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Anglian Water Revised Draft Water Resource Management Plan 2024 Environmental Report

Sub-Report D: Invasive Non-Native Species
(INNS) Assessment

August 2023

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Anglian Water Revised Draft Water Resource Management Plan 2024 Environmental Report

**Sub-Report D: Invasive Non-Native Species
(INNS) Assessment**

August 2023

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	01/11/22	Various	Checked	Approved	Report for draft WRMP24
B	31/08/23	Various	Checked	Approved	Report for revised draft WRMP24 following review

Document reference: 100421065-021-L0-WRMP-MML-RP-EN-0536 | B |

Information class:

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Table of Acronyms

AMP	Asset Management Plan
BAU	Business as Usual
BAU+	Business as Usual+
EA	Environment Agency
EAR	Environmental Appraisal Report
EDD	Emergency Draw Down
EU	European Union
INNS	Invasive Non-Native Species
MPA	Marine Protected Area
NSIP	Nationally Significant Infrastructure Projects
RAPID	Regulators' Alliance for Progressing Infrastructure Development
rdWRMP24	Revised Draft Water Resources Management Plan 2024
RWT	Raw Water Transfer
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SAI-RAT	SRO Aquatic INNS Risk Assessment Tool
SFFD	South Forty Foot Drain
SPA	Special Protection Area
SRO	Strategic Resource Option
SSSI	Site of Special Scientific Interest
WINEP	Water Industry National Environment Programme
WRMP	Water Resources Management Plan
WRMP24	Water Resources Management Plan 2024
WTW	Water Treatment Works
WRZ	Water Resource Zone

Executive summary

All water companies in England and Wales, including Anglian Water, must prepare and maintain a Water Resources Management Plan (WRMP). This sets out how to achieve a secure supply of water for customers and for a protected and enhanced environment. Under legislation, a plan must be produced at least every five years and reviewed annually.

Planning is currently underway for the year 2024 onwards. In developing the Revised Draft WRMP24 (rdWRMP24), Anglian Water have undertaken an Invasive and Non-Native Species (INNS) assessment of the potential risk of INNS transfer as a result of options proposed within the rdWRMP24. This includes an assessment of the potential implications of rdWRMP24 on the risk of transfer of INNS, both individually and in combination.

The INNS assessment, in parallel with a Strategic Environmental Assessment (SEA), ensures that an integrated approach to environmental assessment has been followed and so that the rdWRMP24 complies with relevant legislation and planning guidance.

The Level 1 INNS screening process presented in this report has generated a coarse assessment of each option for INNS risk. This is based on the concept of risk as the product of the frequency and severity of INNS being transferred due to the implementation of an option. An overall Risk Magnitude was assigned to each option and options were subject to a more detailed Level 2 assessment where any risk rating greater than Very Low was identified.

The Level 2 assessment methodology utilised the Strategic Resource Option (SRO¹) Aquatic INNS Risk Assessment Tool (SAI-RAT; “the tool”) to quantify the INNS risk associated with those options not screened out by Level 1 assessment. Whilst the Level 1 screening provided a coarse risk screening of those options likely to involve an INNS risk, the Level 2 assessment aimed to quantify the INNS risk using more detailed option information, including precise location of transfer pathway, transfer volumes and existing INNS presence. The Level 2 assessments are based on the detailed conceptual design information available at the time the assessments are conducted.

The rdWRMP24 Best Value Plan (Plan B) includes 50 supply-side options, five Water Industry National Environment Programme (WINEP) options and an Aspirational demand management strategy. Of the 50 supply-side options, 47 were initially screened for INNS risk. The screening results found 40 of the 47 options had a risk rating of Very Low or No additional risk, meaning no further INNS assessment was required. Seven options were assigned INNS transfer risks of Low (six options) and Moderate (Lincolnshire East Surface Water enhancement (LNE12)). These seven options were subject to a more detailed Level 2 assessment. In addition to the seven, two SRO Options (Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29) and Lincolnshire Reservoir 50MCM (usable volume) (169MI/d) (RTN17)) were also subject to Level 2 assessment, totalling nine options. The Reservoir options bypassed the Level 1 INNS Screening due to their classification as SROs.

The Level 2 INNS assessment process considers risks related to the asset and its components (e.g., intakes, transfers) producing findings as percentage values, with higher values denoting higher risk. None of the nine options subject to Level 2 assessment generated an overall risk score of over 40%, although some individual aspects of the desalination and SRO projects scored above 50% in some cases. The drivers of these higher risk scores related to the potential to spread INNS through new pathways; primarily due to the transfer of raw water, such

¹ The SROs referenced are referring to the reservoirs being progressed.

as the intakes for desalination and the operation of reservoirs through raw water input and recreational and maintenance visits.

The primary risks identified with the assessed options were the transfer of raw water to a new location, and for desalination options the highest risk was associated with short intake pipeline routes with a potential to spread INNS to a new location.

No further in-combination effects of the assessed options were identified.

During the implementation of the WRMP24, Anglian Water will need to remain vigilant to INNS risks as supply options identified in Plan B move into detailed design, seek development consent and are delivered. It is recommended that:

- INNS risk ratings are revised using the SAI-RAT as more information becomes available, including information on biosecurity measures.
- Appropriate mitigation of INNS risk should be considered for all options progressed. Options for which a Level 2 assessment has resulted in higher percentage score risk will be of the highest priority for mitigation. The appropriate level of mitigation is best assessed on an individual option basis as, for example, the existing level of hydrological connectivity in a catchment may determine the level of necessary mitigation.
- The INNS risks associated with the construction phase should also be considered and mitigated through best practice measures.
- Further consideration may need to be given on a case-by-case basis regarding the potential for cumulative effects through interaction with other options being taken forward. These updated assessments should account for both inter- and intra-regional effects.

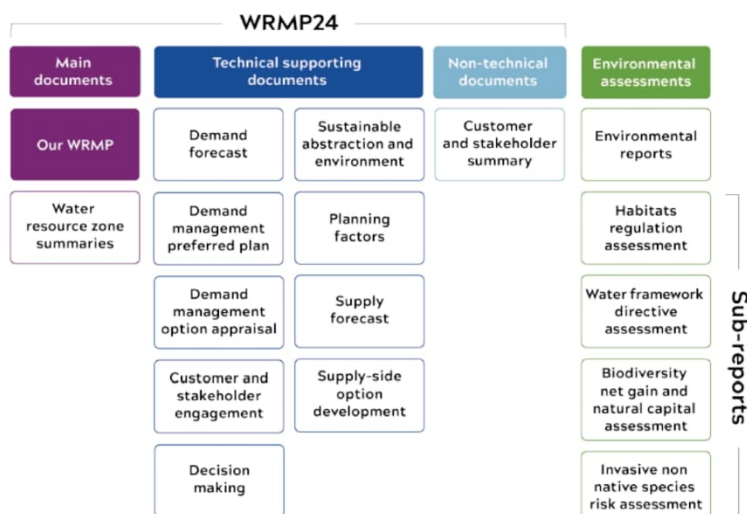
1 Introduction

1.1 Water Resource Management Planning

- 1.1.1.1 Anglian Water is the largest water and wastewater company in England and Wales geographically, covering 20% of the land area.
- 1.1.1.2 As a water company, Anglian Water has a statutory obligation to produce a Water Resources Management Plan (WRMP) every five years. The WRMP sets out how a sustainable and secure supply of clean drinking water will be provided to its customers over a minimum 25-year planning period, whilst showing how its long-term vision for the environment will be achieved. Wider societal benefits, such as tourism, are also considered and balanced against the plan being affordable to create a 'best value' plan.
- 1.1.1.3 In the development of a WRMP, companies in England and Wales must follow the Environment Agency / Ofwat Water Resources Planning Guideline (WRPG)², consider broader government policy objectives and adhere to the relevant legislation. Anglian Water's plan-making for rdWRMP24 has undertaken all six environmental assessments that were highlighted in the WRPG. The broad scope of the Strategic Environmental Assessment (SEA) process has been used as a framework to integrate the findings of the other environmental assessments to avoid duplication and inconsistency across the specific requirements of each assessment:
- Habitats Regulations Assessment (HRA)
 - Water Framework Directive (WFD) assessment
 - Natural Capital Assessment (NCA) via Ecosystem Services
 - Biodiversity Net Gain (BNG) assessment
 - Invasive Non-Native Species (INNS) risk assessment
- 1.1.1.4 The development of a WRMP is a complex process involving the analysis of different types of information and data, the application of modelling and decision-making, and interacting, as required, with the environmental assessments above. To read more about the plan-making process, the suite of rdWRMP24 reports has more information on each aspect (Figure 1.1).
- 1.1.1.5 This INNS assessment sits within the suite of Environmental assessment documents that accompany the rdWRMP24. The assessment process undertaken to generate it feeds into the plan-making process as part of the Anglian Water's best value planning (BVP) approach, which is discussed further below.

² Environment Agency, Natural Resources Wales, Office for Water Services (2023). Water resources planning guideline. Available at: <https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline>

Figure 1.1: The rdWRMP24 reports



Source: Anglian Water

1.2 Anglian Water's rdWRMP24 challenge

- 1.2.1.1 Anglian Water's geographic area is divided into 28 Water Resource Zones (WRZs) including the Hartlepool area and the South Humber Bank, which is a non-potable WRZ that sits within the Central Lincolnshire WRZ. It should be noted that Hartlepool is not covered further in this environmental assessment report as only demand management options (e.g., smart meters, leakage reduction) are required to maintain its supply demand balance through the rdWRMP24 period. An assessment of demand management is reported in Chapter 5 of the rdWRMP24 Environmental Report.
- 1.2.1.2 The East of England is one of the driest regions in the UK, receiving only two thirds of the national average rainfall each year (approximately 600mm), with high evaporation losses³. Water supply is under pressure from multiple challenges. The supply and demand forecast upon which the rdWRMP24 is based must account for all these challenges, including population growth, climate change, sustainability reductions (i.e., licence capping, environmental destination and ambition) and the need to increase resilience of water supplies to severe drought.⁴
- 1.2.1.3 The WRPG sets out the requirements for developing the rdWRMP24. Some components of the forecasts of supply and demand are not fixed in the guidelines and need to be optimised as part of the best value planning (BVP) process. There are five key policy decisions that the plan-making process must take and which influence the rdWRMP24 environmental outcomes. The assessment of which are presented in Chapters 5 and 6 of the rdWRMP24 Environmental Report. The policy decisions are:
- Level of demand management
 - Timing of licence capping
 - Timing of 1 in 500 year drought resilience
 - Level of environmental destination

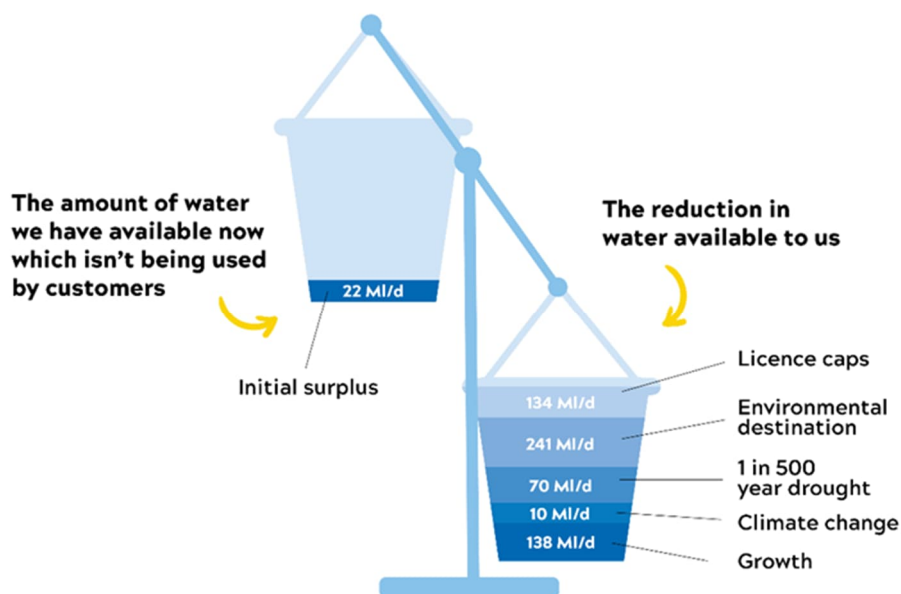
³ Anglian Water Official Website (accessed 04.07.22): <https://www.anglianwater.co.uk/about-us/media/fast-facts/#:~:text=We%20operate%20in%20the%20driest,grow%20by%20another%20175%2C000%20homes.>

⁴ Anglian Water Official Website (accessed 04.07.22): <https://www.anglianwater.co.uk/about-us/our-strategies-and-plans/water-resources-management-plan/>

- Level of environmental ambition (timing and profile of environmental destination)

1.2.1.4 The combined effects of the challenges influence the change in the amount and timing of water available to Anglian Water to deliver secure public water supplies throughout the planning period (2025-2050). The combination of these challenges (Figure 11.2) indicates that rdWRMP24 must deliver well over 400MI/d of new demand management and supply-side infrastructure through the planning period in order to deliver the statutorily required supply-demand balance.

Figure 11.2: The impact of expected challenges for Anglian Water’s rdWRMP24



Source: Anglian Water

1.3 Anglian Water’s WRMP24 plan-making

- 1.3.1.1 Once the supply demand forecast has determined the scale of challenge to be met, the plan-making process identifies how demand management and new supply-side options can deliver a supply and demand balance for all water resource zones at all times throughout the planning period (2025-2050).
- 1.3.1.2 To begin with, demand management options are implemented. Demand management options reduce the amount of water used by customers or lost in the water network. Examples of demand management options include leakage reduction, smart metering and water efficiency.
- 1.3.1.3 The objective led approach of the SEA has been used to assess the rdWRMP24 demand management options as SEA is well suited to assessment activities with a broad scale effect. However, the five other environmental assessments require specific geographic locations to base their assessment upon. Further information on the assessment of demand management options can be found in Chapters 5, 6 and 7 of the rdWRMP24 Environmental Report.
- 1.3.1.4 Following the implementation of demand management options, supply-side options are required to resolve the deficit within the planning period. Due to the numerous challenges Anglian Water face in the coming 25 years, especially in terms of sustainability reductions, they are required to deliver a programme of significant new supply infrastructure. Identifying proposed new supply-side options that pose limited, or no risk, to the environment (as may be the case in other parts of the country that are not water stressed) was not feasible.

- 1.3.1.5 Supply-side options produce new, additional water that can be put into the water network to supply customers. The types of supply-side options available to Anglian Water on their constrained list to deliver rdWRMP24 are:
- Aquifer storage and recovery
 - Backwash recovery
 - Conjunctive use
 - Desalination
 - Groundwater treatment
 - Reservoirs
 - Tankering
 - Transfers
 - Trading
 - Water reuse
 - Water treatment works
- 1.3.1.6 The environmental assessments applied to the rdWRMP24 have influenced the components of the constrained list and, in some cases, they have contributed to the removal of potential supply-side options (more information is in the rdWRMP24 Supply-side options development technical support document).
- 1.3.1.7 In addition to the above, the six environmental assessments completed have produced environmental metrics that have formed part of the BVP framework and therefore the outcomes have been considered throughout the decision-making process. Further information about the environmental assessment metrics is included in Chapter 5 of the rdWRMP24 Environmental Report and the rdWRMP24's Decision making technical supporting document.
- 1.3.1.8 Whilst option level environmental assessments are essential for producing a constrained list and facilitating decision making, there must be a focus on the environmental consequences of the WRMP as a whole plan.
- 1.3.1.9 It is also important to recognise the strategic plan-level of the rdWRMP24 and that, following adoption of the rdWRMP24, individual supply-side options will be progressed at a project-level. This will require detailed design, engagement with key stakeholders, detailed environmental assessments, compliance with environmental laws and policies and gaining any required consents/licences before they can be built and operated.

1.4 INNS Assessment Introduction

- 1.4.1.1 INNS are plants and animals that can spread outside of their natural range through anthropogenic action, and cause harm to the environment and cost to the economy^{5, 6}.
- 1.4.1.2 The transfer of water from one location to another may increase the risk of spreading INNS. Any introduction of INNS to a water body can have significant detrimental effects on ecosystem structure and functioning, as well as jeopardising compliance with the following environmental legislation:
- The Wildlife and Countryside Act 1981 (as amended): Under Section 14, it may be an offence to release or allow to escape into the wild any animal that 'is of a kind which is not

⁵ RSPB, n.d. Invasive non-native species. [online] Available at: <<https://www.rspb.org.uk/our-work/policy-insight/species/invasive-non-native-species/>> [Accessed 25 July 2023].

⁶ GB Non-Native Species Secretariat, 2022. Non-native species. [online] Available at: <<https://www.nonnativespecies.org/non-native-species/>>

ordinarily resident in and is not a regular visitor to Great Britain in a wild state'; or is included in Part I of Schedule 9. Under Section 14, it may also be an offence to plant or otherwise cause 'to grow in the wild any plant which is included in Part II of Schedule 9.'

- The Invasive Non-Native Species (Amendment etc.) (EU Exit) Regulations 2019: This ensures the continued operability of EU Invasive Alien Species Regulation 1143/2024, which outlines a set of measures to combat the spread of INNS on the list of EU concern, through prevention by a number of robust measures that aim to prevent introduction of INNS, early detection and eradication of INNS through a surveillance system and rapid eradication measures, and management action to prevent further spread and harm.
- The Invasive Alien Species (Enforcement & Permitting) Order 2019: It may be an offence to release, cause to escape, plant, or grow species of animal or plant 'not ordinarily resident in' and 'not a regular visitor to Great Britain in a wild state', or otherwise listed in article 1 of Schedule 2.
- Water Environment (Water Framework Directive; England and Wales) Regulations 2017 Guidance: This states that a water body initially classified as 'High Status' (representing near-natural conditions), may drop in classification if populations of High Impact INNS are shown to be significantly affecting the water body. High Impact INNS are identified on the current aquatic alien species list produced by the Water Framework Directive (WFD) UK Technical Advisory Group. Species on the High Impact list are used within the WFD Classification process.

1.4.1.3 Understanding the INNS risk associated with each of the proposed option components is therefore essential to inform the development of appropriate mitigation measures. A high-level assessment of the potential for each of the options to increase transfer risk of INNS is included within the scope of this sub-report.

1.5 Scope of this report

1.5.1.1 The WMRP24 comprises four plans: Plan A (Least Cost), Plan B (Best Value Plan), Plan C (Least Cost Best Value Plan), and Plan D (Best for Environment). This sub-report will discuss the results of the INNS assessments for the supply-side options within Plan B, and their in-combination effects as a plan as a whole. The INNS results from the other plans have fed into the Strategic Environmental Assessment (SEA) and are not reported separately here.

1.5.1.2 The scope of the INNS assessment for rdWRMP24 was to identify and evaluate the potential for different supply-side options and SROs to spread INNS, defined as plants and animals that can spread, and cause harm to the environment and cost to the economy⁷, such as zebra mussel (*Dreissena polymorpha*)⁸ and Himalayan balsam (*Impatiens glandulifera*)⁹.

1.5.1.3 The process undertaken for the INNS assessment is outlined below:

- A high-level INNS 'Level 1 screening' of options in the rdWRMP24 constrained list is undertaken in order to identify options that present an INNS risk and require a more detailed assessment.
- The results of the Level 1 screening (shown in Section 3.1) are used to identify constrained list options requiring a more detailed 'Level 2 assessment'. Options identified that are initially assessed as Low, Moderate or High risk in the Level 1 screening are then put forward for a

⁷ GB Non-Native Species Secretariat (2022) *Non-native species*. [online] Available at: <[Non-native species » NNSS \(nonnativespecies.org\)](https://nonnativespecies.org)> [Accessed 17 July 2023].

⁸ GB Non-Native Species Secretariat (2016) *Zebra mussel*. [online] Available at: <[Zebra Mussel » NNSS \(nonnativespecies.org\)](https://nonnativespecies.org)> [Accessed 17 July 2023].

⁹ GB Non-Native Species Secretariat (2019) *Himalayan balsam*. [online] Available at: <[Himalayan Balsam » NNSS \(nonnativespecies.org\)](https://nonnativespecies.org)> [Accessed 17 July 2023].

Level 2 assessment, whilst those with None or Very Low risk are screened out of further assessment.

- Those options in the constrained list are subject to a more a detailed Level 2 assessment (results in Section 3.2).
- Options in Plan B are screened for in-combination effects to understand the overall INNS implications of rdWRMP24 (Section 3.3). Options initially assessed as having a Low, Moderate or High risk are subject to an in-combination effects assessment as they involve the movement of raw water that may contain INNS. Those with None or Very Low risk were screened out and did not require in-combination effects assessment.
- For those options screened in at the previous stage, an in-combination effects assessment is undertaken by examining spatial connectivity of options and combining the Level 2 assessments of any connected options.

1.5.1.4 The rdWRMP24 also includes a range of other activities, including demand management measures, reduction/closure of existing abstraction licences and the implementation of the next five years of activity under the WINEP. These activities are outside the scope of this INNS assessment. It should be noted that WINEP options are being considered within the region, including river support, river restoration, investigations into eel passage, INNS pathways and INNS mitigation. Assessment of these WINEP options has not been undertaken at the plan stage. However, it is recognised that they have the potential to affect INNS habitat suitability or dispersal and once locations and options have been refined, consideration of these options in relation to the potential for INNS transfer will be undertaken at a project level and measures put in place to manage the spread of INNS.

1.6 Anglian Water rdWRMP24 supply-side options

1.6.1.1 The rdWRMP24 Best Value Plan (Plan B) includes 50 supply-side options, five WINEP options and an Aspirational demand management strategy. A Level 1 screening (Appendix C) was undertaken for 47 of the 50 supply-side options in order to highlight INNS risk, and to identify options requiring a more detailed Level 2 assessment. Ruthamford South Drought Permit (RTS16) was not subject to an INNS assessment due to the nature of the option. The Fens Reservoir 50MCM (usable volume) (44.4MI/d) (FND29) and Lincolnshire Reservoir 50MCM (usable volume) (169MI/d) (RTN17) SROs bypassed the Level 1 screening and were subject only to a Level 2 assessment as part of Gate 2 of the Regulators' Alliance for Progressing Infrastructure Development (RAPID) gated assessment scheme. These assessments are also included in this report and Fens Reservoir 50MCM (usable volume) (44.4 MI/d) FND29 has been updated to incorporate changes to the design since the Gate 2 submission.

1.6.1.2 Seven of the 47 options undergoing Level 1 screening triggered a Level 2 assessment. These assessments are included within this report.

1.6.1.3 The 50 supply-side options within Plan B are listed below alongside their level of assessment (Table 1.1).

Table 1.1: Plan B supply-side options and their level of INNS assessment

Option ID	Description overview	Screening Outcome
CAM4	Ruthamford South to Cambridge Water potable transfer (50 MI/d)	Screened out of Level 2 INNS assessment
LNC25	Lincolnshire East to Lincolnshire Central potable transfer (29 MI/d)	Screened out of Level 2 INNS assessment
EXC3	Essex South to Essex Central potable transfer (10 MI/d)	Screened out of Level 2 INNS assessment
EXC7	Backwash water recovery, Essex Central WTW (0.3 MI/d)	Screened out of Level 2 INNS assessment
FND26	Backwash water recovery, Fenland WTW (0.2 MI/d)	Screened out of Level 2 INNS assessment

Option ID	Description overview	Screening Outcome
FND22	Marham Abstraction (7.9 MI/d up to 2039, 12.3 MI/d after 2039)	Level 2 INNS assessment required
LNC30	Lincolnshire Central WTW Upgrade (3.2 MI/d)	Screened out of Level 2 INNS assessment
LNE11	Lincolnshire East Groundwater (7.5 MI/d)	Screened out of Level 2 INNS assessment
LNE12	Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039)	Level 2 INNS assessment required
LNN3	Lincolnshire Retford and Gainsborough WTW Upgrade (0.72 MI/d)	Screened out of Level 2 INNS assessment
NAY1	Norwich and the Broads to Aylsham potable transfer (3 MI/d)	Screened out of Level 2 INNS assessment
NBR6	Fenland to Norfolk Bradenham potable transfer (50 MI/d)	Screened out of Level 2 INNS assessment
NEH3	Suffolk Thetford to Norfolk East Harling potable transfer (5 MI/d)	Screened out of Level 2 INNS assessment
NHL4	Norfolk East Harling to Norfolk Harleston potable transfer (5 MI/d)	Screened out of Level 2 INNS assessment
NTB10	Norfolk Bradenham to Norwich and the Broads potable transfer (20 MI/d)	Screened out of Level 2 INNS assessment
RTS16	Ruthamford South Drought permit (2.07 MI/d)	Screened out of Level 1 screening and Level 2 INNS assessment
RTS21	Ruthamford South surface water enhancement (9.5 MI/d up to 2040, 6 MI/d after 2040)	Screened out of Level 2 INNS assessment
SUE23	Suffolk East WTW Upgrade (1.7 MI/d)	Screened out of Level 2 INNS assessment
SUE24	Suffolk Sudbury to East Suffolk potable transfer (10 MI/d)	Screened out of Level 2 INNS assessment
SUT6	Backwash water recovery, Suffolk East WTW (0.05 MI/d)	Screened out of Level 2 INNS assessment
SWC8	Cambridge to Suffolk West Cambs potable transfer (50 MI/d)	Screened out of Level 2 INNS assessment
SWC13	Suffolk West & Cambs groundwater relocation (2.6 MI/d)	Screened out of Level 2 INNS assessment
EXS7	Backwash water recovery, Essex South WTW (0.3 MI/d)	Screened out of Level 2 INNS assessment
NBR9	Backwash water recovery, Norfolk Bradenham WTW (0.2 MI/d)	Screened out of Level 2 INNS assessment
NNC5	North Norfolk Coast WTW backwash water recovery (0.18MI/d)	Screened out of Level 2 INNS assessment
NNC6	North Norfolk Coast WTW backwash water recovery (0.2 MI/d)	Screened out of Level 2 INNS assessment
LNE3	Backwash water recovery, Lincolnshire East WTW (1.3 MI/d)	Screened out of Level 2 INNS assessment
NAY4	Backwash water recovery, Norfolk Aylsham WTW (0.75 MI/d)	Screened out of Level 2 INNS assessment
NED3	Backwash water recovery, Norfolk East Dereham WTW (0.1 MI/d)	Screened out of Level 2 INNS assessment
NHL7	Backwash water recovery, Norfolk Harleston WTW (0.2 MI/d)	Screened out of Level 2 INNS assessment
NAY5	Backwash water recovery, Norfolk Aylsham WTW (0.1 MI/d)	Screened out of Level 2 INNS assessment
EXS19	Colchester Reuse direct to Ardleigh Reservoir (no additional treatment) (11.4MI/d up to 2039, 13.9MI/d after 2039)	Screened out of Level 2 INNS assessment
SUT5	Norfolk Bradenham to Suffolk Thetford potable transfer (15 MI/d)	Screened out of Level 2 INNS assessment
SUE25	Backwash water recovery, Suffolk East WTW (0.17 MI/d)	Screened out of Level 2 INNS assessment
LNN1	Lincolnshire Central to Lincolnshire Retford and Gainsborough potable transfer (3MI/d)	Screened out of Level 2 INNS assessment
NED2	Norfolk Bradenham to Norfolk East Dereham potable transfer (10 MI/d)	Screened out of Level 2 INNS assessment
NNC4	Norfolk East Dereham to North Norfolk Coast potable transfer (10 MI/d)	Screened out of Level 2 INNS assessment
SHB9	South Humber Bank Non-potable desalination (60 MI/d)	Level 2 INNS assessment required
FND29	Fens Reservoir 50MCM (usable volume) (44.4MI/d)	Level 2 INNS assessment required
EXS10	Holland on Sea desalination (seawater) (26 MI/d)	Level 2 INNS assessment required

Option ID	Description overview	Screening Outcome
LNB1	Ruthamford North to Bourne potable transfer (20 MI/d)	Screened out of Level 2 INNS assessment
LNC16	Ruthamford North to Lincolnshire Central potable transfer (20 MI/d)	Screened out of Level 2 INNS assessment
LNC28	Bulk trade agreement - River Trent (7 MI/d)	Level 2 INNS assessment required
LNE6	Mablethorpe desalination Seawater (50 MI/d)	Level 2 INNS assessment required
NTB17	Bacton desalination (seawater) (25 MI/d)	Level 2 INNS assessment required
NWY1	Norwich and the Broads to Norfolk Wymondham potable transfer (5 MI/d)	Screened out of Level 2 INNS assessment
RTN30	Lincolnshire Central to Ruthamford North potable transfer (75 MI/d)	Screened out of Level 2 INNS assessment
RTS24	Ruthamford North to Ruthamford South potable transfer (75 MI/d)	Screened out of Level 2 INNS assessment
RTN17	Lincolnshire Reservoir 50MCM (usable volume) (169MI/d)	Level 2 INNS assessment required
RTC3	Ruthamford South to Ruthamford Central potable transfer (20 MI/d)	Screened out of Level 2 INNS assessment

2 Methodology

2.1 Level 1 screening

2.1.1 Overview

2.1.1.1 The Level 1 screening reviews an option's INNS risk, based on the concept of risk as the product of the frequency and severity of INNS being transferred due to the implementation of a supply-side option. This involves an assessor determining a 'Frequency of Impact' and 'Severity of Impact', which are combined to give an overall Risk Magnitude.

2.1.1.2 This methodology is informed by the Environment Agency (EA) Position Statement on managing the risk of INNS through raw water transfers (RWTs)¹⁰. This approach is focused upon the potential pathways (along which INNS can spread) that RWTs create. This INNS assessment does therefore not consider INNS survey or distribution records, instead the Risk Magnitude produced by the Level 1 screening relates to the nature of any new pathways created by supply-side options and the impacts these could have if INNS are present now or in the future. The severity of risk is greater if a RWT links previously unconnected waterbodies or if it involves the transfer of raw fresh or saline water, rather than treated water or groundwater.

2.1.2 Frequency of risk rating

Table 2.1 below shows the criteria for determining the Frequency of Impact rating.

Table 2.1: Frequency of Impact risk criteria used to assess INNS risk.

Frequency of Impact	Criteria
None	Does not occur/no impact for which to determine a frequency
Infrequent	Only occurs in an emergency or during situations that are not considered to be normal operation for the scheme
Periodical	Will happen during start up or shut down, or periodically during routine maintenance or operation of the option
Regular	Will occur throughout the regular operation of the option

2.1.3 Severity of risk rating

2.1.3.1 Table 2.2 below shows the criteria for determining the Severity of Impact rating.

Table 2.2: Severity of Impact risk criteria used to assess INNS risk.

Severity	Criteria
None	No additional severity of impact risk beyond risk associated with existing operations

¹⁰ Environment Agency (2022). Managing the Risk of Spread of Invasive Non-Native Species Through Raw Water Transfers.

Severity	Criteria
Very Low	Treated water, effluent or groundwater assumed unlikely to contain INNS
Low	Existing pathway between waterbodies or treated water/groundwater/effluent with no INNS risk being transferred
Medium	Change in volume of transfer between waterbodies which are already connected
High	New pathway between waterbodies not currently connected or potential to introduce new INNS not currently observed in the UK

2.1.4 Risk Magnitude rating

2.1.4.1 Once Frequency of Impact and Severity of Impact have been determined for a supply-side option, the results are combined in the Risk Magnitude matrix (shown in Table 2.3) to generate an overall Risk Magnitude rating.

Table 2.3: Risk Magnitude calculation matrix used to determine INNS risk.

Frequency/Severity	None	Infrequent	Periodical	Regular
None	0 = No additional risk	0 = No additional risk	0 = No additional risk	0 = No additional risk
Very Low	0 = No additional risk	1 = Very Low	1 = Very Low	1 = Very Low
Low	0 = No additional risk	2 = Low	2 = Low	3 = Low
Medium	0 = No additional risk	3 = Low	4 = Moderate	4 = Moderate
High	0 = No additional risk	4 = Moderate	5 = High	6 = High

2.1.5 Progression to Level 2

2.1.5.1 In accordance with the EA position statement on RWTs¹⁰, the Level 1 screening does not account for INNS distribution and other specific local considerations. By progressing all options screened as Low, Moderate or High risk to a Level 2 assessment, all options which may be affected by local issues such as important nature conservation sites or high impact INNS will be subject to more detailed assessment. It is unlikely that those options initially screened as presenting No risk or Very Low risk would be affected by such local issues, as these will not involve the transfer of raw water with potential to contain INNS.

2.1.5.2 All supply-side options initially screened as having a Low, Moderate or High risk were progressed to a more detailed Level 2 assessment. Fens Reservoir 50MCM (usable volume) (44.4MI/d) (FND29) and Lincolnshire Reservoir 50MCM (usable volume) (169MI/d) (RTN17) had Level 2 assessments completed as part of the RAPID Gate 2 submissions.

2.2 INNS Level 2 assessment

2.2.1 Overview

2.2.1.1 The assessment methodology is provided in Section 2.2.2 and more detailed individual option descriptions are presented in Sections 2.2.3 to 2.2.11.

2.2.2 Assessment methodology

2.2.2.1 The Level 2 assessment methodology utilised the SRO Aquatic INNS Risk Assessment Tool (SAI-RAT) (“the tool”) developed by APEM on behalf of the EA to quantify the INNS risk associated with those options not screened out by Level 1 screening (see Section 2.1). Whilst the Level 1 screening provided a coarse risk screening of those options likely to involve an INNS risk, the Level 2 assessment aims to quantify the INNS risk using more detailed option information, such as the precise location of transfer pathways and transfer volumes. The Level 2 assessment is based on the conceptual design information available at the time it is conducted.

2.2.2.2 A risk assessment is the process by which the level of risk caused by a hazard can be assessed, where hazards are anything that can cause harm. The level of risk is typically the combination of the chance and extent of the harm that could be caused. In the case of this tool, the hazard is the potential movement of INNS along key pathways, and the risk is the chance of that movement occurring combined with the extent of the harm this could cause. The tool takes a pragmatic pathway and source-pathway-receptor model approach to the assessment of INNS risk relating to assets and RWTs. The assessment of each pathway also incorporates information regarding known INNS distribution and sensitive habitats that may interact with a pathway, thereby quantifying a risk of INNS spreading to new areas and causing ecological harm.

2.2.2.3 The SAI-RAT was developed by APEM on behalf of the EA and takes the form of a Microsoft Excel spreadsheet, into which data and information about water transfer options are entered by the assessor to automatically generate an overall risk score. Risk scores are presented as a percentage of the highest potential score, with a higher percentage signifying an increased risk of introducing and transferring INNS¹¹. Individual component scores are likely to show which assets and transfers within an option present the highest risk of INNS transfer, and therefore which components are a priority for mitigation.

2.2.2.4 The SAI-RAT requires a significant amount of information about options to be entered in order to assess the level of risk. As the 50 supply-side options within the rdWRMP24 are in an early stage of conceptualisation, compared to a fully designed project (e.g. one seeking planning permission), the full range of information was not available. The tool is designed to allow for an assessor to select “Unknown” for a limited number of fields where information is unknown, producing an average score for that field; however, given the level of information required to complete an assessment, “Unknown” is not selectable for some fields. It is likely that a failure to complete fields in the absence of information would result in the general under-estimation of risk; therefore, an alternate approach was adopted for the assessment of INNS risk for supply-side options.

2.2.2.5 The method adopted for this INNS assessment was used to find a consistent method to populate the tool for the supply-side options with limited information available. This approach uses pre-determined default values for criteria where information is not yet available. Appropriate default ‘assumed values’ were agreed during a workshop in June 2022 (attended by water companies undertaking INNS risk assessments for rdWRMP24, and assessors working on their behalf), and subsequently agreed with the Environment Agency. These

¹¹ APEM, 2021. SRO Aquatic INNS Risk Assessment Tool (SAI-RAT) – User Guide. Produced on behalf of the Environment Agency.

assumed values are intended to represent the most likely or realistic input values where the tool does not allow for “Unknown” to be selected. The use of assumed values gives an estimation of a typical interaction with a pathway or asset, allowing a precautionary assessment of risk to be made in the absence of specific information. Assumed values are described and detailed in Appendix A.

2.2.2.6 The decision process for entering information into the tool is shown below:

1. For any given criterion, if information is available for the option, then this should be entered into the tool.
2. If information is not available, ‘Unknown’ should be selected if available. Selecting Unknown within the tool results in a median risk score being added for that criterion.
3. If ‘Unknown’ is not available to select, then an assumed value should be entered.

2.2.2.7 A brief overview of each option progressed to a Level 2 assessment is provided below and includes an option description and the rationale used during the assessment. Full details of the SAI-RAT input data and comments/assumptions are provided in Appendix B.

2.2.3 Marham Abstraction (7.9 MI/d up to 2039, 12.3 MI/d after 2039) (FND22)

2.2.3.1 This option would involve a raw water transfer of 7.9 MI/d up to 2039 and 12.3 MI/d after 2039 from the River Nar to Marham WTW via a 13.3km pipeline.

2.2.3.2 The SAI-RAT input data for these components are shown in Appendix B.1. No asset components relating to the option were identified.

2.2.4 Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12)

2.2.4.1 This option proposes increasing the utilisation of the existing surface water licence at Lincolnshire East Surface Water (13MI/d before 2039, 7.3MI/d after 2039), with an expected increase in abstraction from Louth Canal to the reservoir over a long-term average and at times of dry weather. This option includes upgrades to assets at Lincolnshire East Surface Water and an additional storm water storage and pumping station at Louth, and both have the potential to extend the existing sites to accommodate the infrastructure needed.

2.2.4.2 For the purpose of the Level 2 assessment, the option was considered to comprise the following assets: storm water storage, pumping station, and Covenham Reservoir. The RWT from Louth Canal to the reservoir and the abstraction from the reservoir were also considered.

2.2.4.3 The SAI-RAT input data for these components are shown in Appendix B.2.

2.2.5 South Humber Bank Non-potable desalination (60 MI/d) (SHB9)

2.2.5.1 This option proposes to construct a desalination treatment plant. A pumping station would transfer raw seawater from the marine intake inland to the desalination treatment plant. Water would be treated through reverse osmosis and chlorination, then transferred to a service reservoir or a treated water pumping station at Covenham WTW where the output will mix with the output of Covenham WTW onsite at Covenham.

2.2.5.2 For the Level 2 assessment, the option was assumed to comprise a RWT from the North Sea to the treatment plant, a return transfer to the North Sea, and a transfer to Covenham WTW. The assets were the treatment plant, a pumping station, a storage reservoir, and a reception chamber.

2.2.5.3 The SAI-RAT input data for these components are shown in Appendix B.3.

2.2.6 Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29)

2.2.6.1 The Fens Reservoir 50MCM (usable volume) (44.4MI/d) (FND29) option is comprised of the Fens Reservoir SRO (as assessed at Gate 2) and additionally includes alternate sources of supply. Therefore, the assessment included the Fens Reservoir SRO as described in the Gate 2 reporting (Environmental Appraisal Report (RAPID Gate Two) Fens Reservoir, November 2022), and an additional transfer route from Counter Drain (Nene) to the Fens Reservoir via the River Nene, Stanground Lock and the Middle Level system, before abstraction to the reservoir from the Sixteen Foot Drain. As the final details of additional sources of supply are in the development stage, specific details such as additional pumping station locations could not be considered. As a reasonable worst-case scenario, this assessment was based on the maximum likely raw water transfer volume via this route.

2.2.6.2 Six water transfer components were identified. The asset components were defined as:

- Inlet pumping station and water sampling building – for control of water supply to the proposed reservoir
- Fens Reservoir – the proposed reservoir
- Emergency drawdown pond – used to hold and slowly release water in testing of the emergency drawdown system
- Proposed Fens Reservoir WTW – for treatment of water abstracted from the Fens Reservoir
- Potable pumping station – for pumping of water to supply network
- Outlet pumping station – for distribution of potable water to the established distribution network
- Buried service reservoir – for storage of treated water
- Discharge pond – for low level outlet

2.2.6.3 The SAI-RAT input data for these components are shown in Appendix B.4.

2.2.7 Holland on Sea desalination (seawater) (26 MI/d) (EXS10)

2.2.7.1 This option proposes to increase the supply of water through the construction of a desalination treatment plant. A pumping station would transfer raw seawater from the marine intake inland to the desalination treatment plant. Water would be treated through reverse osmosis and chlorination, then transferred to a service reservoir or a treated water pumping station at Great Horkesley WTW.

2.2.7.2 For the Level 2 assessment, the option was assumed to comprise a raw water transfer from the North Sea to the treatment plant, and the treatment plant itself.

2.2.7.3 The SAI-RAT input data for these components are shown in Appendix B.5.

2.2.8 Bulk trade agreement - River Trent (7 MI/d) (LNC28)

2.2.8.1 This option proposes a raw water transfer. A pumping station would transfer raw water from Staythorpe Power Station to Hall WTW.

2.2.8.2 For the Level 2 assessment, the option was assumed to comprise a raw water transfer from Staythorpe Power Station to Hall WTW and a pumping station asset.

2.2.8.3 The SAI-RAT input data for these components are shown in Appendix B.6.

2.2.9 Mablethorpe desalination (seawater) (50 MI/d) (LNE6)

2.2.9.1 This option proposes to increase the supply of water through the construction of a desalination treatment plant. A pumping station would transfer raw seawater from the marine intake inland to

the desalination treatment plant. Water would be treated through reverse osmosis and chlorination, then transferred to a service reservoir or a treated water pumping station at Covenham WTW where the output will mix with the output of Covenham WTW onsite at Covenham.

2.2.9.2 For the Level 2 assessment, the option was assumed to comprise a RWT from the North Sea to the treatment plant, a return transfer to the North Sea, and a transfer to Covenham WTW. The assets were the treatment plant, a pumping station, a storage reservoir, and a reception chamber.

2.2.9.3 The SAI-RAT input data for these components are shown in Appendix B.7.

2.2.10 Bacton desalination (seawater) (25 MI/d) (NTB17)

2.2.10.1 This option proposes to increase the supply of water through the construction of a desalination treatment plant. A reception chamber would allow transfer of raw seawater via a pumping station from the marine intake to the desalination treatment plant. Water would be treated through reverse osmosis and chlorination, then transferred to a service reservoir or a treated water pumping station at Mousehold WTW.

2.2.10.2 The SAI-RAT input data for these components are shown in Appendix B.8.

2.2.11 Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17)

2.2.11.1 The Lincolnshire Reservoir 50MCM option involves the transfer of raw water from the River Trent to the proposed Lincolnshire Reservoir via the River Witham, and transfer to the WTW from the reservoir. The assessment is divided into two components and examines the risk associated with the transfer of water to and from the reservoir and the risk associated with the operation of assets which form part of this SRO.

2.2.11.2 Five water transfers were assessed. The asset components were defined as:

- Inlet pumping station and water sampling building – for control of water supply to the proposed reservoir
- Lincolnshire Reservoir – the proposed reservoir
- Emergency drawdown pond – used to hold and slowly release water in testing of the emergency drawdown system
- Proposed Lincolnshire Reservoir WTW – for treatment of water abstracted from the Lincolnshire Reservoir
- Potable pumping station – for pumping of water to supply network
- Outlet pumping station – for distribution of potable water to the established distribution network
- Buried service reservoir – for storage of treated water

2.2.11.3 The SAI-RAT input data for these components are shown in Appendix B.9.

2.3 In-combination effects

2.3.1.1 The additional in-combination effects of interacting SROs and supply-side options within Plan B were assessed. The overall process involved four stages:

1. Screening out of options assessed as being of No or Very Low risk during Level 1 assessment – as such options would not involve the movement of raw water likely to contain INNS to a new site.

2. Spatial analysis of the Low, Moderate and High risk options to determine connectivity between them, and to derive a list of connected option combinations requiring further assessment.
3. Qualitative (descriptive) screening assessment of the additional risk presented by any connected option combinations identified, to identify those options requiring a combined quantitative assessment using SAI-RAT.
4. Amalgamation of individual SAI-RAT assessments to generate an assessment for each connected option combination, where a risk of in-combination effects was identified.

2.4 Limitations and assumptions

2.4.1 Generic

- 2.4.1.1 The rdWRMP24 also includes a range of other activities, including demand management measures, reduction/closure of existing abstraction licences and the implementation of the next five years of activity under the WINEP. These activities are outside the scope of this INNS assessment. It should be noted that five WINEP options are being considered within the region, including river support, river restoration, investigations into eel passage, INNS pathways and INNS mitigation.
- 2.4.1.2 Desalination options were treated with the same methodology as for freshwater options, as saline or brackish environments may harbour invasive species with a tolerance for different salinity levels.
- 2.4.1.3 Assessments within this report are based on operational INNS transfer risk. Construction phase risks, which are not accounted for in the SAI-RAT, are best evaluated and mitigated on a case-by-case basis at a more advanced stage in option design and implementation. It is therefore assumed that construction phase impacts will be assessed at the appropriate phase of option design, that any construction phase impacts can be appropriately mitigated through implementation of biosecurity best practice.
- 2.4.1.4 Mitigation is not being considered at this stage due to the limited information available for the supply-side options. Mitigation for the SRO options is discussed within their respective RAPID Gate 2 reports^{12,13}.

2.4.2 Level 1 Screening

- 2.4.2.1 Level 1 screening assessments are based on operational INNS transfer risk in accordance with the focus on pathways outlined within the EA position statement on RWT¹⁰.
- 2.4.2.2 Where no information was available regarding the frequency of water transfers for these options, it was assumed transfer frequency would be regular/continuous, which may not provide a true reflection of the overall frequency of risk but represents a precautionary approach to the risk assessment.

2.4.3 Level 2 Assessment

- 2.4.3.1 Several input values within the risk assessment tool were not known at this stage of the design and therefore the value 'Unknown' was selected. Selecting Unknown within the tool results in a median risk score being added for that criterion.

¹² Environmental Appraisal Report (RAPID Gate 2) Fens Reservoir, Chapter 12 (Mott MacDonald, 2022)

¹³ Environmental Appraisal Report (RAPID Gate 2) South Lincolnshire Reservoir, Chapter 12 (Mott MacDonald, 2022)

- 2.4.3.2 As described in Section 2.2.2, agreed 'assumed values' (detailed in Appendix A) were used where 'Unknown' was not available to select as an option within the tool. For this purpose, it was assumed that staff visits to water treatment works, wastewater treatment sites and sewerage treatment works will be frequent. Whilst staff visits to reservoirs may still be frequent, maintenance activities are likely to be less so.
- 2.4.3.3 The overall level of risk indicated may be subject to change as further information about options become available and more representative input data can be entered into the SAI-RAT.

3 Results

3.1 Level 1 screening results

3.1.1.1

3.1.1.2 Table 3.1 below summarises the results from the Level 1 screening assessment of the Plan B options. The table does not include the Fens Reservoir 50MCM (usable volume) (44.4 MI/d) and Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) SROs (FND29 and RTN17, respectively), as they advanced straight to Level 2 assessment. The Ruthamford South Drought permit (2.07 MI/d) (RTS16) is also not included in the table as it is sourced from Anglian Water's adopted Drought Plan (2023)¹⁴ and had already been assessed as part of the environmental assessment process (SEA Objective 1.3 – To avoid introducing or spreading INNS) during the development and adoption of the Drought Plan.

3.1.1.3 Of the 47 supply-side options subject to a Level 1 screening, 17 were classed as presenting 'No additional risk', as these would involve only physical changes to infrastructure capacity; 23 options were determined to be of Very Low risk as these would involve the transfer of treated water. Six options were assessed as Low risk as these options would involve the transfer of raw water within a sealed pipeline and the residual risk would be related to potential pipe bursts.

3.1.1.4 The six supply-side options scoring 'Low' at Level 1 screening are:

- Marham Abstraction (7.9 MI/d up to 2039, 12.3 MI/d after 2039) (FND22)
- South Humber Bank Non-potable desalination (60 MI/d) (SHB9)
- Holland on Sea desalination (seawater) (26 MI/d) (EXS10)
- Bulk trade agreement - River Trent (7 MI/d) (LNC28)
- Mablethorpe desalination Seawater (50 MI/d) (LNE6)
- Bacton desalination (seawater) (25 MI/d) (NTB17)

3.1.1.5 One option was screened as being of Moderate risk, which was Lincolnshire East Surface Water enhancement (LNE12), as it may involve an increase in the transfer of raw water between waterbodies.

3.1.1.6 The full results on the Level 1 screenings of the 47 supply-side options are presented in Table 3.1.

Table 3.1: Summary of rdWRMP24 INNS Level 1 screening results.

Option ID	Description of Risk	Frequency	Severity	Risk Magnitude	Level 2 Assessment Required
Ruthamford South to Cambridge Water potable transfer (50 MI/d) (CAM4)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Lincolnshire East to	Physical transfer of treated water	Regular	Very Low	1 = Very Low	No

¹⁴ Drought Plan 2022 Final version (April 2022). Available at: [aws-drought-plan-2022.pdf \(anglianwater.co.uk\)](#)

Option ID	Description of Risk	Frequency	Severity	Risk Magnitude	Level 2 Assessment Required
Lincolnshire Central potable transfer (29 MI/d) (LNC25)	(between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.				
Essex South to Essex Central potable transfer (10 MI/d) (EXC3)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Backwash water recovery, Essex Central WTW (0.3 MI/d) (EXC7)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
Backwash water recovery, Fenland WTW (0.2 MI/d) (FND26)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
Marham Abstraction (7.9 MI/d up to 2039, 12.3 MI/d after 2039) (FND22)	Physical transfer of untreated water (between two locations assumed currently unconnected). Assumes any transferred INNS would be treated/removed at water treatment facility. Additional risks from pipeline washout, pipeline bursts, wash water discharge, overflows, and sludge disposal.	Regular	Low	3 = Low	Yes
Lincolnshire Central WTW Upgrade (3.2 MI/d) (LNC30)	No risk of transfer/movement of invasive or non-native species with this option type.	None	None	No additional risk	No
Lincolnshire East Groundwater (7.5 MI/d) (LNE11)	No risk of transfer/movement of invasive or non-native species with this option type.	None	None	No additional risk	No

Option ID	Description of Risk	Frequency	Severity	Risk Magnitude	Level 2 Assessment Required
	Assumes sufficient treatment at existing facilities.				
Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12)	Physical transfer of untreated water (between two locations assumed currently connected). Assumes any transferred INNS would be treated/removed at water treatment facility.	Regular	Medium	4 = Moderate	Yes
Lincolnshire Retford and Gainsborough WTW Upgrade (0.72 MI/d) (LNN3)	Very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not increase the risk of INNS transfer.	Regular	Very Low	1 = Very Low	No
Norwich and the Broads to Aylsham potable transfer (3 MI/d) (NAY1)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Fenland to Norfolk Bradenham potable transfer (50 MI/d) (NBR6)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Suffolk Thetford to Norfolk East Harling potable transfer (5 MI/d) (NEH3)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Norfolk East Harling to Norfolk Harleston potable transfer (5 MI/d) (NHL4)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No

Option ID	Description of Risk	Frequency	Severity	Risk Magnitude	Level 2 Assessment Required
Norfolk Bradenham to Norwich and the Broads potable transfer (20 MI/d) (NTB10)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Ruthamford South surface water enhancement (9.5 MI/d up to 2040, 6 MI/d after 2040) (RTS21)	No risk of transfer/movement of invasive or non-native species with this option type.	Regular	None	No additional risk	No
Suffolk East WTW Upgrade (1.7 MI/d) (SUE23)	No risk of transfer/movement of invasive or non-native species with this option type	Regular	None	No additional risk	No
Suffolk Sudbury to East Suffolk potable transfer (10 MI/d) (SUE24)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Backwash water recovery, Suffolk East WTW (0.05 MI/d) (SUT6)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
Cambridge to Suffolk West Cambs potable transfer (50 MI/d) (SWC8)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Suffolk West & Cambs groundwater relocation (2.6 MI/d) (SWC13)	Very limited risk as the source water is likely to be entirely free of INNS. It is assumed that groundwater is free of INNS, and that accessing it will not increase the risk of INNS transfer.	Regular	Very Low	1 = Very Low	No
Backwash water recovery,	No risk of transfer/movement of invasive or non-	None	None	No additional risk	No

Option ID	Description of Risk	Frequency	Severity	Risk Magnitude	Level 2 Assessment Required
Essex Central WTW (0.3 MI/d) (EXS7)	native species with this option type. Assumes sufficient treatment at existing facilities.				
Backwash water recovery, Norfolk Bradenham WTW (0.2 MI/d) (NBR9)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
North Norfolk Coast WTW backwash water recovery (0.18 MI/d) (NNC5)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
North Norfolk Coast WTW backwash water recovery (0.2 MI/d) (NNC6)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
Backwash water recovery, Lincolnshire East WTW (1.3 MI/d) (LNE3)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
Backwash water recovery, Norfolk Aylsham WTW (0.75 MI/d) (NAY4)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
Backwash water recovery, Norfolk East Dereham WTW (0.1 MI/d) (NED3)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
Backwash water recovery, Norfolk Harleston WTW (0.2 MI/d) (NHL7)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No

Option ID	Description of Risk	Frequency	Severity	Risk Magnitude	Level 2 Assessment Required
Backwash water recovery, Norfolk Aylsham WTW (0.1 MI/d) (NAY5)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
Colchester Reuse direct to Ardleigh Reservoir (no additional treatment) (11.4MI/d up to 2039, 13.9MI/d after 2039) (EXS19)	Physical transfer of treated water between two locations assumed currently unconnected. Assumes treated water will be free of INNS. Includes short raw water transfer from Ardleigh Reservoir to Ardleigh WTW, however, limited INNS risk as the WTW is on the reservoir site.	Regular	Very Low	1 = Very Low	No
Norfolk Bradenham to Suffolk Thetford potable transfer (15 MI/d) (SUT5)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Backwash water recovery, Suffolk East WTW (0.17MI/d) (SUE25)	No risk of transfer/movement of invasive or non-native species with this option type. Assumes sufficient treatment at existing facilities.	None	None	No additional risk	No
Lincolnshire Central to Lincolnshire Retford and Gainsborough potable transfer (3MI/d) (LNN1)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Norfolk Bradenham to Norfolk East Dereham potable transfer (10 MI/d) (NED2)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No

Option ID	Description of Risk	Frequency	Severity	Risk Magnitude	Level 2 Assessment Required
Norfolk East Dereham to North Norfolk Coast potable transfer (10 MI/d) (NNC4)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
South Humber Bank Non-potable desalination (60 MI/d) (SHB9)	Potential for pipe bursts to cause water to be released to the environment (creating pathway for the transfer of INNS).	Regular	Low	3 = Low	Yes
Holland on Sea desalination (seawater) (26 MI/d) (EXS10)	Potential for pipe bursts to cause water to be released to the environment (creating pathway for the transfer of INNS).	Regular	Low	3 = Low	Yes
Ruthamford North to Bourne potable transfer (20 MI/d) (LNB1)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Ruthamford North to Lincolnshire Central potable transfer (20 MI/d) (LNC16)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Bulk trade agreement - River Trent (7MI/d) (LNC28)	Physical transfer of untreated water (between two locations assumed currently unconnected). Assumes any transferred INNS would be treated/removed at water treatment facility. Additional risks from pipeline washout, pipeline bursts, wash water discharge, overflows, and sludge disposal.	Regular	Low	3 = Low	Yes

Option ID	Description of Risk	Frequency	Severity	Risk Magnitude	Level 2 Assessment Required
Mablethorpe desalination Seawater (50 MI/d) (LNE6)	Potential for pipe bursts to cause water to be released to the environment (creating pathway for the transfer of INNS).	Regular	Low	3 = Low	Yes
Bacton desalination (seawater) (25 MI/d) (NTB17)	Potential for pipe bursts cause water to be released to the environment (creating pathway for the transfer of INNS).	Regular	Low	3 = Low	Yes
Norwich and the Broads to Norfolk Wymondham potable transfer (5 MI/d) (NWY1)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Lincolnshire Central to Ruthamford North potable transfer (75 MI/d) (RTN30)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Ruthamford North to Ruthamford South potable transfer (75 MI/d) (RTS24)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No
Ruthamford South to Ruthamford Central potable transfer (20 MI/d) (RTC3)	Physical transfer of treated water (between two locations assumed currently unconnected). No INNS risk as treated water will be free from INNS.	Regular	Very Low	1 = Very Low	No

3.2 Level 2 assessment results

3.2.1 Overview

3.2.1.1 The nine supply-side options requiring Level 2 assessment are presented in Table 3.2.

3.2.2 Supply-side options and SROs

- 3.2.2.1 The Level 2 INNS risk assessment results for nine the supply-side options are shown in Table 3.2. Also shown in Table 3.2 are the results for the seven options assessed at Level 1, excluding the two SROs which bypassed Level 1 assessment and are listed as N/A within the table.
- 3.2.2.2 As detailed in Section 2, Level 1 screenings and Level 2 assessments differ in methodology and risk level scoring, and the Level 2 assessments are based on a more detailed understanding of each option. The additional details used in a Level 2 assessment may therefore mean that the more detailed assessment results in an apparent lower or higher risk than indicated by the initial screening. Furthermore, the Level 2 assessment produces an overall score based on the average of its constituent RWT and asset components. Therefore, the risk score generated by individual components may be masked by this averaging; for example, the relatively high-risk score associated with a reservoir may be averaged with lower risk infrastructure (e.g., pipelines, sealed service reservoirs). In understanding the risk presented by an option, the risk scores of individual components are examined alongside the overall risk score.
- 3.2.2.3 Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29) and Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17) assessment results from the Rapid Gate Two assessments^{12,13} are also shown below, however, it should be noted that these scores do not consider any engineering interventions that may be required as mitigation to prevent the spread of INNS.

Table 3.2: Level 2 INNS risk assessment results for supply-side options.

Option ID	Option Name	Level 1 Risk Magnitude	Asset	Asset score	RWT component	RWT score	Overall risk score
FND22	Marham Abstraction (7.9 MI/d up to 2039, 12.3 MI/d after 2039)	Low	N/A	N/A	Pipeline	39.23%	39.23%
LNE12	Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039)	Moderate	Storm water storage	10.52%	Canal pipeline to reservoir	42.63%	24.44%
			Pumping station	10.52%	WTW intake pipeline	34.10%	
SHB9	South Humber Bank Non-potable desalination (60 MI/d)	Low	Storage reservoir	12.92%	Pipeline to desalination plant	53.48%	30.71%
			Reception chamber	12.92%	Pipeline to North Sea	43.48%	
			Desalination plant	31.61%	Pipeline to Covenham	32.70	
			Pumping station	15.32%			
EXS10	Holland on Sea desalination (seawater) (26 MI/d)	Low	Desalination plant	29.81%	Pipeline	49.35%	39.58%

Option ID	Option Name	Level 1 Risk Magnitude	Asset	Asset score	RWT component	RWT score	Overall risk score
LNC28	Bulk trade agreement - River Trent (7 MI/d)	Low	Pumping station	14.12%	Pipeline	44.48%	29.30%
LNE6	Mablethorpe desalination Seawater (50 MI/d)	Low	Storage reservoir	12.92%	Pipeline to desalination plant	53.48%	30.71%
			Reception chamber	12.92%	Pipeline to North Sea	43.48%	
			Desalination plant	31.61%	Pipeline to Covenham	32.70	
			Pumping station	15.32%			
NTB17	Bacton desalination (seawater) (25 MI/d)	Low	Desalination plant	29.21%	Intake pipeline to reception chamber	56.00%	26.02%
			Intake pumping station	12.92%	Outfall pipeline from reception chamber	40.50%	
			Intake reception chamber	12.92%	Intake reception chamber to desalination plant	27.60%	
			Desalination plant pumping station	12.92%	Desalination plant to outfall reception chamber	29.10%	
			Service reservoir	12.92%	Transfer pipeline	28.83%	
			Outfall reception chamber	12.92%			
FND29	Fens Reservoir 50MCM (usable volume) (44.4 MI/d)	N/A	Inlet pumping station	11.84	Ouse River to Fens Reservoir	50.25	35.23
			Reservoir	56.55	River Delph (Ouse Washes) to Fens Reservoir	44.75	
			Potable pumping station	14.24	Reservoir to discharge pond	36.00	

Option ID	Option Name	Level 1 Risk Magnitude	Asset	Asset score	RWT component	RWT score	Overall risk score
			Emergency drawdown pond	23.50	Emergency Drawdown (Forty Foot Drain)	49.75	
			Discharge pond to low level outlet	39.06	Spillway	47.00	
			Proposed Fens Reservoir WTW	15.81			
			Buried service reservoir	15.38	Counter Drain (Nene) to Fens Reservoir	53.88	
			Outlet pumping station	11.84			
RTN17	Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d)	N/A	Buried service reservoir	7.87	River Trent to River Witham	44.63	30.11
			Emergency drawdown pond	18.21	River Witham to Lincolnshire Reservoir	45.00	
			Inlet pumping station and water sampling building	14.24	Lincolnshire Reservoir to discharge pond	30.50	
			Outlet pumping station	13.04	Lincolnshire Reservoir to spillway	41.50	
			Potable pumping station	9.44	EDD to SFFD tributary	42.25	
			Proposed Lincolnshire Reservoir WTW	16.17			
			Lincolnshire Reservoir	57.09			

3.3 In-combination effects

3.3.1.1 Following stage 1 of the process described in Section 2.3, the following SRO, and supply-side Plan B options were included in the in-combination effects assessment:

- Marham Abstraction (7.9 MI/d up to 2039, 12.3 MI/d after 2039) (FND22)
- Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12)
- South Humber Bank Non-potable desalination (60 MI/d) (SHB9)
- Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29)
- Holland on Sea desalination (seawater) (26 MI/d) (EXS10)
- Bulk trade agreement - River Trent (7 MI/d) (LNC28)
- Mablethorpe desalination Seawater (50 MI/d) (LNE6)
- Bacton desalination (seawater) (25 MI/d) (NTB17)
- Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17)

3.3.1.2 Following stage 2 of the process described in Section 2.3 (the connectivity assessment), the following option combinations were identified as requiring assessment of in-combination effects.

- Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12) and South Humber Bank Non-potable desalination (60 MI/d) (SHB9)
- Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12) and Mablethorpe desalination Seawater (50 MI/d) (LNE6)
- South Humber Bank Non-potable desalination (60 MI/d) (SHB9) and Mablethorpe desalination Seawater (50 MI/d) (LNE6)
- Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12), South Humber Bank Non-potable desalination (60 MI/d) (SHB9) and Mablethorpe desalination Seawater (50 MI/d) (LNE6)
- Bulk trade agreement - River Trent (7 MI/d) (LNC28) and Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17)

3.3.1.3 The qualitative screening (stage 3) for each option combination is shown in Table 3.3 below. None of the option combinations identified were suggested for further assessment using the SAI-RAT (stage 4).

Table 3.3: In-combination risk assessment results

Option combination	Description of additional risks/impacts associated with option combination	Qualitative screening outcome	Overall SAI-RAT Risk Score (%)
Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12) and South Humber Bank Non-potable desalination (60 MI/d) (SHB9)	LNE12 involves the abstraction of raw water from Covenham Reservoir to supply Covenham WTW. Option SHB9 involves the transfer of desalinated water to the same receptor (Covenham WTW). Once treated through the desalination process (lamella clarifiers and rapid gravity filters, ultrafiltration, two-stage reverse osmosis, remineralisation, and de chlorination), water from SHB9 that will enter the option's transfer pipeline would therefore not likely represent an INNS transfer risk. As a result, the in-combination INNS transfer risk with LNE12 is deemed negligible.	No likely additional risk from in-combination effects	N/A – further assessment not required
Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12) and Mablethorpe	LNE12 involves the abstraction of raw water from Covenham Reservoir to supply Covenham WTW. Option LNE6 involves the transfer of potable water to Covenham WTW. As a result, the in-combination INNS transfer risk with LNE6 is deemed negligible.	No likely additional risk from in-combination effects	N/A – further assessment not required

Option combination	Description of additional risks/impacts associated with option combination	Qualitative screening outcome	Overall SAI-RAT Risk Score (%)
desalination Seawater (50 MI/d) (LNE6)			
South Humber Bank Non-potable desalination (60 MI/d) (SHB9) and Mablethorpe desalination Seawater (50 MI/d) (LNE6)	These options utilise the same source and receptor and involve parallel transfer routes. SHB9 is a treated desalinated water transfer (non-potable) and LNE6 is the transfer of potable water. As a result, the in-combination INNS transfer risk of these two options is deemed negligible.	No likely additional risk from in-combination effects	N/A – further assessment not required
Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12), South Humber Bank Non-potable desalination (60 MI/d) (SHB9) and Mablethorpe desalination Seawater (50 MI/d) (LNE6)	The three transfers involve the same receptor (Covenham WTW). LNE12 is a raw water abstraction, whilst SHB9 is a desalinated (treated to non-potable standard) transfer, and LNE6 is a potable water transfer (therefore negligible INNS risk). Once treated through the desalination process (lamella clarifiers and rapid gravity filters, ultrafiltration, two-stage reverse osmosis, remineralisation, and de chlorination), water from SHB9 that will enter the option's transfer pipeline would therefore not likely represent an INNS transfer risk. As a result, the in-combination INNS transfer risk of these three options is deemed negligible.	No likely additional risk from in-combination effects	N/A – further assessment not required
Bulk trade agreement - River Trent (7 MI/d) (LNC28) and Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17)	LNC28 and RTN17 both abstract from the same source (River Trent, ~10km apart). Although both options would transfer water away from a similar source location, it is considered that the option combination would not cause a greater INNS transfer risk than the individual options.	No likely additional risk from in-combination effects	N/A – further assessment not required

4 Conclusions and Recommendations

4.1 Conclusions

4.1.1 Level 1 screenings

4.1.1.1 The following is a summary of the conclusions from the Level 1 screening:

- 47 of the 50 supply-side options within the rdWRMP24 were screened to assess the risk of spreading INNS.
 - 17 of the 47 assessed supply-side options were classed as “No additional risk” and therefore did not require a Level 2 assessment.
 - 23 of the 47 assessed supply-side options were assigned a Very Low risk level and therefore did not require a Level 2 assessment.
- Seven of the 47 options assessed at Level 1 screening were progressed to a Level 2 assessment as they scored a risk level of Low, Moderate, or High:
 - The options Marham Abstraction (7.9 MI/d up to 2039, 12.3 MI/d after 2039) (FND22), South Humber Bank Non-potable desalination (60 MI/d) (SHB9), Holland on Sea desalination (seawater) (26 MI/d) (EXS10), Bulk trade agreement - River Trent (7 MI/d) (LNC28), Mablethorpe desalination Seawater (50 MI/d) (LNE6), Bacton desalination (seawater) (25 MI/d) (NTB17) and scored a risk magnitude of Low.
 - Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12) was assigned a Moderate risk level.

4.1.2 Level 2 assessments

4.1.2.1 In addition to the seven options progressing to Level 2 assessment following a Level 1 assessment, the two SRO options, Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29) and Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17), automatically progressed to a Level 2 assessment.

4.1.2.2 The following results have been drawn from the nine Level 2 assessments:

- The overall risk and maximum component risk scores of the assessed supply-side options are as follows:
 - Marham Abstraction (7.9 MI/d up to 2039, 12.3 MI/d after 2039) (FND22) option generated a maximum and overall score risk score of 39.23%, with only one RWT component involved, and the primary risk of INNS transfer by raw water.
 - Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12) option generated an overall risk score of 24.44%, with a maximum component risk score of 42.63% for the transfer from the Louth Canal to Covenham Reservoir due to potential INNS transfer via raw water.
 - South Humber Bank Non-potable desalination (60 MI/d) (SHB9) option scored 30.71% overall, with the maximum component score of 53.48% generated by the intake pipeline, due to a risk of spreading INNS to aquatic habitats along the intake pipeline route.
 - Holland on Sea desalination (seawater) (26 MI/d) (EXS10) option scored 39.58% overall, with a maximum component risk score of 49.35% for the intake pipeline element, due to a risk of spreading INNS to aquatic habitats along the intake pipeline route.

- Bulk trade agreement - River Trent (7 MI/d) (LNC28) option scored 29.30% overall, and the highest scoring component was the pipeline with a score of 44.48%, with the risk of INNS transfer via raw water.
- Mablethorpe desalination Seawater (50 MI/d) (LNE6) option scored 30.71% overall, with the maximum component score of 53.48% generated by the intake pipeline, due to a risk of spreading INNS to aquatic habitats along the intake pipeline route.
- Bacton desalination (seawater) (25 MI/d) (NTB17) option scored 26.02% overall, with the highest component risk score of 56.00% given to the intake to reception pit pipeline, due to a risk of spreading INNS along the pipeline route from a pipe burst.
- Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29) scored 35.23% overall. The highest Risk Scores for transfer components were the Counter Drain (Nene) to Fens Reservoir (53.88%), River Great Ouse to Fens Reservoir transfer (50.25%), the Emergency Draw Down (EDD) to Forty Foot Drain (49.75%), and the spillway (47.00%) due to the risk of INNS transfer via raw water. The highest asset Risk Score was for the Fens Reservoir itself at 56.55%, as this is a potential new habitat for INNS subject to raw water input and recreational and maintenance visits.
- Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17) Overall Risk Score was 30.11%. The highest Risk Scores for transfer components were the River Witham to Lincolnshire Reservoir transfer (45.00%) and the River Trent to River Witham transfer (44.63%), due to the risk of INNS transfer via raw water. The highest asset Risk Score was for the Lincolnshire Reservoir itself at 57.09%, as this is a potential new habitat for INNS subject to raw water input and recreational and maintenance visits.

4.1.2.3 The greatest risks identified with the assessed options are spreading INNS through new pathways – due to the construction of new reservoirs and their associated water transfers, and the transfer of raw water. Options with a higher score represent a greater risk of transferring INNS and therefore should be a priority for mitigation – as in accordance with the EA position statement on raw water transfers¹⁰, INNS should not be spread through new transfer pathways. Individual option components with the highest scores are likely to represent the greatest INNS transfer risk within an option. In interpreting assessment scores, consideration should be given to the relative level of risk scores for transfers and assets, for example the transfer of treated water from a desalination plant would likely pose a negligible INNS transfer risk due to the level of treatment.

4.1.3 In-combination effects for the rdWRMP24

4.1.3.1 The potential for in-combination INNS effects across the option combinations in the BVP (Plan B) identified was deemed to be Very Low and therefore these were not recommended for further assessment. Therefore, at the plan stage, no in-combination effects that would increase the risk of INNS transfer are expected for the BVP presented in Anglian Water's rdWRMP24.

4.1.4 Recommendations and Conclusions

4.1.4.1 It is recommended that the INNS risk ratings are revised using the SAI-RAT for options which are taken forward as more information becomes available, including information on biosecurity measures.

4.1.4.2 Appropriate mitigation of INNS risk should be considered for all options which are progressed. Options for which a Level 2 assessment has resulted in higher percentage score risk will be of the highest priority for mitigation, as INNS should not be spread by new transfers. To ensure that legislative requirements are met, the appropriate level of mitigation is best assessed on an individual option basis, as levels of mitigation necessary to reduce INNS risk in catchments with existing hydrological connections will likely be different to catchments without such existing connections.

- 4.1.4.3 For options that are likely to be implemented, the INNS risks associated with the construction phase should also be considered and mitigated through best practice measures.
- 4.1.4.4 It is acknowledged that additional cumulative effects arising from the interaction of options may arise, such as from successive water transfers or risks due to increased use of assets. It is therefore advised that for options being implemented, further consideration is given on a case-by-case basis regarding the potential for cumulative effects through interaction with other options being taken forward. These updated assessments should account for both inter- and intra-regional effects.

A. Assumed Values for SAI-RAT

A.1.1 With respect to staff visits and maintenance activities at assets, the SAI-RAT requires an estimate of frequency to be entered. The options are the same for each criterion, as follows:

- 0 – never
- 0.5 – rarely (once every 2 years)
- 1 – annually
- 1.5 – monthly
- 2 – weekly

A.1.2 It is likely that the frequency of such visits would vary according to asset type; therefore the 'assumed value' for each activity and asset type within the SAI-RAT is shown in Table A.1 below.

Table A. 1: Proposed assumed values for staff visit and maintenance activities at assets.

Asset type	Visit or maintenance activity	Assumed value (frequency)	Comment/rationale
Reservoir	Staff site visit (not entering water)	2 (weekly)	Assumes visit frequency should be at least weekly
	Staff site visit entering or in contact with raw water	2 (weekly)	Assumes visit frequency should be at least weekly
	Road vehicle site visit	2 (weekly)	Aligned with staff visits, assuming arrival is most likely to be by road vehicle
	Maintenance not entering water	1 (annually)	Assumes maintenance visits would be relatively infrequent
	Maintenance in water	1 (annually)	Assumes maintenance visits within water would be relatively infrequent
	Transfer of waste sludge to land	0 (never)	Sludge removal not associated with this asset type
Water treatment works	Staff site visit (not entering water)	2 (weekly)	Assumes visit frequency should be at least weekly
	Staff site visit entering or in contact with raw water	2 (weekly)	Assumes visit frequency should be at least weekly
	Road vehicle site visit	2 (weekly)	Aligned with staff visits, assuming arrival is most likely to be by road vehicle
	Maintenance not entering water	2 (weekly)	Assumes maintenance would need to be at least weekly
	Maintenance in water	2 (weekly)	Assumes maintenance would need to be at least weekly
	Transfer of waste sludge to land	1 (annually)	Sludge removal occasionally likely to be needed
Sealed water tank	Staff site visit (not entering water)	1.5 (monthly)	Assumes visit frequency should be at least monthly

Asset type	Visit or maintenance activity	Assumed value (frequency)	Comment/rationale
	Staff site visit entering or in contact with raw water	0 (never)	Sealed water tanks are likely to be used to store treated rather than raw water
	Road vehicle site visit	1.5 (monthly)	Aligned with staff visits, assuming arrival is most likely to be by road vehicle
	Maintenance not entering water	1.5 (monthly)	Assumes relatively frequent maintenance
	Maintenance in water	0 (never)	Maintenance should not involve contact with treated water
	Transfer of waste sludge to land	0 (never)	Asset type should not generate sludge
Wastewater treatment site	Staff site visit (not entering water)	2 (weekly)	Assumes visit frequency should be at least weekly
	Staff site visit entering or in contact with raw water	2 (weekly)	Assumes visit frequency should be at least weekly
	Road vehicle site visit	2 (weekly)	Aligned with staff visits, assuming arrival is most likely to be by road vehicle
	Maintenance not entering water frequency	2 (weekly)	Assumes maintenance would need to be at least weekly
	Maintenance in water frequency	2 (weekly)	Assumes maintenance would need to be at least weekly
	Transfer of waste sludge to land frequency	0.5 (rarely)	Sludge removal occasionally likely to be needed
Sewerage treatment works	Staff site visit (not entering water) frequency	2 (weekly)	Assumes visit frequency should be at least weekly
	Staff site visit entering or in contact with raw water frequency	2 (weekly)	Assumes visit frequency should be at least weekly
	Road vehicle site visit frequency	2 (weekly)	Aligned with staff visits, assuming arrival is most likely to be by road vehicle
	Maintenance not entering water frequency	2 (weekly)	Assumes maintenance would need to be at least weekly
	Maintenance in water frequency	2 (weekly)	Assumes maintenance would need to be at least weekly
	Transfer of waste sludge to land frequency	0.5 (rarely)	Sludge removal occasionally likely to be needed

A.1.3 Assets also require assessment for recreational use within the SAI-RAT. In practice, four of the five asset types included (water treatment works, sealed water tank, wastewater treatment site, sewerage treatment works) are unlikely to be accessible for recreational use or by wildlife. Therefore, these asset types should be assigned a value of 0 ('never') for all recreational activities.

A.1.4 Reservoirs are frequently host to recreational activities and accessible by wildlife, though the extent of this is likely to be variable. In the potential absence of available information, the proposed assumed values for activities relating to reconstruction or wildlife are shown in Table A.2 below.

Table A. 2: Proposed assumed values for recreational activities at assets.

Asset	Asset reconstruction or associated activity	Assumed value (frequency)	Comment/rationale
Reservoir	Angling equipment	2 (weekly)	Angling is a relatively common activity at reservoirs. If permitted at a reservoir, likely to occur frequently
	Live bait	0 (never)	Live bait is not typically allowed at reservoirs
	Fish stocking	1 (annually)	Considered a typical stocking frequency
	Large vessels (over 28ft)	0.5 (rarely)	Vessels of this large size are rarely likely to be brought onto a reservoir
	Small vessels (under 28ft)	2 (weekly)	Boating is a relatively common activity at reservoirs. If permitted at a reservoir, likely to occur frequently
	Water sports equipment (Standup paddleboards, canoe, kayaks)	2 (weekly)	Boating is a relatively common activity at reservoirs. If permitted at a reservoir, likely to occur frequently
	Water safety equipment (temporary moorings, jetties, inflatables, buoys)	0.5 (rarely)	It is considered that such equipment is rarely brought to a reservoir
	Mammals/waterfowl on-site	2 (weekly)	If a reservoir is accessible to mammals and waterfowl, they are likely to access the asset frequently
	Reconstructional walker/jogger/runner	2 (weekly)	Relatively common activities at reservoirs. If reservoir is accessible for this purpose, likely to occur frequently
Water treatment works	Angling equipment	0 (never)	Angling not expected at these asset types
Sealed water tank Wastewater Treatment site Sewerage Treatment works	Live bait	0 (never)	Angling not expected at these asset types
	Fish stocking	0 (never)	Angling not expected at these asset types
	Large vessels (over 28ft)	0 (never)	Boating not expected at these asset types
	Small vessels (under 28ft)	0 (never)	Boating not expected at these asset types
	Water sports equipment (SUPs, Canoe, Kayaks)	0 (never)	Water sports not expected at these asset types
	Water safety equipment (temporary moorings, jetties, inflatables, buoys)	0 (never)	Associated activities not expected at these asset types
	Mammals/waterfowl on-site	0 (never)	Mammals/waterfowl unlikely to access these asset types
	Reconstructional walker/jogger/runner	0 (never)	Walking/jogging/running not expected at these asset types

B. SAI-RAT Input Data

B.1 Marham Abstraction (7.9 MI/d up to 2039, 12.3 MI/d after 2039) (FND22)

Table B.1: SAI-RAT input data for Marham abstraction relocation (FND22)

Criterion	River Nar to Marham WTW	Assumptions/comments
Source Name	River Nar	N/A
Source Management Catchment	North West Norfolk Management Catchment	N/A
Source Operational Catchment	North West Norfolk Rivers Operational Catchment	N/A
Source water body ID	GB105033047792	N/A
Source Type	River	N/A
Number of RWT inputs into source	Unknown	Unknown value
Pathway Type	Pipeline	N/A
Receptor Name	Marham WTW	N/A
Receptor Management Catchment	North West Norfolk Management Catchment	N/A
Receptor Operational Catchment	North West Norfolk Rivers Operational Catchment	N/A
Receptor water body	GB105033047662	N/A
Receptor Type	Water treatment works	N/A
Isolated Receptor Catchment	No	N/A
Volume of Water	6-50 MI/d	N/A
Frequency of Operation	Unknown	Unknown value
Transfer Distance (km)	10.1-15	N/A
Washout/maintenance points outside of catchments	Unknown	Unknown value
Details of washout/maintenance points	Unknown	Unknown value
Source Navigable	No	N/A
Pathway Navigable	No	N/A
Angling at Source	Unknown	Local angling club information not available
Angling on Pathway	No	N/A
Water sports at Source	Casual use by individuals/clubs	N/A
Water sports on Pathway	Casual use by individuals/clubs	N/A
Presence of high priority INNS Source	Known to be present	N/A
Presence of high priority INNS Pathway	Known to be present	INNS records up to date as of 19/05/2023
Details of INNS present	Canadian waterweed (<i>Elodea canadensis</i>), Nuttall's Waterweed (<i>Elodea nuttalli</i>), Feral goldfish (<i>Carassius auratus</i>)	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern
Highest order site designation Receptor	None	N/A

Criterion	River Nar to Marham WTW	Assumptions/comments
Presence of priority habitat pathway	Known to be present	N/A
Presence of priority habitat receptor	Known to be present	N/A
Details of priority habitat present	River Nar SSSI, coastal and floodplain grazing marsh, deciduous woodland, traditional orchard, good quality semi-improved grassland	N/A
Other existing connections between source and receptor	Unknown	Unknown value
Details of other existing connections	N/A	N/A

B.2 Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12)

Table B.2.1: SAI-RAT input data for RWT for Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12)

Criterion	Louth Canal to Covenham Reservoir	Covenham Reservoir to Covenham WTW	Assumptions/comments
Source Name	Louth Canal abstraction	Covenham Reservoir	N/A
Source Management Catchment	Louth Grimsby and Ancholme Management Catchment	Louth Grimsby and Ancholme Management Catchment	N/A
Source Operational Catchment	Becks Northern Operational Catchment	Becks Northern Operational Catchment	N/A
Source water body ID	GB104029061990	GB30432209	N/A
Source Type	Canal	Offline water body	N/A
Number of RWT inputs into source	Unknown	Unknown	Unknown value
Pathway Type	Pipeline	Pipeline	It is assumed a pipeline will carry abstracted water reservoir
Receptor Name	Covenham Reservoir	Covenham WTW	N/A
Receptor Management Catchment	Louth Grimsby and Ancholme Management Catchment	Louth Canal abstraction	N/A
Receptor Operational Catchment	Becks Northern Operational Catchment	Louth Grimsby and Ancholme Management Catchment	N/A
Receptor water body	GB30432209	Becks Northern Operational Catchment	N/A
Receptor Type	Offline water body	Water treatment works	N/A
Isolated Receptor Catchment	No	No	N/A
Volume of Water	6-50 MI/d	6-50 MI/d	N/A
Frequency of Operation	Unknown	Unknown	Unknown value
Transfer Distance (km)	1.1-5	>1km	N/A
Washout/maintenance points outside of catchments	Unknown	Unknown	Unknown value

Criterion	Louth Canal to Covenham Reservoir	Covenham Reservoir to Covenham WTW	Assumptions/comments
Details of washout/maintenance points	N/A	N/A	Unknown value
Source Navigable	No	No	N/A
Pathway Navigable	No	No	N/A
Angling at Source	Unknown	Unknown	Local angling club information not available
Angling on Pathway	No	No	N/A
Water sports at Source	Casual use by individuals/clubs	Local events	N/A
Water sports on Pathway	No	No	N/A
Presence of high priority INNS Source	Known to be present	Known to be present	N/A
Presence of high priority INNS Pathway	Not recorded	Not recorded	INNS records up to date as of 26/07/2023
Details of INNS present	Signal crayfish (<i>Pacifastacus leniusculus</i>) Nuttall's pondweed (<i>Elodea nuttallii</i>) Canadian pondweed (<i>Elodea canadensis</i>) Water fern (<i>Azolla filiculoides</i>) Feral goldfish (<i>Carassius auratus</i>) Common carp (<i>Cyprinus carpio</i>) Floating pennywort (<i>Hydrocotyle ranunculoides</i>) Japanese knotweed (<i>Fallopia japonica</i>) Giant hogweed (<i>Heracleum mantegazzianum</i>) Himalayan balsam (<i>Impatiens glandulifera</i>)	Nuttall's pondweed (<i>Elodea nuttallii</i>) Canadian pondweed (<i>Elodea canadensis</i>) Water fern (<i>Azolla filiculoides</i>)	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern
Highest order site designation Receptor	None	None	N/A
Presence of priority habitat pathway	Known to be present	Not known to be present	N/A
Presence of priority habitat receptor	Known to be present	Not known to be present	N/A
Details of priority habitat present	Deciduous woodland Coastal and floodplain grazing marsh Good quality semi-improved grassland	N/A	N/A
Other existing connections between source and receptor	Unknown	Unknown	Unknown value
Details of other existing connections	N/A	N/A	N/A

Table B.2.2: SAI-RAT input data for assets for Lincolnshire East Surface Water (13 MI/d before 2039, 7.3 MI/d after 2039) (LNE12)

Criterion	LNE12 Storm water storage	LNE12 Pumping station	Assumptions/ comments
Asset type	Storm water storage	Pumping station	N/A
Asset size	Unknown	Unknown	N/A
Existing high impact INNS records on site/area of proposed site	Known to be present	Known to be present	INNS records up to date as of 09/09/2022
Details of high impact INNS	Canadian waterweed (<i>Elodea canadensis</i>), water fern (<i>Azolla filiculoides</i>), Nuttall's waterweed (<i>Elodea nuttallii</i>)	Canadian waterweed (<i>Elodea canadensis</i>), water fern (<i>Azolla filiculoides</i>), Nuttall's waterweed (<i>Elodea nuttallii</i>)	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern
Existing Priority Habitats on site	Not known to be present	Not known to be present	N/A
Highest order site designation of asset	None	None	N/A
Staff site visit (not entering water) frequency	1.5 (monthly)	2 (weekly)	Assumed value
Staff site visit entering or in contact with raw water frequency	0 (never)	1 (annually)	Assumed value
Road vehicle site visit frequency	1.5 (monthly)	2 (weekly)	Assumed value
Maintenance not entering water frequency	0 (never)	1.5 (monthly)	Assumed value
Maintenance in water frequency	0 (never)	1 (annually)	Assumed value
Angling equipment frequency	0 (never)	0 (never)	Assumed value
Live bait frequency	0 (never)	0 (never)	Assumed value
Fish stocking frequency	0 (never)	0 (never)	Assumed value
Large vessels (over 28ft) frequency	0 (never)	0 (never)	Assumed value
Small vessels (under 28ft) frequency	0 (never)	0 (never)	Assumed value
Water sports equipment frequency	0 (never)	0 (never)	Assumed value
Water safety equipment frequency	0 (never)	0 (never)	Assumed value
Mammals/waterfowl on site frequency	0 (never)	0 (never)	Assumed value
Transfer of waste sludge to land frequency	0 (never)	0 (never)	Assumed value
Recreational walker/jogger/runner frequency	0 (never)	0 (never)	Assumed value

B.3 South Humber Bank Non-potable desalination (60 MI/d) (SHB9)

Table B.3.1: SAI-RAT input data for RWT South Humber Bank Non-potable desalination (60 MI/d) (SHB9)

Criterion	Intake to desalination plant	Desalination plant to outfall	Mablethorpe desalination to Covenham WTW	Assumptions/ comments
Source Name	North Sea	Mablethorpe Desalination	Mablethorpe Desalination	N/A
Source Management Catchment	Anglian TraC Management Catchment	Witham Management Catchment	Witham Management Catchment	N/A
Source Operational Catchment	Lincolnshire TraC Operational Catchment	Steeping and Eaus Operational Catchment	Steeping and Eaus Operational Catchment	N/A
Source water body ID	GB640402492000	GB105029061641	GB105029061641	N/A
Source Type	Online water body	Water treatment works	Water treatment works	N/A
Number of RWT inputs into source	Unknown	None	None	Assumed
Pathway Type	Pipeline	Pipeline	Pipeline	N/A
Receptor Name	Mablethorpe Desalination plant	North Sea	Covenham WTW	N/A
Receptor Management Catchment	Witham Management Catchment	Anglian TraC Management Catchment	Louth Grimsby and Ancholme Management Catchment	N/A
Receptor Operational Catchment	Steeping and Eaus Operational Catchment	Lincolnshire TraC Operational Catchment	Becks Northern Operational Catchment	N/A
Receptor water body ID	GB105029061641	GB640402492000	GB104029062010	N/A
Receptor Type	Water treatment works	Online water body	Water treatment works	N/A
Isolated Receptor Catchment	No	No	No	N/A
Volume of Water	201-250 MI/d	101-150 MI/d	51-100 MI/d	N/A
Frequency of Operation	Unknown	Unknown	Unknown	N/A
Transfer Distance (km)	1.1-5	1.1-5	15.1-20	N/A
Washout/maintenance points outside of catchments	Unknown	Unknown	Unknown	N/A
Details of washout/maintenance points	N/A	N/A	N/A	N/A
Source Navigable	Yes	No	No	N/A
Pathway Navigable	No	No	No	N/A

Criterion	Intake to desalination plant	Desalination plant to outfall	Mablethorpe desalination to Covenham WTW	Assumptions/ comments
Angling at Source	Unknown	No	No	Angling club information not available for coastal areas
Angling on Pathway	No	No	No	N/A
Water sports at Source	Unknown	No	No	Information not available for coastal areas
Water sports on Pathway	No	No	No	N/A
Presence of high priority INNS Source	Not recorded	Known to be present	Known to be present	INNS records not available below tidal limits INNS records up to date as of 20/07/2023
Presence of high priority INNS Pathway	Known to be present	Known to be present	Known to be present	INNS records up to date as of 20/07/2023
Details of INNS present	Slipper Limpet <i>Crepidula fornicata</i>	Slipper Limpet (<i>Crepidula fornicata</i>)	<i>Elodea canadensis</i> <i>Elodea nuttallii</i> <i>Carassius auratus</i> <i>Azolla filiculoides</i> <i>Impatiens glandulifera</i>	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern
Highest order site designation Receptor	International	International	None	N/A
Presence of priority habitat pathway	Known to be present	Known to be present	Known to be present	N/A
Presence of priority habitat receptor	Known to be present	Known to be present	Known to be present	N/A
Details of priority habitat present	Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby- Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat but additional habitats present Coastal and floodplain grazing marsh	Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby- Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat but additional habitats present Coastal and floodplain grazing	Deciduous woodland Good quality semi-improved grassland Coastal and floodplain grazing marsh Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby- Theddlethorpe	N/A

Criterion	Intake to desalination plant	Desalination plant to outfall	Mablethorpe desalination to Covenham WTW	Assumptions/ comments
	Deciduous woodland	marsh Deciduous woodland	Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat but additional habitats	
Other existing connections between source and receptor	Unknown	Unknown	Unknown	N/A
Details of other existing connections	N/A	N/A	N/A	N/A

Table B.3.2: SAI-RAT input data for assets South Humber Bank Non-potable desalination (60 MI/d) (SHB9)

Criterion	Intake/outfall reception chamber	Reception chamber PS	Mablethorpe Desalination Plant	Assumptions/ comments
Asset type	Storage reservoir	Pumping station	Desalination Plant	N/A
Asset size (m ²)	Unknown	Unknown		N/A
Existing high impact INNS records on site/area of proposed site	Not recorded	Not recorded	Known to be present	INNS records up to date as of 20/07/2023
Details of high impact INNS	N/A	N/A	Goldfish (<i>Carassius auratus</i>)	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern
Existing priority habitats on site	Known to be present	Known to be present	Known to be present	N/A
Details of existing priority habitats	Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat	Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat	Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat	N/A

Criterion	Intake/outfall reception chamber	Reception chamber PS	Mablethorpe Desalination Plant	Assumptions/ comments
	but additional habitats present Coastal and floodplain grazing marsh Deciduous woodland	but additional habitats present Coastal and floodplain grazing marsh Deciduous woodland	but additional habitats present Coastal and floodplain grazing marsh Deciduous woodland	
Highest order site designation of asset	International	International	International	N/A
Frequency of personnel site visits	1.5	1.5	2	Assumed value
Frequency of personnel entering or in contact with raw water	0	0	2	Assumed value
Frequency of road vehicles on site	1.5	1.5	2	Assumed value
Frequency of maintenance operations not requiring personnel to enter water	1.5	1.5	2	Assumed value
Frequency of maintenance operations requiring personnel to enter water	0	0	2	Assumed value
Angling equipment frequency	0	0	0	Assumed value
Live bait frequency	0	0	0	Assumed value
Fish stocking frequency	0	0	0	Assumed value
Large vessels (over 28ft) frequency	0	0	0	Assumed value
Small vessel (under 28ft) frequency	0	0	0	Assumed value
Water safety equipment (temporary moorings, jetties, inflatables, buoys) frequency	0	0	0	Assumed value
Frequency of mammals/waterfowl entering site	0	0	0	Assumed value
Transfer of waste sludge to land frequency	0	0	1	Assumed value
Recreational walker/runner/ jogger frequency	0	0	0	Assumed value

B.4 Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29)

Table B.4.1: SAI-RAT input data for RWT for Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29)

Input variable	River Delph (Ouse Washes) to FR	River Great Ouse to FR	Counter Drain (Nene) to FR	Assumptions/ comments
Source	River Delph	Ouse River	Counter Drain (Nene)	N/A
Source management catchment	Old Bedford and Middle Level Management Catchment	Anglian TraC Management Catchment	Nene Management Catchment	N/A
Source operational catchment	Middle Level Operational Catchment	Great Ouse Operational Catchment	Nene Lower Operational Catchment	N/A
Source water body	GB205033000010	GB530503300300	GB205032050385	N/A
Source type	River	River	River	N/A
Number of raw water transfers into source	Unknown	Unknown	Unknown	N/A
Pathway type	Pipeline	Pipeline	River	N/A
Receptor name	Reservoir	Reservoir	Reservoir	N/A
Receptor management catchment	Old Bedford and Middle Level Management Catchment	Old Bedford and Middle Level Management Catchment	Old Bedford and Middle Level Management Catchment	N/A
Receptor operational catchment	Middle Level Operational Catchment	Middle Level Operational Catchment	Middle Level Operational Catchment	N/A
water body	N/A	N/A	N/A	N/A
Receptor type	Offline water body	Offline water body	Offline water body	N/A
Isolated receptor catchment	No	No	No	N/A
Volumetric rate of transfer (MI/d)	301-400 MI/d	301-400 MI/d	>500 MI/d	N/A
Frequency of transfer	Year round - intermittent	Year round - intermittent	Unknown	N/A
Distance of transfer (km)	5.1-10	15.1-20	>30	N/A
Washout/maintenance points along route	None	3*	Unknown	Assumed based on length of transfer
Source navigable	No	Yes	No	N/A
Pathway navigable	No	No	Yes	N/A
Angling at source	No	Unknown	No	N/A
Angling on pathway	No	No	Members and day ticket holders, local matches	N/A
Water sports at source	No	Casual use by individuals/clubs	No	N/A
Water sports along pathway	No	No	Casual use by individuals/clubs	N/A
High Impact INNS at source	Known to be present	Known to be present	Known to be present	N/A

Input variable	River Delph (Ouse Washes) to FR	River Great Ouse to FR	Counter Drain (Nene) to FR	Assumptions/ comments
High Impact INNS along pathway	Known to be present	Known to be present	Known to be present	N/A
Highest order site designation within 1km of receptor	International	International	International	N/A
Presence of priority habitats within 1km of pathway	Known to be present	Known to be present	Known to be present	N/A
Presence of priority habitats within 1km of receptor*	Known to be present	Known to be present	Known to be present	N/A
Other existing connections present between source and receptor	None	None	None	N/A

Table B.4.2: SAI-RAT input data for emergency drawdowns for Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29)

Input variable	Emergency drawdown option 1 (Forty Foot Drain)	Spillway	Reservoir to discharge pond	Assumptions/ comments
Source	Reservoir	Reservoir	Reservoir	N/A
Source management catchment	Old Bedford and Middle Level Management Catchment	Old Bedford and Middle Level Management Catchment	Old Bedford and Middle Level Management Catchment	N/A
Source operational catchment	Middle Level Operational Catchment	Middle Level Operational Catchment	Middle Level Operational Catchment	N/A
Source water body	N/A	N/A	N/A	N/A
Source type	Offline water body	Offline water body	Offline water body	N/A
Number of raw water transfers into source	None	None	None	N/A
Pathway type	Canal*	Canal	Pipeline	*Assumed value
Receptor name	Ouse Washes	Forty Foot Drain	Discharge Pond	N/A
Receptor management catchment	Old Bedford and Middle Level Management Catchment	Old Bedford and Middle Level Management Catchment	Old Bedford and Middle Level Management Catchment	N/A
Receptor operational catchment	Middle Level Operational Catchment	Middle Level Operational Catchment	Middle Level Operational Catchment	N/A
water body	GB205033000010	GB205033000020	N/A	N/A
Receptor type	River	Canal	Offline water body	*Assumed
Isolated receptor catchment	No	No	No	N/A
Volumetric rate of transfer (MI/d)	>500 MI/d	301-400 MI/d	6-50 MI/d*	*Only volume discharged at any given time.
Frequency of transfer	Very rare, eg burst	Very rare, eg burst	Occasional ie infrequent,	N/A

Input variable	Emergency drawdown option 1 (Forty Foot Drain)	Spillway	Reservoir to discharge pond	Assumptions/ comments
			regulatory compliance	
Distance of transfer (km)	5.1-10	<1	<1	N/A
Washout/maintenance points along route	None	None	None	N/A
Source navigable	No	No	No	N/A
Pathway navigable	No	No	No	N/A
Angling at source	No	No	No	N/A
Angling on pathway	No	No	No	N/A
Water sports at source	International events	International events	International events	N/A
Water sports along pathway	No	No	No	N/A
High Impact INNS at source	Known to be present	Known to be present	Known to be present	N/A
High Impact INNS along pathway	Known to be present	Known to be present	Known to be present	N/A
Highest order site designation within 1km of receptor	International	None	None	N/A
Presence of priority habitats within 1km of pathway	Known to be present	Known to be present	Known to be present	N/A
Presence of priority habitats within 1km of receptor	Known to be present	Known to be present	Known to be present	N/A
Other existing connections present between source and receptor	None	None	None	N/A

Table B.4.3: SAI-RAT input data for raw water assets for Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29)

Input variable	Emergency Drawdown Pond	Buried reservoir	Inlet Pumping Station and Water Sampling	Outlet Pumping Station	Reservoir	Assumption/ comments
Asset type	Emergency drawdown pond	Buried reservoir	Inlet pumping station	Outlet pumping station	Reservoir	N/A
Asset size (m ²)	34000	20000	9678	2450	4404277	Approximate
Existing high impact INNS records on site/area of proposed site	Not recorded	Known to be present	Not recorded	Not recorded	Not recorded	N/A

Input variable	Emergency Drawdown Pond	Buried reservoir	Inlet Pumping Station and Water Sampling	Outlet Pumping Station	Reservoir	Assumption/ comments
Existing priority habitats on site	Known to be present	Known to be present	Known to be present	Known to be present	Known to be present	N/A
Highest order site designation of asset	None	None	None	None	None	N/A
Frequency of personnel site visits	2 (weekly)	2 (weekly)	2 (weekly)	2 (weekly)	2 (weekly)	N/A
Frequency of personnel entering or in contact with raw water	0.5 (rarely)	0 (never)	0.5 (rarely)	0.5 (rarely)	2 (weekly)	N/A
Frequency of road vehicles on site	2 (weekly)	0 (never)	0 (never)	0 (never)	2 (weekly)	Assumed driving to car park not to asset
Frequency of maintenance operations not requiring personnel to enter water	1 (annually)	1.5 (monthly)	1.5 (monthly)	1.5 (monthly)	1.5* (monthly)	*Assumed worst case scenario
Frequency of maintenance operations requiring personnel to enter water	0.5 (rarely)	0.5 (rarely)	0.5 (rarely)	0.5 (rarely)	0.5 (rarely)	Worst case scenario
Angling equipment frequency	0 (never)	0 (never)	0 (never)	0 (never)	1 (annually)	Assumed values
Live bait frequency	0 (never)	0 (never)	0 (never)	0 (never)	1 (annually)	Assumed values
Fish stocking frequency	0 (never)	0 (never)	0 (never)	0 (never)	1 (annually)	Assumed values
Large vessels (over 28ft) frequency	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed values
Small vessel (under 28ft) frequency	0 (never)	0 (never)	0 (never)	0 (never)	2 (weekly)	Assumed values
Water safety equipment (temporary moorings, jetties, inflatables, buoys) frequency	0 (never)	0 (never)	0 (never)	0 (never)	2 (weekly)	Assumed values

Input variable	Emergency Drawdown Pond	Buried reservoir	Inlet Pumping Station and Water Sampling	Outlet Pumping Station	Reservoir	Assumption/comments
Frequency of mammals/waterfowl entering site	2 (weekly)	0 (never)	0 (never)	0 (never)	2 (weekly)	Assumed values
Transfer of waste sludge to land frequency	0.5 (rarely)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed values
Recreational walker/runner/ jogger frequency	2 (weekly)	0 (never)	0 (never)	0 (never)	2 (weekly)	Assumed values

Table B.4.4: SAI-RAT input data for treated water assets for Fens Reservoir 50MCM (usable volume) (44.4 MI/d) (FND29)

Input variable	Water Treatment Works	Potable Pumping Station	Assumption
Asset type	Water treatment works	Potable pumping station	N/A
Asset size (m ²)	33603	8808	N/A
Existing high impact INNS records on site/area of proposed site	Known to be present	Known to be present	N/A
Existing priority habitats on site	Known to be present	Known to be present	N/A
Highest order site designation of asset	None	None	N/A
Frequency of personnel site visits	2	2	N/A
Frequency of personnel entering or in contact with raw water	1 (annually)	0.5 (rarely)	N/A
Frequency of road vehicles on site	0 (never)	0 (never)	N/A
Frequency of maintenance operations not requiring personnel to enter water	1.5 (monthly)	1.5 (monthly)	Worst case scenario
Frequency of maintenance operations requiring personnel to enter water	0.5 (rarely)	0.5 (rarely)	N/A
Frequency of recreational activity (including angling, water sports, vessels, and walker/runner/jogger)*	0 (never)	0 (never)	*Summary of multiple input fields with same input value
Frequency of mammals/waterfowl entering site	0 (never)	0 (never)	N/A
Transfer of waste sludge to land frequency	0 (never)	0 (never)	N/A

B.5 Holland on Sea desalination (seawater) (26 MI/d) (EXS10)

Table B.5.1: SAI-RAT input data for RWT Holland on Sea desalination (seawater) (26 MI/d) (EXS10)

Criterion	Intake to WTW	Assumptions/comments
Source Name	Seawater (North Sea)	N/A
Source Management Catchment	N/A	N/A

Criterion	Intake to WTW	Assumptions/comments
Source Operational Catchment	N/A	N/A
Source water body ID	N/A	N/A
Source Type	Online water body*	N/A
Number of RWT inputs into source	Unknown	Unknown value
Pathway Type	Pipeline	N/A
Receptor Name	Great Horkeley WTW	N/A
Receptor Management Catchment	N/A	N/A
Receptor Operational Catchment	Essex Combined	N/A
Receptor water body	Stour OC	N/A
Receptor Type	Water Treatment Works	Receptor is a water treatment reservoir, so WTW was selected in tool as closest representative.
Isolated Receptor Catchment	No	N/A
Volume of Water	6-50 MI/d	N/A
Frequency of Operation	Year round - continuous, variable flow	N/A
Transfer Distance (km)	25.1-30	N/A
Washout/maintenance points outside of catchments	Unknown	Unknown value
Details of washout/maintenance points	Unknown	Unknown value
Source Navigable	Yes	N/A
Pathway Navigable	No	N/A
Angling at Source	Unknown	Unknown value
Angling on Pathway	No	N/A
Water sports at Source	Unknown	Unknown value
Water sports on Pathway	No	N/A
Presence of high priority INNS Source	Not surveyed - unknown	Data not commercially available
Presence of high priority INNS Pathway	Not surveyed - unknown	Data not commercially available
Details of INNS present	Unknown	Unknown value
Highest order site designation Receptor	National	N/A
Presence of priority habitat pathway	Known to be present	N/A
Presence of priority habitat receptor	Known to be present	N/A
Details of priority habitat present	Option intersects Holland Haven Marshes SSSI and Outer Thames Estuary Marine Protected Area (MPA) and Special Protection Area (SPA). Pipeline is within 500m of Ardleigh Gravel Pit Site of Special Scientific Interest (SSSI). Option intersects priority habitat including coastal and floodplain grazing marsh, deciduous woodland, and good quality semi-improved grassland.	N/A

Criterion	Intake to WTW	Assumptions/comments
Other existing connections between source and receptor	None	No existing connections as the option is a new pipeline to Great Horkesley WTW.
Details of other existing connections	Unknown	N/A

*For example, impounding reservoirs

Table B.5.2: SAI-RAT input data for assets Bulk trade agreement - River Trent (7 MI/d) (LNC28)

Criterion	Desalination Plant	Assumptions/comments
Asset type	Desalination Plant	N/A
Asset size	Unknown	N/A
Existing high impact INNS records on site/area of proposed site	Not surveyed - unknown	Data not commercially available
Existing Priority Habitats on site	Known to be present	N/A
Highest order site designation of asset	National	N/A
Staff site visit (not entering water) frequency	2 (weekly)	Assumed value
Staff site visit entering or in contact with raw water frequency	2 (weekly)	Assumed value
Road vehicle site visit frequency	2 (weekly)	Assumed value
Maintenance not entering water frequency	2 (weekly)	Assumed value
Maintenance in water frequency	2 (weekly)	Assumed value
Angling equipment frequency	0 (never)	Assumed value
Live bait frequency	0 (never)	Assumed value
Fish stocking frequency	0 (never)	Assumed value
Large vessels (over 28ft) frequency	0 (never)	Assumed value
Small vessels (under 28ft) frequency	0 (never)	Assumed value
Water sports equipment frequency	0 (never)	Assumed value
Water safety equipment frequency	0 (never)	Assumed value

B.6 Bulk trade agreement - River Trent (7 MI/d) (LNC28)

Table B.6.1: SAI-RAT input data Trent trade (Staythorpe) (LNC28)

Criterion	Input value	Assumptions/comments
Source Name	River Trent	N/A
Source Management Catchment	Trent Lower and Erewash Management Catchment	N/A
Source Operational Catchment	Nottinghamshire South A Operational Catchment	N/A
Source water body ID	GB104028053410	N/A
Source Type	River	N/A
Number of RWT inputs into source	Unknown	N/A
Pathway Type	Pipeline	N/A
Receptor Name	Hall WTW	N/A

Criterion	Input value	Assumptions/comments
Receptor Management Catchment	Trent Lower and Erewash Management Catchment	N/A
Receptor Operational Catchment	Trent and Trib Operational Catchment	N/A
Receptor water body ID	GB104028058480	N/A
Receptor Type	Water Treatment Works v	N/A
Isolated Receptor Catchment	No	N/A
Volume of Water	6- 50 MI/d	N/A
Frequency of Operation	Unknown	N/A
Transfer Distance (km)	20.1-25	N/A
Washout/maintenance points outside of catchments	Unknown	N/A
Details of washout/maintenance points	N/A	N/A
Source Navigable	Yes	N/A
Pathway Navigable	No	N/A
Angling at Source	Members only, local matches	Most likely scenario based on information available from local angling clubs.
Angling on Pathway	No	N/A
Water sports at Source	Casual use by individual clubs	Most likely scenario based on information available
Water sports on Pathway	No	N/A
Presence of high priority INNS Source	Known to be present	INNS records up to date as of 20/07/2023
Presence of high priority INNS Pathway	Known to be present	INNS records up to date as of 20/07/2023
Details of INNS present	Feral goldfish (<i>Carassius auratus</i>) Common carp (<i>Cyprinus carpio</i>) Zander (<i>Sander lucioperca</i>) Demon shrimp (<i>Dikerogammarus haemobaphes</i>) Himalayan Balsam (<i>Impatiens glandulifera</i>) Bloody red-mysid (<i>Hemimysis anomala</i>) Asian Clam (<i>Corbicula fluminea</i>) Watier's Limpet (<i>Ferrissia californica</i>) Zebra mussel (<i>Dreissena polymorpha</i>) Nuttall's pondweed (<i>Elodea nuttallii</i>) Water fern (<i>Azolla filiculoides</i>) Fringed water lily (<i>Nymphoides peltate</i>) Signal crayfish (<i>Pacifastacus leniusculus</i>) New Zealand pygmyweed (<i>Crassula helmsii</i>) Japanese knotweed (<i>Fallopia japonica</i>)	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern

Criterion	Input value	Assumptions/comments
	Chinese mitten crab (<i>Eriocheir sinensis</i>)	
Highest order site designation Receptor	None	N/A
Presence of priority habitat pathway	Known to be present	N/A
Presence of priority habitat receptor	Known to be present	N/A
Details of priority habitat present	Devon Park Pastures LNR Farndon Ponds LNR Deciduous woodland No main habitat but additional habitats present Coastal and floodplain grazing marsh Good quality semi-improved grassland	N/A
Other existing connections between source and receptor	None	N/A
Details of other existing connections	N/A	N/A

Table B.6.2: SAI-RAT input data for assets Bulk trade agreement - River Trent (7 MI/d) (LNC28)

Criterion	Pumping station	Assumptions/comments
Site name	Staythorpe Powerstation	N/A
Asset type	Pumping station	N/A
Asset size (m ²)	Unknown	N/A
Existing high impact INNS records on site/area of proposed site	Known to be present	INNS records up to date as of 20/07/2023
Details of high impact INNS	Zander (<i>Sander lucioperca</i>) Zebra mussel (<i>Dreissena polymorpha</i>) Signal crayfish (<i>Pacifastacus leniusculus</i>) Himalayan Balsam (<i>Impatiens glandulifera</i>)	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern
Existing priority habitats on site	Known to be present	N/A
Details of existing priority habitats	Deciduous woodland No main habitat but additional habitats present Coastal and floodplain grazing marsh Farndon Ponds LNR	N/A
Highest order site designation of asset	Local	N/A
Frequency of personnel site visits	1.5	Assumed value
Frequency of personnel entering or	0	Assumed value

Criterion	Pumping station	Assumptions/comments
in contact with raw water		
Frequency of road vehicles on site	1.5	Assumed value
Frequency of maintenance operations not requiring personnel to enter water	1.5	Assumed value
Frequency of maintenance operations requiring personnel to enter water	0	Assumed value
Angling equipment frequency	0	Assumed value
Live bait frequency	0	Assumed value
Fish stocking frequency	0	Assumed value
Large vessels (over 28ft) frequency	0	Assumed value
Small vessel (under 28ft) frequency	0	Assumed value
Water safety equipment (temporary moorings, jetties, inflatables, buoys) frequency	0	Assumed value
Frequency of mammals/waterfowl entering site	0	Assumed value
Transfer of waste sludge to land frequency	0	Assumed value
Recreational walker/runner/ jogger frequency	0	Assumed value

B.7 Mablethorpe desalination Seawater (50 MI/d) (LNE6)

Table B.7.1: SAI-RAT input data for RWT Mablethorpe desalination Seawater (50 MI/d) (LNE6)

Criterion	Intake to desalination plant	Desalination plant to outfall	Desalination plant to Covenham WTW	Assumptions/ comments
Source Name	North Sea	Mablethorpe Desalination	Mablethorpe Desalination	N/A
Source Management Catchment	Anglian TraC Management Catchment	Witham Management Catchment	Witham Management Catchment	N/A
Source Operational Catchment	Lincolnshire TraC Operational Catchment	Steeping and Eaus Operational Catchment	Steeping and Eaus Operational Catchment	N/A

Criterion	Intake to desalination plant	Desalination plant to outfall	Desalination plant to Covenham WTW	Assumptions/ comments
Source water body ID	GB640402492000	GB105029061641	GB105029061641	N/A
Source Type	Online water body	Water treatment works	Water treatment works	N/A
Number of RWT inputs into source	Unknown	None	None	Assumed
Pathway Type	Pipeline	Pipeline	Pipeline	N/A
Receptor Name	Mablethorpe Desalination plant	North Sea	Covenham WTW	N/A
Receptor Management Catchment	Witham Management Catchment	Anglian TraC Management Catchment	Louth Grimsby and Ancholme Management Catchment	N/A
Receptor Operational Catchment	Steeping and Eaus Operational Catchment	Lincolnshire TraC Operational Catchment	Becks Northern Operational Catchment	N/A
Receptor water body ID	GB105029061641	GB640402492000	GB104029062010	N/A
Receptor Type	Water treatment works	Online water body	Water treatment works	N/A
Isolated Receptor Catchment	No	No	No	N/A
Volume of Water	201-250 MI/d	101-150 MI/d	51-100 MI/d	N/A
Frequency of Operation	Unknown	Unknown	Unknown	N/A
Transfer Distance (km)	1.1-5	1.1-5	15.1-20	N/A
Washout/maintenance points outside of catchments	Unknown	Unknown	Unknown	N/A
Details of washout/maintenance points	N/A	N/A	N/A	N/A
Source Navigable	Yes	No	No	N/A
Pathway Navigable	No	No	No	N/A
Angling at Source	Unknown	No	No	Angling club information not available for coastal areas
Angling on Pathway	No	No	No	N/A
Water sports at Source	Unknown	No	No	Information not available for coastal areas

Criterion	Intake to desalination plant	Desalination plant to outfall	Desalination plant to Covenham WTW	Assumptions/ comments
Water sports on Pathway	No	No	No	N/A
Presence of high priority INNS Source	Not recorded	Known to be present	Known to be present	INNS records not available below tidal limits INNS records up to date as of 20/07/2023
Presence of high priority INNS Pathway	Known to be present	Known to be present	Known to be present	INNS records up to date as of 20/07/2023
Details of INNS present	Slipper Limpet <i>Crepidula fornicata</i>	Slipper Limpet <i>Crepidula fornicata</i>	Canadian waterweed (<i>Elodea canadensis</i>) Nuttall's aterweed (<i>Elodea nuttallii</i>) Feral goldfish (<i>Carassius auratus</i>) Water fern (<i>Azolla filiculoides</i>) Himalayan balsam (<i>Impatiens glandulifera</i>)	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern
Highest order site designation Receptor	International	International	None	N/A
Presence of priority habitat pathway	Known to be present	Known to be present	Known to be present	N/A
Presence of priority habitat receptor	Known to be present	Known to be present	Known to be present	N/A
Details of priority habitat present	Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat but additional habitats present Coastal and floodplain grazing marsh Deciduous woodland	Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat but additional habitats present Coastal and floodplain grazing marsh Deciduous woodland	Deciduous woodland Good quality semi-improved grassland Coastal and floodplain grazing marsh Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes	N/A

Criterion	Intake to desalination plant	Desalination plant to outfall	Desalination plant to Covenham WTW	Assumptions/ comments
			No main habitat but additional habitats	
Other existing connections between source and receptor	Unknown	Unknown	Unknown	N/A

Table B.7.2: SAI-RAT input data for assets Mablethorpe desalination Seawater (50 MI/d) (LNE6)

Criterion	Intake/outfall reception chamber	Reception chamber PS	Mablethorpe Desalination Plant	Assumptions/comments
Asset type	Storage reservoir	Pumping station	Desalination Plant	N/A
Asset size (m ²)	Unknown	Unknown		N/A
Existing high impact INNS records on site/area of proposed site	Not recorded	Not recorded	Known to be present	INNS records up to date as of 20/07/2023
Details of high impact INNS	N/A	N/A	Feral golfish (<i>Carassius auratus</i>)	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern
Existing priority habitats on site	Known to be present	Known to be present	Known to be present	N/A
Details of existing priority habitats	Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat but additional habitats present Coastal and floodplain grazing marsh Deciduous woodland	Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat but additional habitats present Coastal and floodplain grazing marsh Deciduous woodland	Greater Wash SPA Saltfleetby - Theddlethorpe Dunes NNR Humber Estuary Ramsar Saltfleetby - Theddlethorpe Dunes SSSI Saltfleetby-Theddlethorpe Dunes & Gibraltar Point SAC Humber Estuary SPA Coastal sand dunes No main habitat but additional habitats present Coastal and floodplain grazing marsh Deciduous woodland	N/A
Highest order site designation of asset	International	International	International	N/A

Criterion	Intake/outfall reception chamber	Reception chamber PS	Mablethorpe Desalination Plant	Assumptions/com ments
Frequency of personnel site visits	1.5	1.5	2	Assumed value
Frequency of personnel entering or in contact with raw water	0	0	2	Assumed value
Frequency of road vehicles on site	1.5	1.5	2	Assumed value
Frequency of maintenance operations not requiring personnel to enter water	1.5	1.5	2	Assumed value
Frequency of maintenance operations requiring personnel to enter water	0	0	2	Assumed value
Angling equipment frequency	0	0	0	Assumed value
Live bait frequency	0	0	0	Assumed value
Fish stocking frequency	0	0	0	Assumed value
Large vessels (over 28ft) frequency	0	0	0	Assumed value
Small vessel (under 28ft) frequency	0	0	0	Assumed value
Water safety equipment (temporary moorings, jetties, inflatables, buoys) frequency	0	0	0	Assumed value
Frequency of mammals/waterfowl entering site	0	0	0	Assumed value
Transfer of waste sludge to land frequency	0	0	1	Assumed value
Recreational walker/runner/jogger frequency	0	0	0	Assumed value

B.8 Bacton desalination (seawater) (25 MI/d) (NTB17)

Table B.8.1: SAI-RAT input data RWT for Bacton desalination (seawater) (25 MI/d) (NTB17) (Transfer)

Criterion	Intake pipeline to reception chamber	Outfall pipeline from reception chamber	Intake reception chamber to desalination plant	Desalination plant to outfall reception chamber	Transfer pipeline	Assumptions/ comments
Source Name	North Sea	Reception chamber	Reception chamber and PS	Desalination plant	Desalination plant	N/A
Source Management Catchment	Anglian TraC	Broadland Rivers	Broadland Rivers	Broadland Rivers	Broadland Rivers	N/A
Source Operational Catchment	Norfolk East TraC	Bure	Bure	Bure	Bure	N/A
Source water body ID	GB6505035003	N/A	N/A	N/A	N/A	Area outside of water body boundary
Source Type	Online water body	Sealed water tank	Sealed water tank	Water treatment works	Water treatment works	N/A
Number of RWT inputs into source	Unknown	None	None	None	None	Unknown value
Pathway Type	Pipeline	Pipeline	Pipeline	Pipeline	Pipeline	N/A
Receptor Name	Reception chamber and PS	North Sea	Desalination plant	Reception chamber	Mousehold WTW	N/A
Receptor Management Catchment	Broadland Rivers	Anglian TraC	Broadland Rivers	Broadland Rivers	Broadland Rivers	N/A
Receptor Operational Catchment	Bure	Norfolk East TraC	Bure	Bure	Yare	N/A
Receptor water body	N/A	GB6505035003	N/A	N/A	GB105034051370	Area outside of water body boundary
Receptor Type	Sealed water tank	Online water body	Water treatment works	Sealed water tank	Water treatment works	N/A
Isolated Receptor Catchment	No	No	No	No	No	N/A
Volume of Water	201-250 MI/d	101-150 MI/d	201-250 MI/d	101-150 MI/d	51-100 MI/d	N/A
Frequency of Operation	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown value
Transfer Distance (km)	<1	<1	<1	<1	>30	N/A
Washout/ maintenance points outside of catchments	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown value

Criterion	Intake pipeline to reception chamber	Outfall pipeline from reception chamber	Intake reception chamber to desalination plant	Desalination plant to outfall reception chamber	Transfer pipeline	Assumptions/ comments
Details of washout/ maintenance points	N/A	N/A	N/A	N/A	N/A	N/A
Source Navigable	Yes	No	No	No	No	N/A
Pathway Navigable	No	No	No	No	No	N/A
Angling at Source	Unknown	No	No	No	No	Unknown value
Angling on Pathway	No	No	No	No	No	N/A
Water sports at Source	Unknown	No	No	No	No	N/A
Water sports on Pathway	No	No	No	No	No	N/A
Presence of high priority INNS Source	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	INNS records not available below tidal limits INNS records up to date as of 09/05/2023
Presence of high priority INNS Pathway	Not recorded	Not recorded	Not recorded	Not recorded	Known to be present	INNS records up to date as of 09/05/2023
Details of INNS present	N/A	N/A	N/A	N/A	Giant hogweed (<i>Heracleum mantegazzianum</i>), Himalayan balsam (<i>Impatiens glandulifera</i>), Zebra mussel (<i>Dreissena polymorpha</i>), Nuttall's pondweed (<i>Elodea nuttallii</i>), Japanese knotweed (<i>Fallopia japonica</i>), New Zealand pygmyweed (<i>Crassula helmsii</i>), Water fern (<i>Azolla filiculoides</i>), Common carp	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern

Criterion	Intake pipeline to reception chamber	Outfall pipeline from reception chamber	Intake reception chamber to desalination plant	Desalination plant to outfall reception chamber	Transfer pipeline	Assumptions/ comments
					(<i>Cyprinus carpio</i>)	
Highest order site designation Receptor	International	International	International	International	Local	N/A
Presence of priority habitat pathway	Known to be present	Known to be present	Known to be present	Known to be present	Known to be present	N/A
Presence of priority habitat receptor	Known to be present	Known to be present	Known to be present	Known to be present	Known to be present	N/A
Details of priority habitat present	Greater Wash SPA, Southern North Sea SAC, maritime cliff and slope, deciduous woodland	Greater Wash SPA, Southern North Sea SAC, maritime cliff and slope, deciduous woodland	Greater Wash SPA, Southern North Sea SAC, Paston Great Barn SAC, Paston Great Barn SSSI, Paston Great Barn NNR, maritime cliff and slope, deciduous woodland	Greater Wash SPA, Southern North Sea SAC, Paston Great Barn SAC, Paston Great Barn SSSI, Paston Great Barn NNR, maritime cliff and slope, deciduous woodland	Lion Wood LNR, Whitlingham LNR, Greater Wash SPA, Southern North Sea SAC, Paston Great Barn SAC, Paston Great Barn SSSI, Paston Great Barn SAC, Paston Great Barn SSSI, Paston Great Barn NNR, Deciduous woodland No main habitat but additional habitats present, Lowland meadows, Coastal and floodplain grazing marsh, Traditional orchard, good quality semi-improved grassland, Maritime cliff and slope	N/A
Other existing connections between source and receptor	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown value
Details of other existing connections	N/A	N/A	N/A	N/A	None	N/A

Table B.8.2: SAI-RAT input data for assets Bacton desalination (seawater) (25 MI/d) (NTB17) (Asset)

Criterion	Desalination plant	Pumping station	Sealed water tank	Pumping station	Service reservoir	Sealed water tank	Assumptions/comment
Site name	Bacton Desalination Plant	Intake PS	Intake Reception chamber	Bacton Desalination Pumping Station	Bacton Desalination Service Reservoir	Outfall Reception chamber	N/A
Asset type	Desalination plant	Pumping station	Sealed water tank	Pumping station	Service reservoir	Sealed water tank	N/A
Asset size	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	N/A
Existing high impact INNS records on site/area of proposed site	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	Not recorded	INNS records up to date as of 09/05/2023
Details of high impact INNS	N/A	N/A	N/A	N/A	N/A	N/A	WFD TAG high impact species, species on the Wildlife and Countryside act 1981 Schedule 9 and the European List of Concern
Existing Priority Habitats on site	Known to be present	Known to be present	Known to be present	Known to be present	Known to be present	Known to be present	N/A
Details of existing priority habitats	Maritime cliff and slope Deciduous woodlands Greater Wash SPA Southern North Sea SAC	Maritime cliff and slope Deciduous woodland Greater Wash SPA Southern North Sea SAC	Maritime cliff and slope Deciduous woodland Greater Wash SPA Southern North Sea SAC	Maritime cliff and slope Deciduous woodland Greater Wash SPA Southern North Sea SAC	Maritime cliff and slope Deciduous woodland Greater Wash SPA Southern North Sea SAC	Maritime cliff and slope Deciduous woodland Greater Wash SPA Southern North Sea SAC	N/A
Highest order site designation of asset	International	International	International	International	International	International	N/A
Staff site visit (not entering water) frequency	2 (weekly)	1.5 (monthly)	1.5 (monthly)	1.5 (monthly)	1.5 (monthly)	1.5 (monthly)	Assumed value
Staff site visit entering or in contact with raw water frequency	2 (weekly)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value

Criterion	Desalination plant	Pumping station	Sealed water tank	Pumping station	Service reservoir	Sealed water tank	Assumptions/comment
Road vehicle site visit frequency	2 (weekly)	1.5 (monthly)	1.5 (monthly)	1.5 (monthly)	1.5 (monthly)	1.5 (monthly)	Assumed value
Maintenance not entering water frequency	2 (weekly)	1.5 (monthly)	1.5 (monthly)	1.5 (monthly)	1.5 (monthly)	1.5 (monthly)	Assumed value
Maintenance in water frequency	2 (weekly)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value
Angling equipment frequency	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value
Live bait frequency	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value
Fish stocking frequency	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value
Large vessels (over 28ft) frequency	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value
Small vessels (under 28ft) frequency	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value
Water sports equipment frequency	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value
Water safety equipment frequency	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value
Mammals/ waterfowl on site frequency	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value
Transfer of waste sludge to land frequency	1 (annually)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value
Recreational walker/ jogger/runner frequency	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	0 (never)	Assumed value

B.9 Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17) option transfer component.

Table B.9.1: SAI-RAT input data for RWT for Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17)

Input variable	River Trent to River Witham pipeline	River Witham to Lincolnshire Reservoir	Assumptions/comments
Source	River Trent	River Witham	N/A
Source management catchment	Trent Lower and Erewash	Witham Management Catchment	N/A

Input variable	River Trent to River Witham pipeline	River Witham to Lincolnshire Reservoir	Assumptions/ comments
Source operational catchment	Nottingham Urban	South Forty Foot Drain Operational Catchment	N/A
Source type	River	River	N/A
Number of raw water transfers into source	Unknown	Unknown	N/A
Pathway type*	Pipeline	Pipeline	N/A
Receptor name	River Witham	Lincolnshire Reservoir	N/A
Receptor management catchment	Witham Management Catchment	Witham Management Catchment	N/A
Receptor operational catchment	South Forty Foot Drain Operational Catchment	South Forty Foot Drain Operational Catchment	N/A
Receptor type*	River	Offline water body	N/A
Isolated receptor catchment	No	No	N/A
Volumetric rate of transfer (MI/d) *	251-300 MI/d	301-400 MI/d	Assumed maximum volume
Frequency of transfer	Year round - intermittent	Year round - intermittent	Trent to Witham operation frequency- 100 and 300 MI/d for approximately 50% of the year Witham to Lincolnshire Reservoir operation frequency- 100 and 400 MI/d for between 70% to 90% of the year.
Distance of transfer (km)	10.1-15	15.1-20	N/A
Washout/maintenance points along route*	>3	0	N/A
Source navigable	Yes	Yes	N/A
Pathway navigable	No	No	N/A
Angling at source*	Members only, local matches	Members only, local matches	Based on information from local angling clubs
Angling on pathway	No	No	N/A
Water sports at source*	Casual use by individuals/clubs	Casual use by individuals/clubs	Based on information from local clubs
Water sports along pathway	No	No	N/A
High Impact INNS at source	Known to be present	Known to be present	N/A
High Impact INNS along pathway	Known to be present	Known to be present	N/A
Highest order site designation within 1km of receptor	Not known to be present	Not known to be present	N/A
Presence of priority habitats within 1km of pathway	Not known to be present	Not known to be present	N/A
Presence of priority habitats within 1km of receptor*	Not known to be present	Not known to be present	N/A
Other existing connections present between source and receptor	1	None	N/A
Detail of other existing connections	Trent-Witham-Ancholme Scheme (TWAS)	N/A	N/A

Table B.9.2: SAI-RAT input data for transfers for Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17)

Input variable	Lincolnshire Reservoir to drawdown pond	Assumptions/comments
Source	Lincolnshire Reservoir	N/A
Source management catchment	Witham Management Catchment	N/A
Source operational catchment	South Forty Foot Drain Operational Catchment	N/A
Source type	Offline water body	N/A
Number of raw water transfers into source	None	N/A
Pathway type*	Pipeline	N/A
Receptor name	Discharge pond	N/A
Receptor easting	512825 (approx.)	N/A
Receptor northing	340526 (approx.)	N/A
Receptor management catchment	Witham Management Catchment	N/A
Receptor operational catchment	South Forty Foot Drain Operational Catchment	N/A
Receptor type*	Offline water body	N/A
Isolated receptor catchment	No	N/A
Volumetric rate of transfer (MI/d)	6-50 MI/d*	*Maximum volume transferred at any one time
Frequency of transfer*	Occasional i.e. infrequent, regulatory compliance	N/A
Distance of transfer (km)*	<1	N/A
Washout/maintenance points along route*	None	N/A
Source navigable	No	N/A
Pathway navigable	No	N/A
Angling at source*	No	N/A
Angling on pathway	No	N/A
Water sports at source	Local events*	*Assumed worst-case scenario
Water sports along pathway	No	N/A
High Impact INNS at source	Known to be present*	*Assumed to be present through abstraction from Witham
High Impact INNS along pathway	Known to be present	N/A
Highest order site designation within 1km of receptor	Not known to be present	N/A
Presence of priority habitats within 1km of pathway	Not known to be present	N/A
Presence of priority habitats within 1km of receptor*	Not known to be present	N/A
Other existing connections present between source and receptor	None	N/A

Table B.9.3: SAI-RAT input data for emergency drawdowns for Lincolnshire Reservoir 50MCM (usable volume) (169 MI/d) (RTN17)

Input variable	Emergency drawdown option 1 (to SFFD tributary)	Spillway (to SFFD)	Assumptions/ comments
Source	South Lincolnshire Reservoir	South Lincolnshire Reservoir	N/A
Source management catchment	Witham Management Catchment	Witham Management Catchment	N/A
Source operational catchment	South Forty Foot Drain Operational Catchment	South Forty Foot Drain Operational Catchment	N/A
Source type	Offline water body	Offline water body	N/A
Number of raw water transfers into source	None	None	N/A
Pathway type*	Canal	Canal	N/A
Receptor name	SFFD tributary	Helpingam Beck	N/A
Receptor management catchment	Witham Management Catchment	Witham Management Catchment	N/A
Receptor operational catchment	South Forty Foot Drain Operational Catchment	South Forty Foot Drain Operational Catchment	N/A
Receptor type*	River	Canal*	*Overland flow
Isolated receptor catchment	No	No	N/A
Volumetric rate of transfer (MI/d)	>500 MI/d	301-400 MI/d	Maximum volume discharged at any one time
Frequency of transfer	Very rare, e.g. burst	Very rare, e.g. burst	Not intended as part of routine usage
Distance of transfer (km)	5.1-10	<1	N/A
Washout/maintenance points along route*	None	None	N/A
Source navigable	No	No	N/A
Pathway navigable	No	No	N/A
Angling at source	No	No	N/A
Angling on pathway	No	No	
Water sports at source	Local events	Local events	Assumed likely worst-case scenario
Water sports along pathway	No	No	N/A
High Impact INNS at source	Known to be present	Known to be present	N/A
High Impact INNS along pathway	Known to be present	Known to be present	N/A
Highest order site designation within 1km of receptor	Not know to be present	Not known to be present	N/A
Presence of priority habitats within 1km of pathway	Not know to be present	Not known to be present	N/A
Presence of priority habitats within 1km of receptor	Not know to be present	Not known to be present	N/A
Other existing connections present between source and receptor	None	None	N/A

