none"> The extent and distribution of qualifying bird species; The structure and function of the habitats of qualifying species; and The supporting processes on which habitats of qualifying species rely. <p>No residual effects after mitigation are expected</p>

¹³ Full references of guidance documents are given in Section 3.4. where they are first listed

Designated Site (Habitats Site)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹³	Residual Effects (after mitigation)
		<p>The identified effects have the potential to reduce the extent and distribution of the qualifying species as well as affecting the structure and function of their supporting habitats, compromising the integrity of the [REDACTED] SPA/Ramsar site.</p> <p>No pathways have been identified during operation that could lead to significant effects to the integrity of this SPA/Ramsar site.</p>	<p>Adequate screening to avoid visual disturbance should also be employed.</p> <ol style="list-style-type: none"> 3. Works at river crossings or in the vicinity of the waterbodies to be informed by hydrological investigations to ensure no disruption to surface or groundwater continuity. If impact is identified, direction drilling to be employed at river crossings wherever possible, including where river is linked to the Habitats Site. 4. If directional drilling does not negate hydrological disruptions at the beginning of the pipeline corridor, the pipeline should be rerouted to a sufficient distance from the Habitats Sites where groundwater continuity will not be affected. 5. Good practice guidelines in relation to spread of INNS during construction (including unexpected pollution events) to be followed. 6. Development of a Construction and Environmental Management Plan which will include all the above proposed mitigation measures and any further measures identified at the project stage. 	



3.2.4 Summary of Sunnymeads 2a Appropriate Assessment

No pathways by which a Likely Significant Effect could occur were identified in the HRA Stage 1: Screening assessment for this option for the following Habitats Sites in the Zol:

- [REDACTED] SAC;
- [REDACTED] SPA;
- [REDACTED] SAC; and,
- [REDACTED] SAC

No significant adverse effects on the integrity of the following Habitats Sites are expected, if the suggested mitigation measures in the HRA Stage 2: Appropriate Assessment are implemented:

- [REDACTED] SPA, and,
- [REDACTED] Ramsar site.

In conclusion, provided that the proposed mitigation measures are taken forward at the project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no further stages in the HRA process will be necessary for Sunnymeads 2a.

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3.3 Walton 2b

3.3.1 Summary of the Option

The Walton 2b option conveys water from the existing [redacted] abstraction point to the proposed [redacted] 2 WTW site, then onto the existing [redacted] SR site. The route is significantly longer in comparison to other T2AT options, largely passing alongside the [redacted] following its abstraction, requiring a Thames crossing and routing through the [redacted] before it goes west after the [redacted] Reservoir to join with the proposed [redacted] to [redacted] 2

50MI/d or 100MI/d of raw water will be abstracted at [redacted], treated at [redacted] 2, and the potable water will then be distributed to supply from the [redacted] reservoir. A geographic representation of the Walton 2b option is provided on Figure A3, Appendix A.

3.3.2 HRA Stage 1 Screening of National Network Sites

The WRSE Stage 1 Screening assessment identified four Habitats Sites within the ZoI of the option. As mentioned in Section 2.2, the option was optimised for the Gate 1 submission.

Re-screening of the optimised option has ultimately identified the same four Habitats Sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. The Habitats Site must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible. The updated Stage 1 Screening assessment is given in Table 3.5 where there is potential for Likely Significant Effects or Uncertain Effects as a result of Walton 2b.

Table 3.5: Walton 2b Stage 1 Screening Assessment (rescreened based on Gate 1 submission option)

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
[redacted] SPA <ul style="list-style-type: none"> • Wintering Gadwall <i>Anas strepera</i> • Wintering Shoveler <i>Anas clypeata</i> 	Directly adjacent to proposed option	Yes There is potential for adverse effects on this SPA as a result of the pipeline running directly adjacent to the SPA [redacted] and its close proximity to the pipeline construction corridor at [redacted] Reservoir ([redacted] SSSI) and [redacted] The site may be in hydrologically connected as the pipeline runs directly adjacent to a waterbody that forms part of the designation. It is also may be in hydrological continuity due to its proximity. Adverse effects as a result of construction-related disturbance (noise/light/dust pollution/sediment discharge/pollution events) on qualifying species within the designation and on qualifying species within non-designated waterbodies along the route should be considered.
[redacted] Ramsar site <ul style="list-style-type: none"> • Criterion 6: regularly supports internationally important 	Directly adjacent to proposed option	Yes There is potential for adverse effects on this Ramsar as a result of the pipeline running through the SPA at [redacted] and its close proximity to the pipeline construction corridor at [redacted] Reservoir ([redacted] SSSI) and [redacted]

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
populations of Gadwall <i>Anas strepera</i> and Shoveler <i>Anas clypeata</i>		The site might be hydrologically connected as the pipeline runs directly adjacent to a waterbody that forms part of the designation. It also may be in hydrological continuity due to its proximity.
		Adverse effects as a result of construction-related disturbance (noise/light/dust pollution/sediment discharge/pollution events) on qualifying species within the designation and on qualifying species within non-designated waterbodies along the route should be considered
[redacted] SAC	3.0km south west of the [redacted] intake	No This SAC is suitably removed from the pipeline corridor and is not hydrologically connected, therefore construction-related impacts are considered unlikely
<ul style="list-style-type: none"> Annex I habitats Old acidophilous oak woodland with <i>Quercus robur</i> and Atlantic acidophilous beech forests with <i>Ilex</i> and <i>Taxus</i> Annex II species Violet click beetle <i>Limoniscus violaceus</i> 		
[redacted] SAC	15km east of the pipeline route	No This SAC is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. The SAC site is downstream of the proposed pipeline but hydraulically connected to it being set-back and raised above the River Thames floodplain
<ul style="list-style-type: none"> Annex II species Stag beetle <i>Lucanus cervus</i> 		

3.3.3 Likely Impact Pathways and Potential Effects

Considering the type, size and scale of the Walton 2b option, the potential impacts (of construction and operational phases) are described below.

3.3.3.1 Construction

Walton 2b requires the construction of approximately [redacted] of new pipeline, from an existing intake on the River Thames at [redacted], before it joins the Sunnymeads 2a pipeline route just north of the [redacted]. Before it joins [redacted], the pipeline follows the [redacted] from its intake which is routed directly adjacent to the [redacted] which forms part of the [redacted] SPA and Ramsar site. The pipeline is directly adjacent to another waterbody just south of the [redacted], which although not part of the SPA/Ramsar site boundary, could be used as supporting habitat to the qualifying bird species of the Habitats Site. Further along the route, the proposed pipeline runs between and in close proximity to both the [redacted] Reservoir and the [redacted], both components of the [redacted] SPA/Ramsar site.

Given the close proximity of these waterbodies, construction activities associated with trenching and pipeline layout has the potential to result in disturbance of sensitive species due to noise, lighting, visual impact, vibration, etc. The bird interest features of the designated site (namely Gadwall and Northern Shoveler) are sensitive to disturbance impacts such as noise and visual disturbance over the wintering period when they are present in congregations (the wintering period is considered October to March inclusive). Given the scale of the works, these risks can almost certainly be avoided or controlled through the application of standard best practice measures and mitigation. Typical mitigation considered adequate to reduce disturbance effects during construction to levels that will not result in significant effects are given in Section 2.6. For the Sunnymeads options there was considerable screening of the gravel pits from the works, but in the case of pipeline in this section of Walton 2b, special consideration should be given to visual screening during construction. Gadwall and Northern Shoveler are not considered highly sensitive to visual disturbance and in this location are already subject to high levels of anthropogenic presence. But if construction works were to take place in the winter months, appropriate screening would be required to ensure birds are not flushed due to visual disturbance.

The impact of noise disturbance is more of a concern in this location, given the close proximity of the works to the waterbodies. As for Sunnymeads, it would be impossible to fully assess the magnitude of this impact at this stage as there is no detailed design and construction information available. Therefore it will be a requirement for the project-stage HRA to include a noise assessment and to ensure that appropriate mitigation is in place to ensure noise level do not breach agreed thresholds at these waterbodies that form part of the [REDACTED] SPA/Ramsar site. Mitigation measures and noise thresholds that cannot be exceeded should be agreed with Natural England. Mitigation measures might include using quieter construction techniques such as cowling or damping to limit noise and use of close-board fencing. Avoiding construction works during the wintering period could also be considered.

There is also potential for toxic contamination of [REDACTED] as a result of pipeline trenching directly adjacent to [REDACTED]. This could be in the form of water pollution from construction run off affecting the water table, air pollution from dust emissions and unexpected pollution events resulting in physical damage or degradation to habitats which support the qualifying species of the SPA/Ramsar site (including by the spread of INNS).

Given the nature of the gravel pits in this area and the vicinity of the pipeline construction corridor, it is likely that the pipeline is in continuity with the Habitats Site, therefore there is potential for changes to the water table in the [REDACTED] SPA/Ramsar site. The design of the pipeline would therefore have to be carefully informed by hydrogeological investigations to ensure any excavation works were undertaken so as not to disrupt groundwater continuity to the Habitats Site.

Dust emissions are unlikely to result in significant adverse effects given the geology of the area is predominantly sand and gravel (i.e. not very dusty) and is located a significant distance from the chalk aquifer in the Chilterns area of the Thames region. Appropriate mitigation will need to be included at the design-stage of this option to ensure dust emissions are regulated. Appropriate measures to ensure there is no risk in spreading INNS will also be required.

Toxic contamination might also be an issue at the number of river crossings (including crossing the Thames at [REDACTED]) required in this section of the Walton 2b pipeline before it joins Sunnymeads. At river crossings, construction activities can result in temporary habitat degradation through in-channel works or temporary river diversions might be required. There is also potential for increased sedimentation and silting. Similar to the previous paragraph, there is also potential for pollution resulting from increased traffic to and from construction sites and

accidental pollution events that can result in contamination of watercourses and habitats. With regards accidental pollution events at river crossings, risks can almost certainly be avoided or controlled through the application of standard best practice measures and mitigation and typical mitigation considered adequate to ensure water-pollution control are given in Section 2.6. There are no Habitats Sites downstream on the River Thames that could be affected by construction-related impacts in feeding rivers.

Once the pipeline route joins the Sunnymeads option north of [REDACTED], approximately [REDACTED] of new pipeline will be required to convey the water to the proposed [REDACTED] 2 WTW. From [REDACTED] 2 the pipeline will extend over approximately [REDACTED], re-joining the Sunnymeads 1 route to the existing [REDACTED] SR, located east of [REDACTED]. The new WTW [REDACTED] 2 is located in an agricultural field, bounded by the [REDACTED] and residential housing and significantly removed from any Habitats Site (~8km) or watercourses that may feed into a Habitats Site.

No further impacts on Habitats Sites are identified during construction for the remainder of the pipeline route after it joins Sunnymeads.

The key risks identified during construction are:

- Non-physical disturbance – increased noise/visual/human presence may result in disturbance to qualifying bird species of the [REDACTED] SPA/Ramsar site at [REDACTED].
- Toxic contamination – water pollution due to accidental pollution events at river crossings may result in habitat degradation or biological disturbance (including by the introduction of INNS) to the qualifying bird species of the [REDACTED] SPA/Ramsar site at [REDACTED].
- Non-toxic contamination – air pollution due to dust deposition may affect chemical balance of the water table and aquatic habitat of the [REDACTED] SPA/Ramsar site in the vicinity of [REDACTED].
- Changes to water table availability – ground water level and flows may be affected during excavation works and dewatering of the pipeline construction in the vicinity of the [REDACTED] SPA/Ramsar site at [REDACTED].

3.3.3.2 Operation

The Walton 2b option will require increased abstraction of 50MI/d or 100MI/d from an existing licenced intake location on the River Thames. The *Thames to Affinity Transfer SRO Secondary Screening report* (Mott MacDonald 2020) indicates that the source is not subject to sustainability reductions and has a reliable supply. The Thames River CAM states "For all consumptive abstractions of 2MI/d or above, a HoF of between Q30 and Q50 will be applied based on the perceived level of risk to the water body or downstream bodies." The introduction of the new supply will ensure that abstraction will be able to be utilised'. It is therefore assumed that the increase in abstraction will be within the terms of the existing licence and ultimately protected by the Review of Consents process for existing abstractions. Regardless, there are no Habitats Sites located downstream on the River Thames from the [REDACTED] intake location which could be realistically affected by the abstraction increase proposed by this option.

Operation of the option will transfer raw water to the new [REDACTED] 2 WTW for treatment, after which it will be conveyed directly into [REDACTED] SR. Therefore no inter-basin water transfers to surface or groundwater bodies will be required.

As states for Sunnymeads 1, the INNS risk assessment reported on in the EAR¹⁴ suggests that there will not be any significant increase in the risk of INNS transfer as a result of the operation of any of the T2AT options, due in part to the effectiveness of treatment at WTWs such as the proposed [REDACTED] 2. Furthermore, [REDACTED] 2 WTW does not have any planned discharges to any receptors that are hydrologically linked to any Habitats Sites. Therefore there is confidence that the risk of INNS spread to Habitats Sites as a result of operation of Walton 2b is low.

No key risks to Habitats Sites have been identified as a result of the operation of Walton 2b

3.3.3.3 Potential Effects on Designated Sites

The following Habitats Sites have been screened in as having the potential to result in Likely Significant Effects or Uncertain Effects as a result of the option, and therefore are subject to a HRA Stage 2: Appropriate Assessment:

- [REDACTED] SPA; and,
- [REDACTED] Ramsar site.

For the Appropriate Assessment, a review of the sensitivity of the qualifying features of these Habitats Sites in relation to the potential impacts from the option and the conservation objectives of the designated site is required. Section 3.3.3.4 lists the features for which each site is designated and identifies the likely significant effects before and after mitigation measures are assumed. As the qualifying features for both the SPA and Ramsar site are the same in the case of [REDACTED], both Habitats Sites have been assessed together. An assessment of each potential impact on the integrity of the sites are made, in view of the sites' structure, function and conservation objectives. Where adverse impacts are deemed significant, standard mitigation measures addressing some of these impacts are described in Section 2.6.

Full descriptions of the Habitats Sites including their conservation objectives and any current pressures or threats are given in Appendix C

¹⁴ Mott MacDonald (2021) Thames to Affinity Transfer Strategic Resource Option – Annex B Environment Assessment Report RAPID Gate 1 submission Draft version

3.3.3.4 Walton 2b Appropriate Assessment

Considering the type, size and scale of the proposed Walton 2b option, the potential impacts (of construction and operational phases) are described in Table 3.6 below.

Table 3.6: Walton 2b: Potential effects on designated sites and qualifying features

Designated Site (Habitats Site)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁵	Residual Effects (after mitigation)
<p>██████████ SPA</p> <p>██████████ Ramsar site</p>	<ul style="list-style-type: none"> Gadwall <i>Anas strepera</i> 710 individuals - wintering (5-year peak mean 1993/94 - 1997/98) 2.4 % NW Europe Shoveler <i>Anas clypeata</i> 853 individuals - wintering (5-year peak mean 1993/94 - 1997/98) 2.1 % NW/Central Europe 	<p>The initial pipeline corridor from the intake at ██████████ to the Sunnymeads pipeline is located directly adjacent to ██████████ and within 200m of ██████████ and the ██████████ belonging to the ██████████ SPA. Given the distance and the likely hydrological continuity, there is potential for the construction of the new pipeline in this area to result in significant construction-related impacts on the qualifying bird species and their supporting habitats in the form of:</p> <ul style="list-style-type: none"> Non-physical disturbance – increased noise/visual/human presence may result in disturbance to qualifying bird species Toxic contamination – water pollution due to accidental pollution events at river crossings may result in habitat degradation or biological disturbance (including by the introduction of INNS) to the qualifying bird species Non-toxic contamination – air pollution due to dust deposition may affect chemical balance of the water table and aquatic habitat in the vicinity of ██████████ Changes to water table availability - ground water level and flows may be affected during excavation works and dewatering of the pipeline construction in the vicinity of the ██████████ 	<ol style="list-style-type: none"> Standard best practice procedures should be followed during construction to limit construction-related disturbance and contamination including (but not limited to): <ul style="list-style-type: none"> CIRIA C741 Environmental good practice on site guide Environment Agency's PPGs (PPG1: General Guide to Prevention of Pollution; PPG5: Works and maintenance in or near water; PPG6: Pollution prevention guidance for working at construction and demolition sites). Best practice such as BS 5228-1:2009+A1:2014 (The British Standards Institute, 2008) to avoid significant effects due to noise. Best practice such as 'Guidance Notes for the Reduction of Obtrusive Light' (Institute of Lighting Professionals, 2011) to avoid significant effects due to increased light (if works are programmed at night). Industry best practice mitigation measures for dust suppression Works in the vicinity of ██████████ to either be accompanied by a noise assessment and noise thresholds agreed 	<p>Assuming all proposed mitigation is implemented it is considered there will not be a significant change in:</p> <ul style="list-style-type: none"> The extent and distribution of qualifying bird species; The structure and function of the habitats of qualifying species; and The supporting processes on which habitats of qualifying species rely. <p>No residual effects after mitigation are expected</p>

¹⁵ Full references of guidance documents are given in Section 3.4. where they are first listed

Designated Site (Habitats Site)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁵	Residual Effects (after mitigation)
		<p>The impacts are considered to be temporary and localised and affecting only a small proportion of the designated site, which includes seven significant waterbodies.</p> <p>There are no Habitats Sites downstream from the River Thames which could be impacted by increased abstraction at the [REDACTED] intake. Therefore no pathways have been identified during operation that could lead to significant effects to the integrity of this SPA/Ramsar site.</p> <p>The identified effects have the potential to reduce the extent and distribution of the qualifying species as well as affecting the structure and function of their supporting habitats, compromising the integrity of the [REDACTED] SPA/Ramsar site.</p>	<p>with Natural England or works in this location to be undertaken outside the wintering period.</p> <ol style="list-style-type: none"> 3. Works in the vicinity of [REDACTED] to be accompanied by hydrogeological investigations to ensure excavation works do not disrupt groundwater continuity to the SPA/Ramsar site. 4. Direction drilling to be employed at river crossings wherever possible to reduce potential for in-channel contamination. 5. Good practice guidelines in relation to spread of INNS during construction (including unexpected pollution events) to be followed. 6. Development of a Construction and Environmental Management Plan which will include all the above proposed mitigation measures and any further measures identified at the project stage. 	



3.3.4 Summary of Walton 2b Appropriate Assessment

No pathways by which a Likely Significant Effect could occur were identified in the HRA Stage 1: Screening assessment for this option for the following Habitats Sites in the Zol:

- [REDACTED] SAC; and,
- [REDACTED] SAC.

No significant adverse effects on the integrity of the following Habitats Sites are expected, if the suggested mitigation measures in the HRA Stage 2: Appropriate Assessment are implemented:

- [REDACTED] SPA; and,
- [REDACTED] Ramsar site.

In conclusion, provided that the proposed mitigation measures are taken forward at the project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no further stages in the HRA process will be necessary for Walton 2b

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3.4 Maidenhead

3.4.1 Summary of the Option

The Maidenhead options requires abstraction of raw water from a new intake at [REDACTED] on the River Thames to a proposed new WTW at [REDACTED] SR site. New pipeline infrastructure will be required for conveyance, with much of the route passing through rural areas. After treatment, available storage capacity at the existing [REDACTED] SR will be used.

50MI/d or 100MI/d of raw water will be abstracted at [REDACTED] for conveyance. A geographic representation of the Maidenhead option is provided on Figure A4, Appendix A

3.4.2 HRA Stage 1 Screening of National Network Sites

The WRSE Stage 1 Screening assessment identified two Habitats Sites within the Zol of the option. As mentioned in Section 2.2, the option was optimised for the Gate 1 submission.

Re screening of the updated design has been undertaken and has identified one further Habitats Site located downstream of the new abstraction that has the potential to be linked to the option. The Habitats Sites must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible.

The updated screening results for the Maidenhead option (based on the Gate 1 option) is given in Table 3.7 where there is potential for Likely Significant Effects or Uncertain Effects.

Table 3.7: Maidenhead Stage 1 Screening Assessment (re-screened based on Gate 1 route submission option)

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
[REDACTED] SPA/Ramsar site <ul style="list-style-type: none"> Wintering Gadwall <i>Anas strepera</i> Wintering Shoveler <i>Anas clypeata</i> 	>20km downstream of the intake on the River Thames	Uncertain The new intake requires abstraction of 50MI/d or 100MI/d of water from the River Thames at [REDACTED]. There is potential for this designated site located downstream on the River Thames to be affected by reductions in water flows on the Thames as a result of increased abstraction
<ul style="list-style-type: none"> Annex II habitats: Atlantic acidophilous beech forests 	1.8km south west of the pipeline route	Uncertain Option comprises a transfer of 50MI/d or 100MI/d. Part of the pipeline route runs [REDACTED] SAC. The site is not hydrologically connected to the construction route, however it is unknown what the impacts on the SAC will be from the construction traffic during construction of the pipeline with regards to dust arisings and vehicle emissions (i.e. increased nitrogen from numerous vehicle movements).
[REDACTED] SAC <ul style="list-style-type: none"> Annex II habitats: Asperulo-Fagetum beech forests 	3.6km west from the [REDACTED] intake location	No This SAC is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. The SAC is unlikely to be in hydrological continuity with the option.

3.4.3 Likely Impact Pathways and Potential Effects

Considering the type, size and scale of the Maidenhead option, the potential impacts (of construction and operational phases) are described below.

3.4.3.1 Construction

The updated pipeline route as per the Gate 1 submission is located at a significant distance from the Habitats Sites identified in the Stage 1 Screening process, the closest being ██████████ SAC, located approximately ██████████ away. Construction-related disturbance such as noise and visual impacts are only usually considered when the boundary of the option extends within or directly adjacent to the Habitats Site. In some HRA guidance documents (such as UKWIR (2012), noise from construction traffic is considered to be more significant than noise derived from construction activities and a 3-5km Zol is sometimes recommended. This should be considered an extremely precautionary approach. The Design Manual for Roads and Bridges (Highways Agency, 2003)¹⁶ suggests it would take a 100% increase in vehicular traffic to achieve a roadside increase of 3dB, and this is very unlikely to be considered a disturbance for most sensitive terrestrial species. Regardless, ██████████ SAC is designated for its beech forest habitat and this feature is not considered sensitive to noise. Air emissions and dust associated with construction works and vehicular traffic is only likely to be significant where the transport route to and from the option is within 200m of the boundary of the designated site therefore is not considered to result in any adverse effects on the Habitats Sites identified in the Zol. Given the distance, the SAC is unlikely to be in hydrological continuity with the pipeline either, therefore no impacts as a result of the construction of the pipeline are considered likely in this assessment.

Regarding the construction of the new WTW at the existing ██████████ reservoir site; this location is a rural setting with no surface waterbodies adjacent and is sufficiently removed from any Habitats Site (>10km) to consider impacts from excavation works affecting groundwater bodies to be not relevant to this HRA.

Construction of the new intake at ██████████ has the potential to result in water pollution contamination from runoff from accidental pollution events or dust emissions from construction-related activities. The effects will be minor, temporary and localised and there are no downstream Habitats Sites on the River Thames that are likely to be indirectly affected.

Therefore there are no key risks identified during construction of the Maidenhead option.

3.4.3.2 Operation

The Maidenhead option will require a new abstraction licence of 50MI/d or 100MI/d of raw water from the River Thames. New abstractions are not covered by the Review of Consents. Increased abstraction could lead to changes to surface water levels and flows in the River Thames, indirectly affecting river habitats and species. These effects would only be significant where a Habitats Site is located downstream and extends within the same ground or surface water catchment as the Thames. The only Habitats Site downstream on the River Thames is the ██████████ SPA/Ramsar site, located at its nearest approximately 20km downstream. There is no indication that this site is has any surface water continuity with the Thames; the Site Improvement Plan does not list any pressures (e.g. from abstraction) relating directly to the main river and the reservoirs pertaining to the Habitats Site are either filled by rainwater or used for water supply. When considering groundwater connectivity, the likelihood that the gravel pits included in the ██████████ SPA/Ramsar site are hydrologically connected with the water table has already been discussed for Sunnymeads. Given the new abstraction is a surface water abstraction and of considerable distance from the

¹⁶ Highways Agency (2003) Design Manual for Roads and Bridges (DMRB), Volume 11

however, it is likely that any changes to groundwater as a result of the new abstraction would be localised much further upstream and not relevant to the groundwater levels at the SPA/Ramsar site. The WFD assessment does not consider groundwater impacts as a result of this option. Therefore it is unlikely that the increased abstraction on the River Thames as a result of this option would result in any adverse effects on the SPA/Ramsar but this will be confirmed during the Gate 2 investigations when full project design is available.

Operation of the new WTW will transfer potable water directly into SR where it will be pumped into the supply network and no inter basin water transfers to surface or groundwater bodies will be required.

Raw water transfers always introduce a risk of spreading invasive species, but as discussed for Sunnymeads 1, the INNS risk assessment undertaken for the EAR suggests that there will not be any significant increase in the risk of INNS transfer as a result of the operation of any of the T2AT options. Furthermore, there are currently no planned discharges from the proposed WTW to waterbodies that are designated as Habitats Sites, therefore the risk of INNS as a result of operation of this option is not considered to result in significant effects at this stage.

No key risks to Habitats Sites have been identified as a result of the operation of the Maidenhead option.

3.4.4 Summary of Maidenhead Appropriate Assessment

No pathways by which a Likely Significant Effect could occur were identified in the initial HRA Stage 2: Appropriate Assessment for this option for the following Habitats Sites in the Zol:

- SAC; and,
- SAC

No significant adverse effects on the integrity of the following Habitats Sites are expected, but full confirmation that the increased abstraction on the River Thames would not affect groundwater interactions are required:

- SPA;
- Ramsar site; and,

3.5 Teddington Direct River Abstraction

3.5.1 Summary of the Option

The Teddington Direct River Abstraction (DRA) option includes raw water abstraction from a new intake at [REDACTED] on the River Thames, upstream of [REDACTED] and upstream of the proposed [REDACTED] outfall. Raw water is essentially replaced immediately downstream by effluent treated for reuse from [REDACTED] as part of the Teddington DRA option within the London Reuse SRO.

A new pipeline will be required to convey the raw water to a new WTW at the existing [REDACTED] SR.

50MI/d or 100MI/d of raw water will be conveyed and available storage at the existing reservoir will be used to store the treated water. A geographic representation of the Teddington DRA option is provided in Figure A5, Appendix A.

3.5.2 HRA Stage 1 Screening of National Network Sites

The WRSE Stage 1 Screening assessment identified five Habitats Sites within the Zol of the option. As mentioned in Section 2.2, the option was optimised for the Gate 1 submission. Re-screening of the updated design has ultimately identified the same five Habitats Sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. The Habitats Site must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible. The updated Stage 1: Screening assessment for the Gate 1 submission options is given in Table 3.8 where there is potential for Likely Significant Effects or Uncertain Effects as a result of the Teddington DRA option.

Table 3.8: Teddington DRA Stage 1 Screening Assessment (rescreened based on Gate 1 submission option)

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
[REDACTED] Ramsar site <ul style="list-style-type: none"> Criterion 6: regularly supports internationally important populations of Gadwall <i>Anas strepera</i> and Shoveler <i>Anas clypeata</i> 	1.3km south west of the pipeline route	Uncertain There is potential for adverse effects on this Ramsar site as a result of its close proximity to the pipeline construction corridor and may be hydrologically connected. Adverse effects as a result of construction-related disturbance (noise/light/dust pollution) on qualifying species should be considered.
[REDACTED] SPA: <ul style="list-style-type: none"> Wintering Gadwall <i>Anas strepera</i> Wintering Shoveler <i>Anas clypeata</i> 	1.3km south west of the pipeline route	Uncertain There is potential for adverse effects on this SPA site as a result of its close proximity to the pipeline construction corridor and may be hydrologically connected. Adverse effects as a result of construction-related disturbance (noise/light/dust pollution) on qualifying species should be considered.
[REDACTED] SAC <ul style="list-style-type: none"> Annex I habitats: Northern Atlantic 	4.0km east of the new intake at [REDACTED]	No

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
wet heaths with <i>Erica tetralix</i> and European dry heaths <ul style="list-style-type: none"> Annex II species: Stag beetle <i>Lucanus cervus</i> 		This SAC is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. Although both the SAC and the option are both hydrologically connected to the River Thames, they are unlikely to be in hydrological connection with each other due to the direction of flow of associated minor rivers
[REDACTED] SAC <ul style="list-style-type: none"> Annex II species: Stag beetle <i>Lucanus cervus</i> 	1.3 km east from the new intake at [REDACTED]	Uncertain There is potential for adverse effects on this SAC site as a result of its close proximity to the new intake at [REDACTED]. Although both the SAC and the option are both hydrologically connected to the River Thames, they are unlikely to be in hydrological connection with each other due to the direction of flow of associated minor rivers. As such, only adverse effects during construction and through increased traffic (dust, air, lighting and noise pollution) on qualifying species should be considered.
[REDACTED] SAC <ul style="list-style-type: none"> Annex I habitats: Atlantic acidophilous beech forest with <i>Ilex</i> and <i>Taxus</i> 	10.3 km to the west of the proposed pipeline	No This SAC is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely. The SAC is unlikely to be in hydrological continuity with the option.

3.5.3 Likely Impact Pathways and Potential Effects

Considering the type, size and scale of the Teddington DRA option, the potential impacts (of construction and operational phases) are described below.

3.5.3.1 Construction

The updated pipeline route as per the Gate 1 submission option is located at a significant distance from the Habitats Sites identified in the Stage 1 Screening process, the closest being The [REDACTED] SPA/Ramsar site and [REDACTED] SAC, both located approximately 1.5 km at their closest. Construction-related disturbances such as noise and visual impacts are not considered likely at this distance, including air emissions and dust associated with construction works and vehicular traffic as is discussed for the Maidenhead option in Section 3.4.3.1. It is also unlikely that either site is in hydrological continuity with the pipeline corridor, therefore no impacts as a result of the construction of the pipeline are considered likely on these sites and the other Habitats Sites in the Zol located further from the option.

Regarding the construction of the new WTW at the existing [REDACTED] reservoir site; this location is a rural setting with no surface waterbodies adjacent and is sufficiently removed from any Habitats Site (>10 km) to consider impacts from excavation works affecting groundwater bodies to be not relevant to this HRA.

Construction of the new intake at [REDACTED] has the potential to result in water pollution contamination from runoff from accidental pollution events or dust emissions from construction-related activities. The effects will be minor, temporary and localised and there are no downstream Habitats Sites on the River Thames that are likely to be indirectly affected.

Therefore there are no key risks identified during construction of the Teddington DRA option

3.5.3.2 Operation

The Teddington DRA option will require a new abstraction licence of 50MI/d or 100MI/d of raw water from the River Thames but assumes that this water will be replaced immediately downstream by effluent from [REDACTED] as part of the Teddington DRA option within the London Reuse SRO. Therefore there are no changes to surface water levels and flows predicted.

Operation of the new WTW will transfer potable water directly into [REDACTED] SR where it will be pumped into the supply network and no inter-basin water transfers to surface or groundwater bodies will be required.

Raw water transfers always introduce a risk of spreading invasive species and the risk will depend on the presence/absence of pathogens in the River Thames at the abstraction and the effectiveness of water treatment carried out at the new WTW at [REDACTED]. The abstraction at [REDACTED] coincides with the upstream limit of the Thames Tideway, therefore the EAR states that the risk of future marine INNS invasion at this source location is categorised as 'high'. As the option terminates at a WTW, the overall risk of INNS spread through the operation of this option is considered low. Regardless of the risk determination, there are currently no planned discharges from the proposed [REDACTED] WTW to waterbodies that are designated as Habitats Sites or are in hydrological continuity with Habitats Sites. Therefore the risk posed by the spread of INNS as a result of the operation of this option is not considered to result in Likely Significant Effects on Habitats Sites at this stage.

Therefore no key risks to Habitats Sites have been identified as a result of the operation of the Teddington DRA option.

3.5.4 Summary of Teddington DRA Appropriate Assessment

No significant adverse effects on the integrity of the following Habitats Sites are expected as a result of the Teddington DRA option:

- [REDACTED] SPA;
- [REDACTED] Ramsar site,
- [REDACTED] SAC;
- [REDACTED] SAC; and,
- [REDACTED] SAC.

3.6 Beckton Reuse Indirect

3.6.1 Summary of the Option

This option requires the abstraction of raw water from the [REDACTED] and conveyance to a new WTW and reservoir near [REDACTED]. The abstracted water will essentially be treated reuse non potable water from the Beckton Reuse option within the London Effluent Reuse SRO with the abstraction point north of [REDACTED] and just downstream of the Beckton Reuse option outfall

A new pipeline would be required to convey the raw water to a new WTW at [REDACTED] and treated water stored in an adjoining new reservoir. 50MI/d or 100MI/d of raw water is proposed to be conveyed.

A geographic representation of the Beckton Reuse Indirect option is provided in Figure A6, Appendix A.

3.6.2 HRA Stage 1 Screening of National Network Sites

The WRSE Stage 1 Screening assessment identified four Habitats Sites within the Zol of the option. As mentioned in Section 2.2, the option was optimised for the Gate 1 submission. Re screening of the updated route has been undertaken and has ultimately identified the same Habitats Sites that have the potential to be linked to the option. The Habitats Site must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible. The updated screening results for the Beckton Reuse Indirect option (based on the Gate 1 option) is given in Table 3.9 where there is potential for Likely Significant Effects or Uncertain Effects.

Table 3.9: Beckton Reuse Indirect Use Stage 1 Screening Assessment (based on Gate 1 submission option)

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
[REDACTED] Ramsar <ul style="list-style-type: none"> Criterion 6: over winter the site regularly supports internationally important populations of gadwall <i>Anas strepera</i> and shoveler <i>Anas clypeata</i> 	2.0km north of the abstraction point on the [REDACTED]	Uncertain There is potential for adverse effects on these designations as a result of its proximity to the pipeline construction corridor and abstraction point on the [REDACTED]. The designations are hydrologically connected to the construction route as they are downstream of the works. Adverse effects as a result of construction-related disturbance (noise/light/dust pollution/sediment discharge/pollution events) on qualifying species should be considered.
[REDACTED] SPA <ul style="list-style-type: none"> Bittern <i>Botaurus stellaris</i> Shoveler <i>Anas clypeata</i> Gadwall <i>Anas strepera</i> 		
[REDACTED] SAC Annex I habitats: <ul style="list-style-type: none"> Annex I habitats: Atlantic acidophilous beech forests, Northern Atlantic wet heaths and European dry heaths Annex II species: stag beetle <i>Lucanus cervus</i> 	2.2km south east of the abstraction point on the [REDACTED]	No Although part of the SAC is hydrologically connected to the pipeline route, it is located upstream of the works. As such, construction-related impacts are considered unlikely
[REDACTED] SAC	3.5km north of the pipeline route	No

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
<ul style="list-style-type: none"> Annex I habitats: sub-Atlantic and medio-European oak or oak-hornbeam forests 		Although part of the SAC is hydrologically connected to the pipeline route, it is located upstream of the works. As such, construction-related impacts are considered unlikely.

3.6.3 Likely Impact Pathways and Potential Effects

Considering the type, size and scale of the Beckton Reuse Indirect option, the potential impacts (of construction and operational phases) are described below

3.6.3.1 Construction

The updated pipeline route as per the Gate 1 submission is located at a significant distance from the Habitats Sites identified in the Stage 1 Screening process, the closest being [REDACTED] SAC and the [REDACTED] waterbody belonging to the [REDACTED] SPA/Ramsar site; both located over 2km from the abstraction point and the initial stages of the new pipeline corridor. Construction-related disturbances such as noise and visual impacts are not considered likely at this distance, including air emissions and dust associated with construction works and vehicular traffic, as is discussed for the Maidenhead option in Section 3.4.3.1. Contamination from construction-related activities is also not considered at this distance, therefore no impacts as a result of the construction on the [REDACTED] SAC and the upstream portions of the [REDACTED] SPA/Ramsar site are considered likely

The abstraction will require construction of a new intake just north of the [REDACTED]. Construction of the new intake has the potential to result in water pollution contamination from runoff from accidental pollution events or dust emissions from construction related activities. The [REDACTED] belonging to the [REDACTED] SPA/Ramsar site are located approximately [REDACTED] downstream of the intake location. There is therefore the potential for construction of the intake to result in temporary habitat degradation in the SPA/Ramsar site through, for example, runoff from accidental pollution events or dust emissions from construction-related activities. There is also potential for increased sedimentation and silting during construction. Appropriate mitigation will need to be included at the design-stage of this option to ensure accidental pollution events are appropriately mitigated. Risks can almost certainly be avoided or controlled through the application of standard best practice measures and mitigation. Typical mitigation considered adequate to ensure water pollution control are given in Section 2.6.

Regarding the construction of the new WTW and reservoir at [REDACTED], the location is a rural setting with no surface waterbodies adjacent and is sufficiently removed from any Habitats Site (>8km) to consider impacts from excavation works affecting groundwater bodies to be not relevant to this HRA

The key risks identified during construction are:

- Toxic contamination water pollution due to accidental pollution events during construction of the intake may result in habitat degradation or biological disturbance to the qualifying bird species of the [REDACTED] SPA/Ramsar site at the [REDACTED].
- Non-toxic contamination air pollution due to dust deposition may affect chemical balance of the water table and aquatic habitat of the [REDACTED] SPA/Ramsar site at the [REDACTED]. Increased sediments in suspension due to construction activities may result in increased turbidity, siltation and river substrate smothering in the [REDACTED] SPA/Ramsar site at the [REDACTED].

3.6.3.2 Operation

The Beckton Reuse Indirect option will require a new abstraction licence of 50MI/d or 100MI/d of raw water from the [REDACTED] but assumes that this water is essentially reuse water from the Beckton Reuse option of the London Effluent Reuse SRO which outfalls [REDACTED] upstream of this option's intake. The option would not require abstraction beyond licensed limits at times of low flow and is not currently subject to sustainability reductions. Therefore no reduction in surface water levels and flows as a result of the abstraction are considered for this option and no indirect impacts on downstream Habitats Sites are considered likely.

Operation of the new WTW at [REDACTED] will treat the raw water and convey it to an adjacent new reservoir for storage. Raw water transfers always introduce a risk of spreading invasive species and the risk will depend on the presence of pathogens in the [REDACTED] at the abstraction and the effectiveness of water treatment carried out at the new WTW. The INNS risk assessment tool reported on in the EAR¹⁷ suggest that there will not be an increase in the risk of INNS transfer as a result of the operation of Beckton Reuse Indirect option. Furthermore, there are currently no planned discharges from the proposed [REDACTED] WTW to waterbodies that are designated as Habitats Sites or are in hydrological continuity with a Habitats Site. Therefore the risk posed by the spread of INNS as a result of operation of this option is not considered to result in significant effects on Habitats Sites at this stage.

No key risks to Habitats Sites have been identified as a result of the operation of the Beckton Reuse Indirect option.

3.6.3.3 Potential Effects on Designated Sites

The following Habitats Sites have been screened in as having the potential to result in Likely Significant Effects or Uncertain Effects as a result of the option, and therefore are subject to a HRA Stage 2: Appropriate Assessment:

- [REDACTED] SPA; and,
- [REDACTED] Ramsar site.

For the Appropriate Assessment, a review of the sensitivity of the qualifying features of these Habitats Sites in relation to the potential impacts from the option and the conservation objectives of the designated site is required. Table 3.10 lists the features for which each site is designated and identifies the likely significant effects before and after mitigation measures are assumed. As the qualifying features for both the SPA and Ramsar site are the same in the case of the [REDACTED], both Habitats Sites have been assessed together. An assessment of each potential impact on the integrity of the sites are made, in view of the sites' structure, function and conservation objectives. Where adverse impacts are deemed significant, standard mitigation measures addressing some of these impacts are described in Section 2.6.

Full descriptions of the Habitats Sites including their conservation objectives and any current pressures or threats are given in Appendix C.

¹⁷ Mott MacDonald (2021) Thames to Affinity Transfer Strategic Resource Option – Annex B Environment Assessment Report. RAPID Gate 1 submission. Draft version.

3.6.3.4 Beckton Reuse Indirect Appropriate Assessment

Considering the type, size and scale of the proposed Beckton Reuse Indirect option, the potential impacts (of construction and operational phases) are described in Table 3.10 below.

Table 3.10: Beckton Reuse Indirect: Potential effects on designated sites and qualifying features

Designated Site (Habitats Site)	Qualifying features	Potential Adverse Significant Effects (before mitigation)	Proposed Mitigation Measures ¹⁸	Residual Effects (after mitigation)
<p>████████ SPA</p> <p>████████ Ramsar site</p>	<ul style="list-style-type: none"> • Bittern <i>Botaurus stellaris</i> • Shoveler <i>Anas clypeata</i> • Gadwall <i>Anas strepera</i> • Ramsar Criterion 6: over winter the site regularly supports internationally important populations of gadwall <i>Anas strepera</i> and shoveler <i>Anas clypeata</i> 	<p>The new intake is located approximately ██████ upstream of the ██████ which form part of the ██████ SPA/Ramsar site. There is potential for the construction of the new pipeline in this area to result in significant construction-related impacts on the qualifying bird species and their supporting habitats in the form of:</p> <ul style="list-style-type: none"> • Toxic contamination – water pollution due to accidental pollution events during construction of the intake may result in habitat degradation or biological disturbance to the qualifying bird species at the ██████ • Non-toxic contamination – air pollution due to dust deposition may affect chemical balance of the water table and aquatic habitat. Increased sediments in suspension due to construction activities may result in increased turbidity, siltation and river substrate smothering at the ██████ <p>The impacts are considered to be temporary and localised. This designated site is already suffering from similar pressures from other sources and therefore the proposed works may further prevent the improvement of the site condition (currently unfavourable-recovering).</p> <p>The identified effects have the potential to reduce the extent and distribution of this habitat as well as affecting its structure and function compromising the integrity of the ██████ SPA/Ramsar site.</p> <p>No significant effects are identified during operation.</p>	<ol style="list-style-type: none"> 1. Standard best practice procedures should be followed during construction to limit construction-related disturbance and contamination including (but not limited to) the following: <ul style="list-style-type: none"> – CIRIA C741 Environmental good practice on site guide – Environment Agency's PPGs (PPG1: General Guide to Prevention of Pollution; PPG5: Works and maintenance in or near water; PPG6: Pollution prevention guidance for working at construction and demolition sites). – Industry best practice mitigation measures for dust suppression 2. Sediment traps should be installed near or in watercourses or the use of cofferdams should also be implemented to control sediment runoff. 3. Good practice guidelines in relation to spread of INNS during construction (including unexpected pollution events) to be followed. 4. Development of a Construction and Environmental Management Plan which will include all the above proposed mitigation measures and any further measures identified at the project stage. 	<p>Assuming all proposed mitigation is implemented it is considered there will not be a significant change in:</p> <ul style="list-style-type: none"> • The extent and distribution of qualifying bird species; • The structure and function of the habitats of qualifying species; and • The supporting processes on which habitats of qualifying species rely. <p>No residual effects after mitigation are expected</p>

¹⁸ Full references of guidance documents are given in Section 3.4. where they are first listed

3.6.4 Summary of Beckton Reuse Indirect Appropriate Assessment

No pathways by which a Likely Significant Effect could occur were identified in the HRA Stage 1: Screening assessment for this option for the following Habitats Sites in the Zol:

- [REDACTED] SAC; and,
- [REDACTED] SAC.

No significant adverse effects on the integrity of the following Habitats Sites are expected, if the suggested mitigation measures in the HRA Stage 2: Appropriate Assessment are implemented:

- [REDACTED] SPA; and,
- [REDACTED] Ramsar site.

In conclusion, provided that the proposed mitigation measures are taken forward at the project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no further stages in the HRA process will be necessary for the Beckton Reuse Indirect option

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3.7 Lower Thames Reservoir Transfer 2a

3.7.1 Summary of the Option

This option requires conveyance of water from the [redacted] to a new WTW at [redacted] 2 and then to the existing [redacted] SR for storage. Affinity Water's [redacted]. A new pipeline will be required to transport the raw water from the [redacted] WTW site to the proposed [redacted] 2 WTW. The treated water will require new infrastructure to transport it to onwards to [redacted] SR

50MI/d or 100MI/d of raw water will be conveyed although it is understood that this will not require increased abstraction from the reservoirs as Thames Water will substitute their current abstraction with additional abstraction from downstream reservoirs

A geographic representation of the Lower Thames Reservoir Transfer 2a option is provided in Figure A7, Appendix A

3.7.2 HRA Stage 1 Screening of National Network Sites

The WRSE Stage 1 Screening assessment identified three Habitats Sites within the ZoI of the option. As mentioned in Section 2.2, the option was optimised for the Gate 1 submission. Re-screening of the optimised option has been undertaken and has ultimately identified the same Habitats Sites that have the potential to be linked to the option. The Habitats Site must be both exposed and sensitive to potential effects from the construction or operation of the option for Likely Significant Effects to be considered possible. The updated screening results for the Lower Thames Reservoir Transfer 2a option (based on the Gate 1 submission option) is given in Table 3.11 where there is potential for Likely Significant Effects or Uncertain Effects

Table 3.11: Lower Thames Reservoir Transfer 2a Stage 1 Screening Assessment (based on Gate 1 submission option)

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
[redacted] Ramsar site <ul style="list-style-type: none"> Criterion 6: regularly supports internationally important populations of Gadwall <i>Anas strepera</i> and Shoveler <i>Anas clypeata</i> 	Abstraction is from the [redacted] SPA/Ramsar site waterbody. Pipeline route is [redacted] north of the [redacted] WTW site end of the pipeline route	Uncertain There is potential for adverse effects on these designations as they are hydrologically connected to the construction route. They are located downstream of the works. Adverse effects as a result of construction-related disturbance (noise/light/dust pollution/sediment discharge/pollution events) on qualifying species should be considered
[redacted] SPA <ul style="list-style-type: none"> Wintering Gadwall <i>Anas strepera</i> Wintering Shoveler <i>Anas clypeata</i> 		
[redacted] SAC <ul style="list-style-type: none"> Annex I habitats Old acidophilous oak woodland with 	9.1km south west [redacted]	No This SAC is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely

National Network Site	Distance from the Option	Potential for Likely Significant Effects or Uncertain Effects
<p><i>Quercus robur</i> and Atlantic acidophilous beech forests with <i>Ilex</i> and <i>Taxus</i></p> <ul style="list-style-type: none"> Annex II species Violet click beetle <i>Limoniscus violaceus</i> 		The option does not affect groundwater and so the groundwater dependent habitats at this location are not likely to be affected by the scheme.
<p>██████████ SAC</p> <ul style="list-style-type: none"> Annex I habitats: Atlantic acidophilous beech forest with <i>Ilex</i> and <i>Taxus</i> 	7.9km west of the proposed pipeline	<p>No</p> <p>This SAC is suitably removed from the pipeline corridor so that construction-related impacts are considered unlikely.</p> <p>The option does not affect groundwater and so the groundwater dependent habitats at this location are not likely to be affected by the scheme.</p>

3.7.3 Likely Impact Pathways and Potential Effects

Considering the type, size and scale of the Lower Thames Reservoir Transfer 2a option, the potential impacts (of construction and operational phases) are described below

3.7.3.1 Construction

The new infrastructure required for this option to join the ██████████ to ██████████ SR is located at a significant distance from the Habitats Sites identified in the Stage 1 Screening process, the closest being the ██████████ SPA/Ramsar site approximately 5km away. Construction-related disturbances such as noise, vibration and visual impacts are not considered likely at this distance, including air emissions and dust associated with construction works and vehicular traffic. Contamination from construction-related activities is also not considered at this distance. Although the ██████████ currently abstracts water from waterbodies that belong to the ██████████, no new infrastructure is required to bring ██████████ and therefore its proximity to this site is not considered a constraint during construction.

Regarding the construction of the new WTW at ██████████ 2; this location is agricultural field, bounded by the ██████████ and residential housing and sufficiently removed from any Habitats Site (~8km) or watercourses to consider impacts from excavation works affecting groundwater bodies to be not relevant to this HRA

No impacts as a result of the construction of this option are considered likely.

3.7.3.2 Operation

The Lower Thames Reservoir Transfer 2a option is not expected to require a new license or an increase to peak abstraction from the ██████████, but the required license conditions will remain under investigation as this option progresses. Therefore, the current operation does not have the potential to result in adverse effects to surface water levels or water quantity in the reservoir. This should be revised if further investigations disagree with this assessment.

As discussed for the previous options, raw water transfers between different waterbodies always introduces a risk of spreading invasive species, but the INNS risk assessment reported on in the EAR¹⁹ suggests that there will not be any significant increase in the risk of INNS

¹⁹ Mott MacDonald (2021) Thames to Affinity Transfer Strategic Resource Option – Annex B Environment Assessment Report RAPID Gate 1 submission Draft version

transfer as a result of the operation of any of the T2AT options, due in part to the effectiveness of treatment at WTWs such as the proposed [REDACTED] 2. Furthermore, [REDACTED] 2 WTW does not have any planned discharges to any receptors that are hydrologically linked to any Habitats Sites. Therefore there is confidence that the risk of INNS spread to Habitats Sites as a result of operation of the Lower Thames Reservoir Transfer option is low.

No key risks to Habitats Sites have been identified as a result of the operation of the Lower Thames Reservoir Transfer 2a option

3.7.4 Summary of Lower Thames Reservoir Transfer 2a Appropriate Assessment

No significant adverse effects on the integrity of the following Habitats Sites in the Zol are considered as a result of this option:

- [REDACTED] SPA;
- [REDACTED] Ramsar site;
- [REDACTED] SAC; and,
- [REDACTED] SAC.

This assessment must be revised if further investigations lead to a different conclusion in relation to possible impacts from abstraction to reservoirs that are part of the [REDACTED] [REDACTED] SPA and Ramsar sites.

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4 Conclusions

The options for the Thames to Affinity Transfer have been subject to a HRA Stage 1 assessment, which was completed by WRSE. Subsequently, a HRA Stage 2 Appropriate Assessment (plan stage) has been undertaken. The HRA Stage 2 Appropriate Assessment did not identify any options that, if implemented (alone) for T2AT, would result in any residual significant impacts on the National Site Network of designated sites.

The Appropriate Assessment undertaken for Maidenhead, Teddington DRA and Lower Thames Reservoir Transfer 2a options did not identify any transmission pathways by which a Likely Significant Effect could reasonably occur. No key risks to Habitats Sites were identified during construction or operation of these options. It should be noted however that the assessment for Lower Thames Reservoir Transfer 2a is based on the conclusion that there will be no change to the current abstraction regime at [REDACTED]. This assessment must be revised if further investigations lead to a different conclusion in relation to possible impacts to surface water levels and flows [REDACTED]. The Appropriate Assessment undertaken for Sunnymeads 1, Sunnymeads 2a, Walton 2b and Beckton Reuse Indirect options identified transmission pathways, but concluded that no significant effects are foreseeable on the integrity of the following Habitats Sites if the suggested mitigation measures are observed:

- Sunnymeads 1 and Sunnymeads 2a: There is a potential for Likely Significant Effects on the [REDACTED] SPA and the [REDACTED] Ramsar site as a result of their close proximity to the construction pipeline corridor and intake location, the site being located within the same river catchment as the intake location and as a result of disturbance (noise, light, dust pollution) during construction on qualifying species. Provided that the proposed mitigation measures are taken forward at the project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no further stages in the HRA process will be necessary for Sunnymeads 1 or Sunnymeads 2a options.
- Walton 2b: There is a potential for Likely Significant Effects on the [REDACTED] SPA and the [REDACTED] Ramsar site as a result of their close proximity to the construction pipeline corridor, the possibility the site may be hydrologically connected as the pipeline runs directly adjacent to a waterbody that forms part of the designation, and as a result of disturbance (noise, light, dust pollution) during construction on qualifying species. Provided that the proposed mitigation measures are taken forward at the project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no further stages in the HRA process will be necessary for Walton 2b option.
- Beckton Reuse Indirect: There is a potential for Likely Significant Effects on the [REDACTED] SPA and [REDACTED] Ramsar site as a result of their close proximity to the construction pipeline corridor and abstraction point on the [REDACTED] and as a result of disturbance (noise, light, dust pollution) during construction on qualifying species. Provided that the proposed mitigation measures are taken forward at the project stage, no residual impacts on the Habitats Sites are likely to occur and therefore no further stages in the HRA process will be necessary for Beckton Reuse Indirect option.

It should be noted that at this stage an in combination assessment to identify potential cumulative effects of T2AT with other related or non related plans or projects has not been conducted. An in-combination assessment would not be considered proportionate at this stage (at WRSE regional plan level), due to the early stages of the regional plan, and the preliminary nature of design details on T2AT and other SROs. It is recommended that an updated HRA be conducted at Gate 2 to include an in-combination assessment of the options within T2AT,

between different SROs and between any other external plans or projects that may put pressure on the same water resources.

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A. Maps

Appendix Redacted

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B. WRSE Screening Results for T2AT

The WRSE HRA outputs are available on [REDACTED]

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C. Designated Sites

Appendix Redacted

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