River Thames Scheme

Protecting our communities
Securing our economy
Enhancing our Thames

Preliminary Environmental Information Report

Volume 4
Appendix 7.3

Terrestrial and Aquatic Invasive Non-Native Species Report

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Executive Summary

Galliford Binnies Joint Venture Ltd (GBJV) was commissioned by the Environment Agency (EA) to undertake terrestrial and aquatic invasive non-native species (INNS) surveys at various locations for the proposed River Thames Scheme (RTS), here forth referred to as the 'RTS' or 'the Project'. This report sits within an overarching Environmental Impact Assessment (EIA) for the RTS, which has recently been through scoping stage.

A desk study, walkover and boat-based surveys were conducted across the area within the project boundary for EIA scoping to identify terrestrial invasive non-native species (T-INNS) and aquatic invasive non-native species (A-INNS). Species on the London Invasive Species Initiative (LISI) were also noted.

From the T-INNS surveys carried out in 2022, eight T-INNS species listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) or Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019 were recorded, and 11 additional species listed as concern on the LISI were recorded.

From the aquatic and riparian surveys carried out in 2022, a total of 36 A-INNS were identified, of which 19 were plants and 17 were macroinvertebrates. Of these 36 species, 20 are listed as High Impact or Moderate Impact according to the WFD UK TAG guidance based on their propensity to become invasive and damage recipient ecosystems. Furthermore, seven plant and two macroinvertebrate species listed in Schedule 9 of the Wildlife and Countryside Act or Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019 were detected as well as four plant and three macroinvertebrate species of Union Concern.

1 Introduction

Background

Galliford Binnies Joint Venture Ltd (GBJV) was commissioned by the Environment Agency (EA) to undertake terrestrial and aquatic invasive non-native species (INNS) surveys at various locations for the proposed River Thames Scheme (RTS), here forth referred to as the 'RTS' or 'the Project'. This report sits within an overarching Environmental Impact Assessment (EIA) for the RTS, which has recently been through scoping stage.

This terrestrial and aquatic INNS report has assessed record and survey data in areas where the RTS would need to take land and/or have access for the creation of the flood channel and associated works. This also includes bed lowering downstream of Desborough Cut and capacity improvements at River Thames weirs and 11 potential Habitat Creation Areas (HCAs); the area for these works are collectively referred to as the 'Project Boundary for EIA scoping'.

Site Location and Context

For EIA scoping purposes, the area within the Project boundary is approximately the pink shaded area shown in Figure 1, which includes a large corridor of land south of the River Thames and north of the M3 between Thorpe and Chertsey, and north of the River Thames between Chertsey and Shepperton; as well as separate areas around Sunbury, Molesey and Teddington Weirs, plus land south of Island Barn Reservoir and south of Virginia Water (note that Figure 1 excludes the HCAs within the project boundary that lie south of Wraysbury Reservoir and at Drinkwater Pit).

Figure 1: Overview of RTS (Environment Agency, 2022)

Project Description

River Thames Scheme (RTS) ('the Project') is a flood alleviation and blue/green infrastructure project being jointly promoted by the Environment Agency and Surrey County Council. The Project will reduce flood risk to communities in Surrey and south west London. The RTS design comprises the following elements, which will be undertaken within the Project boundary:

- A new flood channel in two sections, through the boroughs of Runnymede and Spelthorne in Surrey. Permanent features associated with the flood channel include flow and water level control structures, flood embankments, erosion prevention, bridges and permanent site compounds for maintenance; the channel will include planting for wildlife and places for recreational access;
- Capacity improvements to the River Thames through lowering the bed of the River Thames downstream of Desborough Cut, upgrades to Sunbury, Molesey and Teddington Weirs;
- New green open spaces adjacent to the channel and accessible to local communities;
- Habitat creation areas which link with existing and new blue and green wildlife corridors and build upon the network of existing wildlife sites;
- New or improved active travel provision along and across the flood channel corridor and new open spaces with connections to the existing network;
- Permanent compounds for maintenance; and
- Temporary construction features such as site compounds and materials reprocessing sites.

The Runnymede Channel will be around 4.8 km in length, from the inlet at Egham Hythe to the outlet at Chertsey. This channel will flow through five lakes and intersect four existing watercourses, as well as five road crossings including the M3. The Spelthorne Channel will be around 3.2 km in length, from the inlet in Laleham to the outlet at Shepperton. The channel flows through four lakes and includes five road crossings. The capacity improvements to the River Thames will consist of lowering the bed of the central section of the river for a length of approximately 1 km downstream of Desborough Cut, and additional gates at Sunbury, Molesey and Teddington Weirs. The outline design of landscape and green infrastructure opportunities such as open green spaces, active travel and habitat improvements is ongoing and being refined through an integrated optioneering process.

Scope of the report

The brief provided to GBV for this terrestrial and aquatic INNS, is as follows:

- Provide ecological baseline information about the Project Boundary for EIA Scoping;
- To provide recommendations to enable compliance with relevant nature conservation legislation and planning policy; and,
- To identify the need for avoidance, mitigation, compensation and/or enhancement measures for the RTS.

Planning Policy and Legislation

The report has been compiled with reference to relevant nature conservation legislation, planning policy and the UK Biodiversity framework from which the protection of sites, habitats and species is derived in England. The context and how these have been applied is detailed in relevant sections of this report with additional information in Appendix C. The following legislation and policy are highlighted:

- The Conservation of Habitats and Species Regulations 2017 (as amended[1]) (commonly referred to as the Habitats Regulations);
- Natural Environment and Rural Communities Act (NERC) 2006;
- Wildlife and Countryside Act 1981 (as amended);
- Injurious Weeds Act 1959;
- Invasive Alien Species (Enforcement and Permitting) Order 2019;
- Water Framework Directive (WFD) UK Technical Advisory Group (UKTAG) alien species;
- Invasive Alien Species (Enforcement and Permitting) Order 2019;
- The Water Framework Directive UK Technical Advisory Group (WFD UK TAG) classification of aquatic alien species according to their level of impact (vs 8)[2,3];
- Invasive alien species of Union Concern; and
- Great Britain Non-Native Species Secretariat (GB NNSS) species risk assessments (where available).

Section 15 of The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021) states that planning policies and decisions should contribute to and enhance the natural and local environment, minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures.

[1] As amended by the Conservation of Habitats and Species Regulations (Amendment) (EU Exit) Regulations 2019

[2] Water Framework Directive UK TAG (2021). Classification of aquatic alien species according to their level of impact, vs 8, pp. 9.

[3] WFD UK TAG Guide to Aquatic Alien Species. WFD UK TAG Assessment Method: Aquatic Alien Species. https://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Biological%20Method%20Statements/Alien%20Species%20UKTAG%20Method%20Statement.pdf

Another strategy at the local level which is of relevance to this development is the London Invasive Species Initiative (LISI). Further information on this is also provided in Appendix C.

2 Methodology

Outline

This report is produced with reference to current good practice guidelines by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2021a,b) and Joint Nature Conservation Committee (JNCC, 2010) and guidelines contained in the British Standards – Code of Practice for Biodiversity and Development BS42020:2013.

The recommendations detailed in this T-INNS and A-INNS report are based on the following data sources:

- An ecological desk study using data from previous studies and information from local record centres; and,
- Site walkovers and boat-based surveys.

Desk Study

A review of existing ecological and environmental baseline information available in the public domain was undertaken and local records from the below centres were reviewed from a request made in 2022 as part of the Preliminary Ecological Appraisal (GBV 2023, *in progress*).

- Thames Valley Environmental Records Centre (TVEC)
- Surrey Biodiversity Information Centre (SBIC)
- Greenspace information for Greater London (GiGL)

For the purpose of this exercise, data was collected using 2 km radii. This approach is in line with good practice guidelines published by CIEEM, 2017a,b and 2020.

The following existing ecological reports were reviewed as part of the desk study:

- River Thames Scheme - Preliminary Ecological Appraisal for the Flood Channel (GBV 2016)
- Six Phase One habitat validation reports for the HCAs (Binnies, GBV 2020a-c and 2021a-c);
- River Thames Scheme - Invasive Non-Native Species desktop study (2021e)
- Aquatic and Terrestrial Invasive Non-Native Species Gap Analysis (GBV 2022); this consolidates data from INNS surveys in 2017, 2020 and 2022.

- River Thames Scheme - Water Vole Survey Report (Binnies, GBV 2021d);
- Aquatic invertebrate and aquatic/riparian plant INNS surveys (APEM 2020); and
- Invasive Non-native Aquatic Species report (APEM, 2022)

T-INNS – Walkover Survey

The T-INNS walkover surveys were undertaken between 20th July and 11th August 2022 throughout the whole Project Boundary for EIA Scoping including the 11 HCAs. The weather conditions during the surveys were mostly dry with warm to hot temperatures (19-26°C) with a light breeze. The surveys were carried out by experienced Binnies ecologists Casey Higgins-King, Chantae Wells and Alex Bell who hold qualifying membership of the Chartered Institute of Ecology and Environmental Management (CIEEM), and assisted by Environmental Scientist, Henry Johnston.

The scientific names for plant species recorded follow those in the New Flora of the British Isles (Stace, 2019).

As part of the T-INNS walkover survey, incidental evidence of aquatic INNS species was also noted, and are discussed in the results and recommendations below.

Invasive plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019, WFD UKTAG alien species, on the LISI, and other non-native species which were evident during the survey, were recorded and plotted in a location aware application (Survey123) and were subsequently digitised using a Geographical Information System (GIS). Additional notes on management of T-INNS and other incidental finds were also recorded. A T-INNS survey results map was then prepared.

A-INNS – Survey overview

Surveys were conducted by APEM along a 40 km stretch of the River Thames where the new flood channels will adjoin the main Thames, as well as within one pond in the Laleham Reach HCA and within two ponds in the Land South of Chertsey Road HCA (Figure 2).

Aquatic and riparian plant surveys were carried out along the whole survey reach of the River Thames and around the perimeter of each pond where accessible. Aquatic macroinvertebrate surveys were carried out at 50 points distributed across the River Thames as well as at five locations around the perimeter of each pond surveyed. All surveys were conducted in adherence with strict biosecurity procedures to minimise the risk of transferring INNS between sites. For all surveys, all non-native species detected were recorded, not just those that are considered invasive. Assessment of

the invasion status and potential impact of the species recorded was based on the legislation mentioned above.

For prioritisation purposes, the species recorded were grouped according to their WFD UK TAG classification whereby species are categorised as ‘High’, ‘Moderate’, ‘Low’ or ‘Unknown’ impact according to their propensity to become invasive and for causing detrimental effects on recipient ecosystems (Table 1).

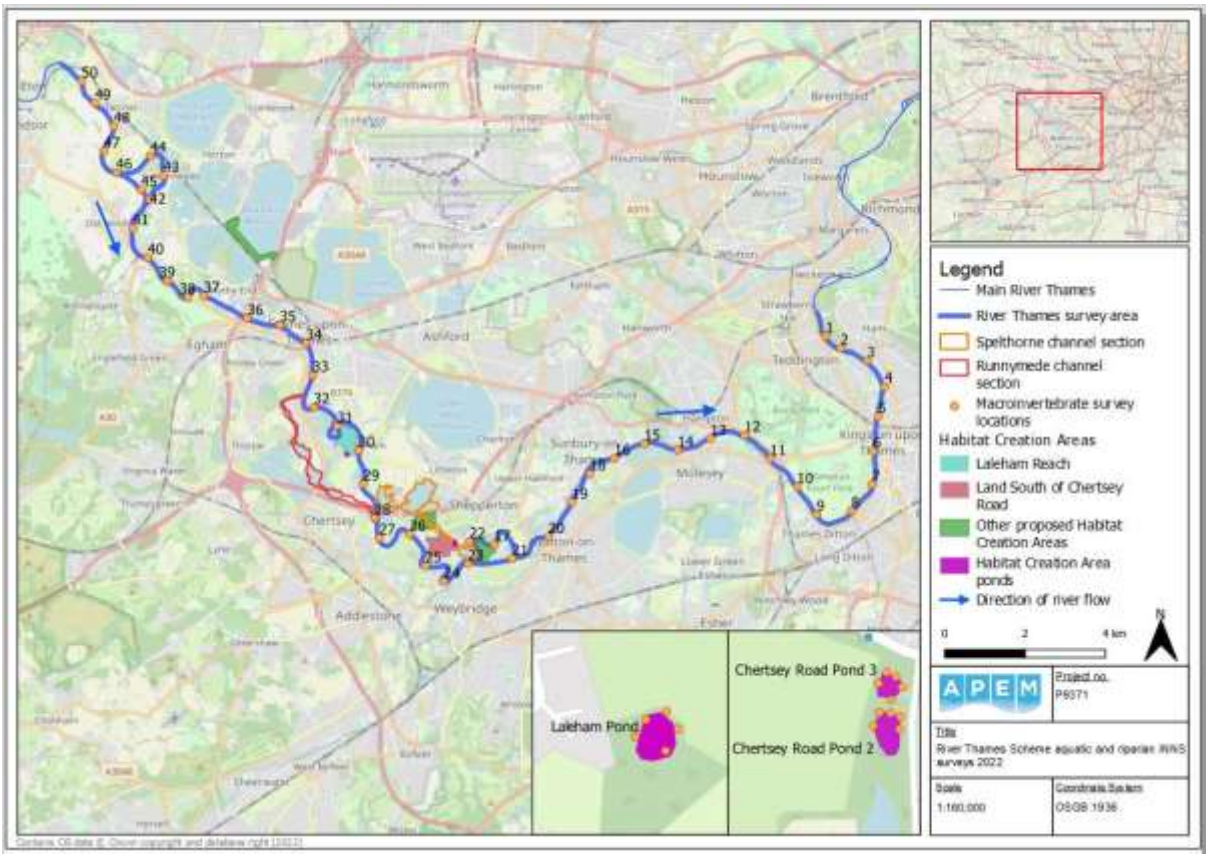

Figure 2: River Thames Scheme survey area, showing the proposed flood channel sections, HCAs and macroinvertebrate sampling locations (including sample site numbers).

Table 1: WFD UK TAG classification criteria

WFD UK TAG Impact level	Criteria
High	Alien species known to be invasive which have caused harm in the habitats they have become established in.
Moderate	Alien species that clearly fall between the Low and High categories.
Low	Alien species known to have a low probability of becoming invasive and where no adverse impacts have been observed in the field over many years of establishment.
Unknown	Alien species with an unknown probability of becoming invasive that require a full risk assessment.

A-INNS – Aquatic and riparian plant surveys

Aquatic and riparian plant walk-over and boat-based surveys were conducted in June - July 2022. Surveys were carried out along the entire 40 km stretch of the River Thames and all accessible areas of the HCA ponds. All INNS plants identified by visual inspection growing in or immediately adjacent to the water were recorded along with the grid reference of where patches were observed. Where appropriate, submerged plants were surveyed utilising a grapnel to sample areas where visual identification was compromised due to depth, high turbidity and / or density of floating vegetation.

A-INNS – Macroinvertebrate survey and sampling

Macroinvertebrate surveys were undertaken between July and September 2022 at 50 sites along the River Thames and five sites in each pond where suitable macroinvertebrate habitat was present (Figure 2). Depending on the nature of the waterbody, a range of sampling methods were employed and details of these are provided below.

Upon collection, all macroinvertebrate samples were preserved in 70% Industrial Methylated Spirit (IMS) and then transported to a bio-laboratory where all INNS were identified by morphological examination under a dissecting microscope to the lowest possible taxonomic level.

Airlifting

At each site along the River Thames, one three-minute airlift sample was collected by deploying a Yorkshire-pattern airlift device from a boat as per the EA operational instruction[4]. Airlifting is the standard protocol for sampling macroinvertebrates at sites

[4] Environment Agency (2017). Freshwater macroinvertebrate sampling in rivers: Operational Instruction 018_08. Issued 01/03/2017 Environment Agency, Bristol.

that are too deep (> 80 cm depth) for surveying by three-minute kick sampling. To ensure that a representative sample was obtained via airlifting, the compressed air was turned on for a series of five second intervals over numerous locations within each sampling site until the required time was reached.

Multi-habitat sweeps

Multi-habitat sweep sampling was carried out at all sites along the River Thames and in each of the three ponds for three minutes. Sweep sampling was conducted in accordance with Bass et al. (2000)[5], Neale et al. (2006)[6] and EA standard protocols using a pond net[7] to disturb substrate and marginal vegetation and collect macroinvertebrates inhabiting these areas. Samples were collected from optimal and representative habitat in the margins. The pond net was also used to scrape hard surfaces to capture any encrusting species present.

Upon collection, samples underwent a preliminary bank side screen so that any protected species, e.g., depressed river mussel *Pseudanodonta complanate*, white clawed crayfish *Austropotamobius pallipes*, could be removed and returned to where they were found. All other macroinvertebrates found were grouped by River Thames site number (50 in total) or pond (three in total) and preserved in 70% IMS before being transported to a bio-laboratory for identification.

Colonisers (Artificial Refuge Traps)

Colonisers, or artificial refuge traps, were utilised as a means of surveying for macroinvertebrates that are less likely to be detected via airlifting or sweep sampling, such as nocturnal INNS like the bloody red mysid *Hemimysis anomala*. Two macroinvertebrate colonisers were deployed at each sampling location along the Thames (n = 50 sites, 100 colonisers in total) and within each pond (n = five sites per pond, 10 colonisers per pond). All colonisers were left in-situ for at least one week after which they were collected and all inhabiting invertebrates (except any protected species located which were returned to the water where they were found) removed and preserved in 70% IMS. Samples were then transported to a bio-laboratory for identification to the lowest possible taxonomic level by morphological examination.

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[5] Bass J. A. B., Wright J. F., Clarke R. T., Gunn R. J. M. and Davy-Bowker J. (2000). Assessment of sampling methods for macroinvertebrates (RIVPACS) in deep watercourses. *Environment Agency R&D Technical Report* E134, pp.57.

[6] Neale M.W., Kneebone N.T., Bass J.A.B., Blackburn J.H., Clarke R.T., Corbin T.A., Davy-Bowker J., Gunn R.J.M., Furse M.T. and Jones J.I. (2006). Assessment of the Effectiveness and Suitability of Available Techniques for Sampling Invertebrates in Deep Rivers. *North South Shared Aquatic Resource (NS Share) Final Report* T1 (A5.8) – 1.1, pp.97.

[7] A standard Freshwater Biological Association pattern long-handled net with a 250 mm wide frame and a 1 mm mesh net 0.3 m deep.

Baited Traps

Baited cylindrical 'trappy' traps were deployed at the same time and locations as the colonisers to survey for crayfish, e.g., signal crayfish *Pacifastacus leniusculus* and virile crayfish *Faxonius virilis* (which are known to be present in the wider catchment) and Chinese mitten crabs *Eriorcheir sinensis*. Traps were deployed under licence from the EA (Permit numbers: EP/EW048-F-911/23716/01, EP/EW112-Q-128/23718/01, EP/EW112-S-130/23735/01, EP/EW112-U-132/23736/01, EP/EW112-W-134/23737/01) and in accordance with the Joint Nature Conservation Committee (JNCC) guidance[8]. The dimensions of the traps adhered to EA guidance[9]. Cat food, which has been commonly used in long-term trapping programmes[10], was used to bait the traps. Traps were either deployed from a boat or from the bankside depending on the accessibility of each location. Traps were set in areas deemed most suitable for crayfish / crab inhabitation, such as rocky substrate, soft banks, areas near hard structures and plant patches. When the habitat was homogenous or crayfish / crab habitat was not obvious, traps were set at approximately equidistant locations along the survey reach of the River Thames or within the ponds. Traps were left in-situ for an initial period of 24 hours after which they were checked. Traps were then redeployed for a further 24 hours before being removed (i.e., in-situ for a total of 48 hours).

Environmental DNA

In addition to conventional survey methods (airlifting / sweep sampling / trapping), water samples were collected for eDNA analysis. Environmental DNA, or eDNA, refers to the genetic material that can be obtained from an environmental sample, such as water, soil or sediment and this DNA can originate from a variety of sources including urine, faeces, shed cells and gametes[11,12]. Once extracted, quantitative Polymerase Chain Reaction (qPCR) or metabarcoding analysis can be used to either detect a single species / small group of species or conduct a community biodiversity assessment for a given taxonomic group.

At each site where an airlift / multi-habitat sweep sample was gathered, a water sample for eDNA testing was also collected (i.e., 50 samples from the River Thames and five

[8] JNCC (2015). Common Standards Monitoring Guidance for Freshwater Fauna. Version: October 2015, JNCC, Freshwater, ISSN 1743-8160.
[9] Dimensions detailed in the Environment Agency's CR1 license to trap crayfish application form under Section 27A of the Salmon and Freshwater Fisheries Act 1975.
[10] Stebbing, P., McPherson, N., Ryder, D. and Jeffrey, K. (2016). Centre for Environment Fisheries & Aquaculture Science (Cefas). Controlling Invasive Crayfish. Managing signal crayfish populations in small enclosed water bodies. Report C5775. https://randd.defra.gov.uk/ProjectDetails?ProjectId=18605
[11] Rees, H.C., Maddison, B.C., Middleditch, D.J., Partmore, J.R.M. and Gough, K.C. (2014). The detection of aquatic animal species using environmental DNA – a review of eDNA as a survey tool in ecology. *Journal of Applied Ecology* 51: 1450-1459
[12] Thomsen, P.F. and Willerslev, E. (2015). Environmental DNA – an emerging tool in conservation for monitoring past and present diversity. *Biological Conservation* 183: 4-18.

samples per pond). All eDNA samples were collected following NatureMetrics guidance[13] with precautions in place to minimise contamination risks (e.g., always wearing gloves, not touching the inside of sampling receptacles). Furthermore, new sterile kits and equipment were used for each sample and samples from different locations were stored separately. Samples were collected immediately prior to the conventional macroinvertebrate surveying to minimise sediment disturbance which can impact the results of eDNA testing. For any sites being surveyed on foot (i.e., without the need of a boat), samples were collected from the bankside when possible and safe to do so. If water entry was required, samples were collected from upstream to minimise the impact of sediment disturbance. Sampling during or immediately after periods of heavy rainfall was avoided where possible.

All eDNA samples were tested by NatureMetrics using signal crayfish, zebra mussel *Dreissena polymorpha* and generic Dreissenid mussel qPCRs (the latter test is less sensitive for detecting zebra mussel than the specific assay but will also detect other Dreissena species including quagga mussel *D. rostriformis bugensis*. As part of this, each sample was split into 12 aliquots, which were tested via qPCR separately. A sample was considered positive if one of the 12 aliquots returned a positive result. All assays were performed in the presence of positive and negative controls.

Limitations

Terrestrial INNS Survey

Every effort has been made to provide a comprehensive and robust assessment of the Survey Area. However, the following limitations remained during the assessment:

- Information obtained during a desk study is dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack of records for a habitat or species does not necessarily mean that they are absent.
- Given the seasonal nature of T-INNS the survey should not be taken as providing a full and definitive survey of any T-INNS and their extent – nevertheless, conducting these surveys in summer is anticipated to have mitigated this limitation to an extent. This limitation has been supplemented by desk study records to provide a more comprehensive floristic picture.
- T-INNS map has been reproduced from field notes and plans. Whilst this provides a sufficient level of detail to fulfil the requirements of this T-INNS report and Survey123 was used to log T-INNS locations, the maps are not intended

[13] Aquatic eDNA sampling instructions with NatureMetrics (video) https://www.youtube.com/watch?v=UXIA-yR8EcY

to provide information on exact locations of T-INNS; given the nature of spread of T-INNS exact locations are only valid on the day of survey.

- Given the extent of RTS, it is possible that field surveyors may have not observed all T-INNS present.
- Due to land access issues, Land Between Desborough Cut and Engine River HCA was unable to be surveyed.

Aquatic INNS Survey

When reviewing the A-INNS survey results the following limitations should be considered:

- All results presented below only include species recorded from the surveys conducted as part of this 2022 study and have not been combined with any data from previous surveys as this was beyond the scope of these works. Furthermore, as per the scope for these works, only aquatic macroinvertebrates and aquatic / riparian plants were surveyed as part of this study. As such, additional INNS to those mentioned within this report may have already been recorded within the survey area.
- The species distribution maps provided in the sections below for the plant surveys show the grid references at which patches were located. These maps do not specify the size/extent of individual patches and as such should be considered as being indicative of the distribution of each species recorded within the survey area. Further information on the extent of individual patches is contained within the supplementary raw data spreadsheet provided.
- Traps and colonisers were deployed as securely as possible, however, at five out of the 50 sites (1, 5, 29, 47 and 50) along the River Thames, colonisers could not be retrieved. Furthermore, at one site (44) colonisers did not remain fully submerged for the entire deployment duration due to reduced water levels.
- All macroinvertebrates collected were identified to the lowest possible taxonomic unit by APEM's bio-laboratory. For some specimens, identification was only possible to family level.
- The use of eDNA as a surveillance tool in ecology is relatively new compared to conventional methods and there are still many uncertainties regarding the reliability of this technique as a detection method. Furthermore, eDNA can be moved downstream in flowing systems[14] meaning that a positive detection does not necessarily confirm that the species is present at the specific location where the sample was collected. As such, positive eDNA results should be interpreted

[14] Deiner, K. and Altermatt, F. (2014). Transport distance of invertebtrate environmental DNA in a natural river. *PLoS ONE* 9(2): e88786

as an indication that the taxa detected is likely to be present within the vicinity of the sample collection site. Negative eDNA results should not be used to rule out the presence of a species / taxonomic group.

- No species specific eDNA assay is currently available for quagga mussels (*D. rostriformis bugensis*). As such, a general *Dreissena* assay was used in conjunction with the specific zebra mussel (*D. polymorpha*) qPCR assay. Whilst a positive result for the general *Dreissena* assay and negative for the *D. polymorpha* assay could indicate the presence of another Dressenid species (quagga mussels are currently the only other *Dreissena* species known to be in the UK) it should not be ruled out that this could also still be zebra mussel DNA, and it is just by stochastic change that is has been detected by one assay and not the other.

Despite the above limitations, the T-INNS and A-INNS survey is still considered to deliver a good assessment of the presence of T-INNS and A-INNS within RTS. The limitations above are not deemed severe enough to significantly affect the outcomes described within this report.

3 Results

Overview

This part of the report compiles the finding from the desk study and the T-INNS and A-INNS surveys of RTS in 2022.

T-INNS Desk study

A total of 165 terrestrial INNS records were reported from 26 species, as being present within proximity to the proposed footprint of the Runnymede and Spelthorne Channels. A further 803 terrestrial INNS records from 36 species were recorded in the remaining Project boundary for EIA scoping. Of these, 15 species were additional species to those recorded within the waterbodies associated with Runnymede and Spelthorne Channels.

A total of 859 terrestrial INNS records were reported as being presented within the Project boundary for EIA scoping +2km, comprising 49 species. Of these, 27 species were different to those recorded in the proposed footprint of the waterbodies associated with Runnymede and Spelthorne Channels.

Table 2 below summarises the records of T-INNS from the existing records search undertaken as described in the Methodology section.

Table 2: Desk top study results for reported T-INNS

Area	Species
Runnymede Channel	Himalayan Balsam *Impatiens glandulifera* Japanese Knotweed *Reynoutria japonica*
Spelthorne Channel	Japanese Knotweed *Reynoutria japonica*
Project boundary for EIA Scoping +2 km	American Mink *Neovison vison* Canada Goose *Branta canadensis* Chinese Muntjac *Muntiacus reevesi* Eastern Grey Squirrel *Sciurus carolinensis* Egyptian Goose *Alopochen aegyptiaca* Giant-rhubarb *Gunnera tinctoria* Giant Hogweed *Heracleum mantegazzianum* Himalayan Balsam *Impatiens glandulifera* Japanese Knotweed *Reynoutria japonica* Japanese Rose *Rosa rugosa* Mandarin Duck *Aix galericulata* Montbretia *Crocosmia pottsii x aurea = C. x crocosmiiflora* Rhododendron *Rhododendron ponticum* Ring-necked Parakeet *Psittacula krameria* Three-cornered Garlic *Allium triquetrum* Virginia-creeper *Parthenocissus quinquefolia* Wall Cotoneaster *Cotoneaster horizontalis* Yellow Archangel *Lamiastrum galeobdolon subsp. argentatum*
Land South of Wraysbury Reservoir HCA	-
Laleham Reach HCA	-
Chertsey Road Tip (Sheepwalk) HCA	Japanese Knotweed *Reynoutria japonica*
Land South of Chertsey Road HCA	-
Desborough Island HCA	Himalayan Balsam *Impatiens glandulifera*
Land between Desborough Cut and Engine River HCA	-
Laleham Golf Course HCA	Himalayan Balsam *Impatiens glandulifera*
Drinkwater Pit HCA	-
Grove Farm HCA	-

Area	Species
Littleton Lane HCA	-
Norlands Lane HCA	-

T-INNS - Walkover survey summary

Eight T-INNS species listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) or Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019 were recorded during the surveys. These were Himalayan balsam *Impatiens glandulifera*, Japanese knotweed *Reynoutria japonica*, variegated yellow archangel *Lamiastrum galeobdolon subsp. argentatum*, false Virginia creeper *Parthenocissus inserta*, montbretia *Crocosmia x crocosmiiflora*, *Cotoneaster* spp, Japanese rose *Rosa rugosa*, giant hogweed *Heracleum mantegazzianum,* muntjac deer *Muntiacus reevesi*, ring-necked parakeet *Psittacula krameri* and Egyptian goose *Alopochen aegyptiacus*.

Three aquatic INNS listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) or Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019 were also recorded; floating pennywort *Hydrocotyle ranunculoides*, New Zealand pygmyweed *Crassula helmsii* and duck potato *Sagittaria latifolia.*

Eleven additional species listed as concern on the LISI were recorded and comprised butterfly bush *Buddleia davidii*, orange balsam *Impatiens capensis*, common snowberry *Symphoricarpos albus*, cherry laurel *Prunus laurocerasus*, holm oak *Quercus ilex,* green alkanet *Pentaglottis sempervirens,* false-acacia *Robinia pseudoacacia*, passion flower *Passiflora caerulea*, goat's-rue *Galega officinalis* and *Lemna* species. Oak processionary moth *Haumetopea processionea* was also noted during the surveys.

Detailed T-INNS results are shown on drawing number ENVIMSE500260-GBV-ZZ-3ZZ -DR-EN-10121 (Sheets 1-14) in Appendix A. A summary of the T-INNS survey is also outlined in Table 3.

Three additional T-INNS species - giant rhubarb *Gunnera manicata* (IAS order 2019 Schedule 2), Chilean rhubarb *Gunnera tinctoria* and Himalayan knotweed *Persicaria wallichii* – were recorded during the aquatic INNS surveys (see Table 5).

Table 3: INNS plant species recorded during 2022 T-INNS surveys

Species Name	Common Name	Type	WFD UK TAG Impact	LISI	Species of Union Concern	Schedule 9 WCA 1981	Schedule 2 IAS Order 2019	Recorded in EIA Scoping Area + 2km as part of 2022 desk study
Fallopia japonica	Japanese knotweed	Terrestrial	High	Yes	No	Yes	No	Yes
Impatiens glandulifera	Himalayan balsam	Terrestrial	High	Yes	Yes	No	Yes	Yes
Heracleum mantegazzianum	Giant hogweed	Terrestrial	High	Yes	Yes	No	Yes	Yes
Hydrocotyle ranunculoides	Floating pennywort	Aquatic	High	Yes	Yes	No	Yes	Yes
Cotoneaster spp.	Cotoneaster	Terrestrial	-	Yes	No	Yes	No	Yes
Galega officinalis	Goat's-rue	Terrestrial	-	Yes	No	No	No	No
Buddleja davidii	Buddleia	Terrestrial	-	Yes	No	No	No	Yes
Quercus ilex	Holm oak	Terrestrial	-	Yes	No	No	No	No
Pentaglottis sempervirens	Green alkanet	Terrestrial	-	Yes	No	No	No	No
Prunus laurocerasus	Cherry laurel	Terrestrial	-	Yes	No	No	No	No
Robinia pseudoacacia	False acacia	Terrestrial	-	Yes	No	No	No	No
Parthenocissus inserta	False Virginia creeper	Terrestrial	-	No	No	Yes	No	Yes
Symphoricarpos albus	Common snowberry	Terrestrial	-	Yes	No	No	No	No
Impatiens capensis	Orange balsam	Terrestrial	Low	Yes	No	No	No	No
Crocosmia pottsii x aurea	Montbretia	Terrestrial	Unknown	Yes	No	Yes	No	Yes
Passiflora caerulea	Passion Flower	Terrestrial	Unknown	Yes	No	No	No	No
Lamiastrum galeobdolon subsp. argentatum	Variegated yellow archangel	Terrestrial	-	Yes	No	Yes	No	Yes
Rosa rugosa	Japanese rose	Terrestrial	-	No	No	Yes	No	Yes
Sagittaria latifolia	Duck-potato	Aquatic	-	Yes	No	No	Yes	No
Crassula helmsii	New Zealand pygmyweed	Aquatic	High	Yes	No	Yes	No	Yes
Thaumetopea processionea	Oak processionary moth	Invertebrate	-	Yes	No	No	No	Yes

Runnymede Channel

Patches of Himalayan balsam (IAS Order 2019 Schedule 2) were recorded at the north east and south east of the fields east of Abbey 1 Lake and Abbey 2 Lake within the Laleham Golf Course HCA, along the Burway channel. A large area of Himalayan balsam is present at the terminal end of the Runnymede Channel, in the understorey of the woodland east of Abbey Chase Nursing Home.

Japanese knotweed (WCA 1981 Schedule 9) was recorded east of Norlands Lane HCA. A small patch of Japanese knotweed was noted on the bank at Lake South of Norlands Lane, which appeared to be under management as it was taped off.

Floating pennywort (IAS Order 2019 Schedule 2) is present within the channel east of Norlands Lane HCA, at the northern end of Lake South of Norlands Lane, and along Abbey River, west of Abbey 2 Lake.

Goat's-rue (LISI) and buddleia (LISI) were recorded along the edges of the channel north of Fleet Lake towards Lake South of Green Lane, in the woodland understorey, within grassland and along footpath edges, east of Norlands Lane HCA and in the woodland north of Fleet Lake. Buddleia was also recorded in the woodland surrounding Abbey 1 and Abbey 2 Lakes.

Oak processionary moth was recorded in the woodland to the south of Abbey Lake 1 and Abbey Lake 2. All instances of OPM were reported to the Forestry Commission.

Spelthorne Channel

Several T-INNS were observed in the areas surrounding Littleton North lake. Japanese knotweed (WCA 1981 Schedule 9) was recorded near buildings to the southwest of the lake. Cotoneaster (WCA 1981 Schedule 9) was recorded growing along the access track within the open-mosaic habitat to the east of Littleton North lake. Goat's-rue (LISI) was present throughout the grassland, buddleia (LISI) was recorded infrequently within the woodland, and frequently within the open mosaic habitat to the east of the lake. Holm oak (LISI) was recorded in the woodland to the south.

Holm oak, buddleia and goat's-rue were scattered in the woodland along the track around Littleton South lake. There was a large stand of Japanese knotweed in the grassland to the east of the lake, which was fenced off, and some scattered around the gate to the site which showed signs of recent treatment (browning off).

Himalayan balsam (IAS Order 2019 Schedule 2) was recorded growing along the east bank of the terminal end of the Spelthorne Channel, around Ferry Lane lake. Buddleia, green alkanet (LISI), cherry laurel (LISI) and false acacia (LISI) were observed growing within hedgerows and woodland at Ferry Lane lake.

Five LISI species were recorded at Littleton East lake: holm oak, cherry laurel, goat's-rue, buddleia and false acacia.

An area of Himalayan balsam was recorded at the north of Sheepwalk East lake. Three LISI species were also recorded at Sheepwalk East lake: holm oak, false acacia and cherry laurel. Potential cotoneaster (WCA 1981 Schedule 9) was recorded just at the eastern point of Sheepwalk East lake, however due to limited access, it may have been mis-identified.

Land South of Wraysbury Reservoir HCA

No WCA 1981 Schedule 9 or IAS order 2019 Schedule 2 INNS were recorded on the site, however Himalayan balsam was present along the river just outside of the western boundary and was encroaching on the edge of the footpath adjacent to the boundary fence. False acacia (LISI), goat's-rue (LISI) and buddleia (LISI) were observed growing in a few places on the site.

Laleham Reach HCA

False Virginia creeper (WCA 1981 Schedule 9) was observed to the north of the site, along the boundary in the scrub and in the fence line adjacent to Laleham Reach road. Common snowberry (LISI) was also observed growing along the western boundary, likely planted as an ornamental hedge.

Chertsey Road Tip HCA

Japanese knotweed (WCA 1981 Schedule 9) was observed frequently at this site, primarily towards the eastern and western site boundaries. A large area (20m x 20m) of Japanese knotweed was observed to the south-east of the site, where it appeared to have been treated and was starting to grow back. Other instances of smaller patches of Japanese knotweed were recorded throughout the site.

Green alkanet (LISI), goat's-rue (LISI) and buddleia (LISI) were recorded at multiple points throughout the site.

Land South of Chertsey Road HCA

New Zealand pygmyweed (WCA 1981 Schedule 9) was observed within vegetation which had been cleared from the ditch to the south of the Survey Area during UKHab surveys on 5th July 2022. No evidence of New Zealand pygmyweed was found during the INNS survey in August 2022. No other INNS were recorded during the survey.

Desborough Island HCA

Himalayan balsam (IAS Order 2019 Schedule 2) was recorded along the north boundary of the site, along the river and in dense patches in the woodland understorey. One stand of Himalayan balsam was recorded along the river to southwest.

Holm oak (LISI) was recorded infrequently throughout the site, and frequently in the woodland in the southwest corner. Green alkanet (LISI) was present along footpaths across the site and buddleia was frequent along the road to the south and within the scrub to the southeast. Approximately 20 m of snowberry (LISI) was recorded in one area adjacent to the road to the south.

Land between Desborough Cut and Engine River HCA

No access was available to this area.

Laleham Golf Course HCA

Cotoneaster (WCA 1981 Schedule 9) and false Virginia creeper (WCA 1981 Schedule 9) were recorded around buildings/residential areas to the northeast, but no signs of these spreading to the wider environment were observed. Himalayan balsam (IAS Order 2019 Schedule 2) was recorded at the edge of the wet woodland to the northwest of the site and along the banks of the Abbey River, where it was observed beginning to encroach onto the footpath.

Stands of cherry laurel (LISI) were present within the golf course and hedges of cherry laurel and scattered buddleia were present along the road to northeast. False acacia (LISI) was observed in the south of the site.

Drinkwater Pit HCA

No WCA 1981 Schedule 9 or IAS Order 2019 Schedule 2 INNS were observed on the site. A 30 m x 5 m patch of goat's rue (LISI) was recorded to the east of the site, within a patch of tall ruderal vegetation. A patch of Himalayan balsam (IAS Order 2019 Schedule 2) was recorded just outside the northern site boundary.

Grove Farm HCA

Japanese knotweed (WCA 1981 Schedule 9) was observed in the woodland around the lake and Himalayan balsam (IAS Order 2019 Schedule 2) was recorded to the north-east of the site. Buddleia (LISI) was observed to the south of the field.

Littleton Lane HCA

Japanese knotweed (WCA 1981 Schedule 9) was recorded to the south of the site, and along the top of the earth bund which creates a barrier between the HCA and the field to the east. A 10 m strip of giant hogweed (IAS Order 2019 Schedule 2) was recorded along the earth bund; approximately 14 stands were present at the time of survey. Additional stands of giant hogweed and Japanese knotweed were observed to the east of the HCA boundary.

Buddleia (LISI) and goat's-rue (LISI) were scattered across site. Green alkanet (LISI) was recorded to the north of the site on the northern side of the base of the earth bund.

Norlands Lane HCA

Goat's-rue (LISI) was frequent along Green Lane, just outside the Land Logical site. Goat's-rue was also scattered throughout the grassland within the site and within the woodland west of the lake. Further LISI species buddleia, snowberry and cherry laurel were recorded on site. Bamboo was starting to encroach on the south-west of the site. Cotoneaster (WCA 1981 Schedule 9) was recorded south of Lake South of Green Lane.

There were multiple T-INNS recorded around the lake to the west, just outside the site boundary. Notably, Japanese knotweed (WCA 1981 Schedule 9) by the edge of the southern part of the lake and oak processionary moth to the northeast of the lake. Holm oak (LISI), green alkanet (LISI), snowberry and goat's-rue (LISI) were also recorded.

Remaining EIA Scoping Boundary

False Virginia creeper (WCA 1981 Schedule 9) was recorded on residential boundary walls along the public footpath east of the fields north of Mead Lake. Buddleia (LISI), goat's-rue (LISI), holm oak (LISI) and false acacia (LISI) were also recorded along the public footpath.

Himalayan balsam (IAS Order 2019 Schedule 2) was scattered along The Bourne by Thorpe Waterskii Park (St. Ann's Lake) with some stands in the watercourse and in

the woodland understorey. Oak processionary moth (LISI), false Virgina creeper, and cotoneaster (WCA 1981 Schedule 9) were also recorded in the woodland.

Stands of Himalayan balsam were observed along the ditch to the southeast of the Fields East of Abbey 2/Burway Ditch. Duck potato (WCA 1981 Schedule 9) and floating pennywort (IAS Order 2019 Schedule 2) were present in Abbey River by Abbey Chase Care Home.

Himalayan balsam was present in the woodland by Walton Bridge, along the stream to south of Project Boundary for EIA Scoping, and just within the Project Boundary for EIA Scoping. Japanese knotweed (WCA 1981 Schedule 9) and cherry laurel were recorded along the river below the bridge where Walton Lane crosses over to Desborough Island. Two trees with oak processionary moth nests were recorded along the Thames path south of Desborough Island. Orange balsam (LISI) was recorded frequently along the along the riverbank north of Walton Bridge, below Felix Road Recreation Ground.

Multiple patches of Japanese knotweed were recorded in the southern half of the fields and woodland to the west of Chertsey road tip. There was a large patch around a pond to the southwest, a 3 m x 3 m area in the west of the field, two large stands within the woodland understory along Chertsey Road, and some which looked to have been sprayed on the boundary fence to the east.

Japanese knotweed was also recorded in Manor Farm (north of Renfree Way, South of the M3). A 10 m x 8 m patch on the west boundary, a 3 m stretch along the bank to the southwest and a stand on the southwest corner of Manor Lake was observed, all stands showed evidence of being treated but were growing back.

Within Funky Footprints Nature Reserve, there was holm oak (LISI), buddleia (LISI) and green alkanet (LISI) scattered in the woodland and areas of New Zealand pygmyweed (WCA 1981 Schedule) around Black Ditch Pond. Although no Japanese knotweed was recorded at the time of survey, there were notices on the access gate and around the site saying that Japanese knotweed is being managed in the area. Cotoneaster and variegated yellow archangel (WCA 1981 Schedule 9) were recorded along the woodland path to the northeast.

Giant hogweed (IAS Order 2019 Schedule 2) and Japanese rose (WCA 1981 Schedule 9) were recorded in the fields north of Littleton North lake. Goat’s-rue was also recorded at low density.

Cotoneaster, Japanese rose, montbretia (WCA 1981 Schedule 9), Japanese knotweed, and Himalayan balsam were all recorded along the footpath along the north of the Thames, between Staines and D'oyly Carte Island.

Himalayan balsam was recorded on the southwest corner of the island at Sunbury Weir, along with scattered holm oak, buddleia and cherry laurel throughout the woodland and the broken hardstanding, and one record of orange balsam at the bridge to the Lock. Cotoneaster and cherry laurel were observed in the ornamental planting at Molesey Lock. Orange balsam and buddleia were recorded frequently along the riverbank south of Molesey Lock. Cotoneaster was observed in the ornamental planting at Teddington Lock. Himalayan balsam covered a 50 m stretch of the south side of Teddington Lock, and one patch was observed on the north side of the connected island.

A-INNS Desk Study

Table 4 below summarises the records of A-INNS from the existing records search as described in the Desk Study Methodology section.

Table 4: Desk top study results for reported A-INNS

Area	Species
Waterbodies or areas that would be linked to Runnymede Channel	Demon Shrimp *Dikerogammarus haemobaphes* Zebra Mussel *Dreissena polymorpha* Nuttall's (Pondweed) Waterweed *Elodea nuttallii* Floating Pennywort *Hydrocotyle ranunculoides* Water Fern *Azolla filiculoides* Signal Crayfish *Pacifastacus leniusculus* Jenkin's Spire Snail *Potamopyrgus antipodarum* Northern River Crangonyctid *Crangonyx pseudogracilis/floridanus* Duckweed *Lemna sp.* Least Duckweed *Lemna minuta* Bladder Snail *Physella acuta* Pale duckweed *Lemna valdiviana* Amphipod *Cryptorchestia cavimana*

Area	Species
	North American Limpet *Ferrissia californica* North American Flatworm *Girardia tigrine*
Waterbodies or areas that would be linked to Spelthorne Channel	Demon Shrimp *Dikerogammarus haemobaphes* Zebra Mussel *Dreissena polymorpha* Quagga Mussel *Dreissena rostriformis bugensis* Canadian (Pondweed) Waterweed *Elodea canadensis* Nuttall's (Pondweed) Waterweed *Elodea nuttallii* Water Fern *Azolla filiculoides* Jenkin's Spire Snail *Potamopyrgus antipodarum* Northern River Crangonyctid *Crangonyx pseudogracilis/floridanus* Mud shrimp *Chelicorophium curvispinum* Bladder Snail *Physella acuta* Waterlily *Nymphaea* × *marliacea* Spatterdock *Nuphar advena* North American Limpet *Ferrissia californica* North American Flatworm *Girardia tigrina*
Project boundary for EIA Scoping +2 km	New Zealand Pygmyweed *Crassula helmsii* Demon Shrimp *Dikerogammarus haemobaphes* Zebra Mussel *Dreissena polymorpha* Quagga Mussel *Dreissena rostriformis bugensis* Canadian (Pondweed) Waterweed *Elodea canadensis* Nuttall's (Pondweed) Waterweed *Elodea nuttallii* Floating Pennywort *Hydrocotyle ranunculoides* Water Fern *Azolla filiculoides* Jenkin's Spire Snail *Potamopyrgus antipodarum* Northern River Crangonyctid *Crangonyx pseudogracilis/floridanus* Least Duckweed *Lemna minuta* Bladder Snail *Physella acuta*
Land South of Wraysbury Reservoir HCA	-
Laleham Reach HCA	-

Area	Species
Chertsey Road Tip (Sheepwalk) HCA	-
Land South of Chertsey Road HCA	New Zealand Pygmyweed *Crassula helmsii*
Desborough Island HCA	Nuttall's (Pondweed) Waterweed *Elodea nuttallii* Floating Pennywort *Hydrocotyle ranunculoides*
Land between Desborough Cut and Engine River HCA	-
Laleham Golf Course HCA	Floating Pennywort *Hydrocotyle ranunculoides*
Drinkwater Pit HCA	-
Grove Farm HCA	-
Littleton Lane HCA	-
Norlands Lane HCA	-

A-INNS - Walkover Survey Summary

River Thames

Along the surveyed reach of the River Thames, eight High Impact, three Moderate Impact, three Low Impact and one Unknown Impact WFD UK TAG[4] species were recorded. The High Impact WFD UK TAG species include both aquatic (water fern *Azolla filiculoides*, Nuttall's waterweed *Elodea nuttallii* and floating pennywort) and riparian/terrestrial (Japanese knotweed, Himalayan balsam, giant rhubarb, Chilean rhubarb and Himalayan knotweed) species. Based on the 2020 desk study, there are no known records of giant rhubarb, Chilean rhubarb and Himalayan knotweed adjacent to the River Thames prior to 2020 (Table 4).

The Moderate Impact WFD UK TAG species include the monkey flower *Mimulus guttatus* and its hybrid *Mimulus x robertsii*, which are riparian species, and least duckweed *Lemna minuta*, an aquatic species. The Low Impact WFD UK TAG species include two riparian species (montbretia *Crocosmia* × *crocosmiiflora* and orange balsam *Impatiens capensis*) and one aquatic (sweet flag *Acorus calamus*). Canadian / tall goldenrod *Solidago canadensis / gigantea*, a riparian species, was also recorded but the impact of this species is currently unknown. Based on the 2021 desk study (GBV 2021e), all of these species, except for Canadian / tall goldenrod, have been previously recorded in the River Thames or surrounding lakes and streams.

A further four species that are non-native but not generally considered invasive in the UK were recorded along the River Thames: (beggarticks *Bidens frondosa*, sweet galingale *Cyperus longus*, orange day lily *Hemerocallis fulva* and baby tears *Soleirolia soleirolii*). It should be noted that although sweet galingale is native to the UK, it is

locally invasive in London. Based on the 2020 desk study, beggarticks has been previously recorded in the River Thames, but the other three species have not been recorded in the area prior to 2021 (Table 5).

Table 5: INNS (Aquatic and Riparian) plant species recorded in the surveyed reach of the River Thames in 2022

Species Name	Common Name	Type	WFD UK TAG Impact	GB Risk Assessment	Species of Union Concern	Schedule 9 WCA1981/ Schedule 2 IAS Order 2019	Previously recorded in River Thames
Azolla filiculoides	Water fern	Aquatic	High	Yes	No	Yes	Yes
Elodea nuttallii	Nuttall's waterweed	Aquatic	High	Yes	Yes	Yes	Yes
Fallopia japonica	Japanese knotweed	Terrestrial	High	Yes	No	Yes	Yes
Hydrocotyle ranunculoides	Floating pennywort	Aquatic	High	Yes	Yes	Yes	Yes
Impatiens glandulifera	Himalayan balsam	Terrestrial	High	Pending	Yes	Yes	Yes
Gunnera manicata	Giant rhubarb	Terrestrial	High	Yes	No	Yes	No
Gunnera tinctoria	Chilean rhubarb	Terrestrial	High	Yes	Yes	Yes	No
Persicaria wallichii	Himalayan knotweed	Terrestrial	High	Yes	No	No	No
Lemna minuta	Least duckweed	Aquatic	Moderate	Pending	No	No	Yes
Mimulus guttatus	Monkey flower	Terrestrial	Moderate	Yes	No	No	Yes
Mimulus x Robertsii	Hybrid monkey flower	Terrestrial	Moderate	Yes	No	No	No†
*Acorus calamus**	Sweet flag	Aquatic	Low	No	No	No	No†
Crocosmia x Crocosmiiflora	Montbretia	Terrestrial	Low	Pending	No	Yes	No†
Impatiens capensis	Orange balsam	Terrestrial	Low	Yes	No	No	Yes
*Soleirolia soleirolii**	Baby tears	Terrestrial	-	No	No	No	No
*Bidens frondosa**	Beggarticks	Terrestrial	-	No	No	No	Yes
Convolvulus spp.	Bindweed	Terrestrial	-	No	No	No	NA
*Cyperus longus***	Sweet galingale	Terrestrial	-	No	No	No	No
*Hemerocallis fulva**	Orange day lily	Terrestrial	-	No	No	No	No
Solidago canadensis/gigantea	Canadian / Tall goldenrod	Terrestrial	-	No	No	No	No

**Non-native but not considered invasive in the UK*

***Native to the UK but known to be locally invasive in London*

† *Not previously recorded in the River Thames but recorded in surrounding lakes or streams*

'-' Not listed in the WFD UK TAG guidance at the time of survey

In terms of distribution, aquatic plant INNS were not confined to a specific area of the survey reach, however, many of the High Impact WFD UK TAG species located were in the mid-section of the survey reach near to the proposed flood channel locations (Figure 3).

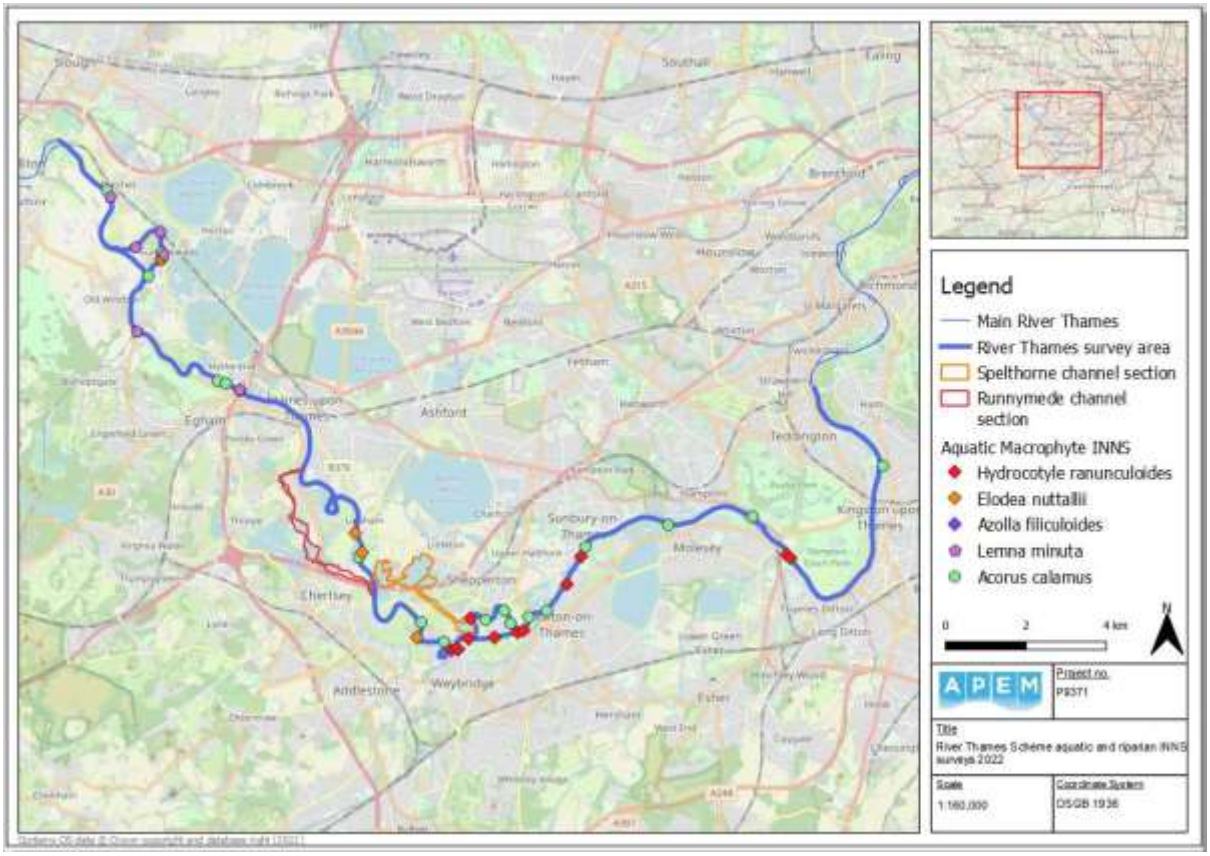


Figure 3: Distribution of aquatic plant INNS within RTS. ◇ = High Impact WFD UK TAG species, ⬠ = Moderate Impact WFD UK TAG species, ○ = Low Impact WFD UK TAG species.

Terrestrial INNS species were found along much of the survey reach of the River Thames. Himalayan balsam, (a High Impact WFD UK TAG species), and Himalayan knotweed (a Low Impact WFD UK TAG species), were particularly prevalent and observed at upstream, mid and downstream locations of the survey reach (Figure 4).

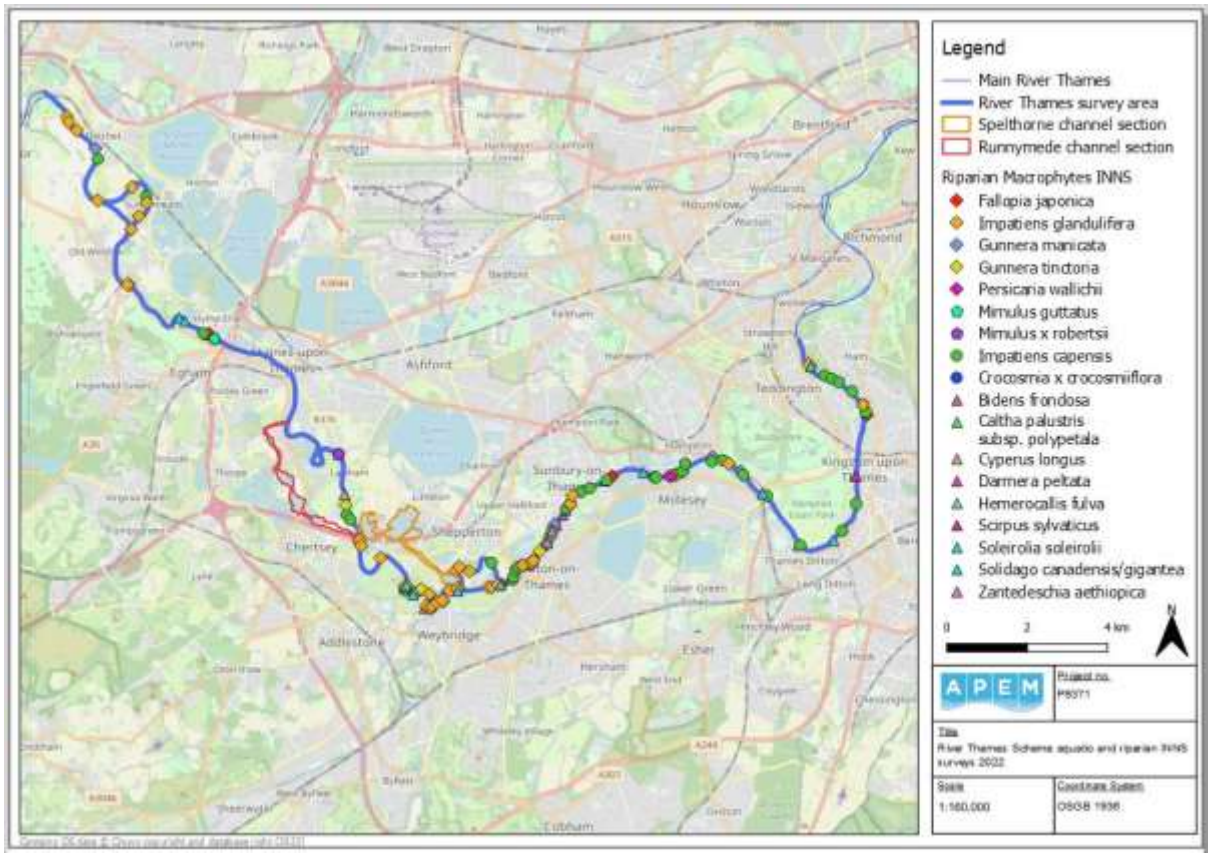


Figure 4: Distribution of riparian plant INNS species within RTS. ◇ = High Impact WFD UK TAG species, ⬠ = Moderate Impact WFD UK TAG species, ○ = Low Impact WFD UK TAG species, △ = Unknown Impact or not in WFD UK TAG species list.

HCA Ponds

No aquatic or riparian plant INNS were recorded at the Laleham Reach Pond or either of the two ponds situated on the Land South of Chertsey Road HCA. Whilst terrestrial species were not the focus of this study, one terrestrial plant INNS (bindweed *Convolvulus* spp.) was recorded as an incidental finding between the two Chertsey Road ponds and along the road next to these ponds.

Conventional Macroinvertebrate Survey

River Thames

WFD UK TAG High Impact invasive macroinvertebrate species recorded along the River Thames survey reach included Asian clam *Corbicula fluminea*, zebra mussel *Dreissena polymorpha*, demon shrimp *Dikerogammarus haemobaphes* and bloody red mysid *Hemimysis anomala*. Some mussels *Dreissena* spp. and freshwater shrimp *Dikerogammarus* spp. that were collected could only be identified to the family level. It should not be ruled out that these individuals could potentially be other high impact

invasive species within these families, such as quagga mussel *D. rostriformis bugensis* and killer shrimp *D. villosu*.

The New Zealand mudsnail *Potamopyrgus antipodarum*, which is a Moderate Impact WFD UK TAG invasive species, and a freshwater amphipod *Crangonyx pseudogracilis / floridanus*, which is a Low Impact WFD UK TAG invasive species, were also recorded in the River Thames.

Species listed as Unknown Impact WFD UK TAG status were also present in the River Thames and included another freshwater shrimp belonging to the family *Corophiidae Corophium* spp., a polychaete worm *Hypania invalida* and pulmonate snails, most of which were identified to family level *Physella* spp. with one identified to species level, *P. acuta*, commonly known as the bladder snail.

Flatworms belonging to the family *Dendrocoelidae* were also found at three of the sites along the main Thames. This is the first time species from this family have been found in the UK and their potential impact has not yet been assessed.

One Chinese mitten crab (High Impact WFD UK TAG species) carapace was located at site 10, and this was preserved in 70% IMS for confirmation of species identification at the bio-laboratory. Results of the macroinvertebrate surveys are present in Table 6.

Table 6: Macroinvertebrate INNS species recorded in River Thames 2022

Species Name	Common Name	No. of individuals from Thames	Location(s) found in River Thames	WFD UK TAG Impact	GB Risk Assessment	Union Concern	Schedule 9 WCA 1981 / Schedule 2 IAS Order 2019	Previously recorded in River Thames
Corbicula fluminea	Asian clam	121	1,2,4,5,6,7,12,13,14, 16,17,19,20,21, 24,37	High	Yes	Yes	No	Yes
Dikerogammarus haemobaphes	Demon shrimp	4367	All (1-50)	High	Yes	No	No	Yes
Dikerogammarus spp.	Malacostracan	70	6,9,13,38	High*	Yes	No	No	No*
Dreissena polymorpha	Zebra mussel	5	13,39,45, 47,50	High	Yes	Yes	No	Yes
Dreissena spp.	Mussel	1	26	High**	Yes	No	No	Yes**
Eriocheir sinensis†	Chinese mitten crab	1	10	High	Yes	Yes	Yes	Yes
Hemimysis anomala	Bloody-red mysid	4	16,17	High	Yes	No	No	Yes
Potamopyrgus antipodarum	New Zealand mudsnail	7513	1-21,23-50	Moderate	Yes	No	No	Yes
Crangonyx pseudogracilis / floridanus	Malacostracan	9	7,16,19,22,25	Low	Yes	No	No	Yes
Corophium spp.	Malacostracan	67	3,7,8,12,14, 16,19,23,27, 31,34,42,47,48,50	Unknown***	No	No	No	No***
Dendrocoelidae spp.	Platyhelminth	1	22	Unknown	No	No	No	No
Dendrocoelum romanodanubiale	Platyhelminth	2	6,13	Unknown	No	No	No	No
Hypania invalida	Polychaete worm	2725	2-38, 40-50	Unknown	No	No	No	Yes
Physella acuta	Bladder snail	1	9	Unknown	No	No	No	Yes

Species Name	Common Name	No. of individuals from Thames	Location(s) found in River Thames	WFD UK TAG Impact	GB Risk Assessment	Union Concern	Schedule 9 WCA 1981 / Schedule 2 IAS Order 2019	Previously recorded in River Thames
Physella spp.	Pulmonate snail	16	1,3,4,12,16, 20, 24, 27,28, 31,32,37,46	Unknown	No	No	No	Yes
Corophium spp.	Malacostracan	67	3,7,8,12,14, 16, 19, 23, 27,31,34,42,47, 48,50	Unknown	No	No	No	No
Chelicorophium curvispinum	Malacostracan	3421	2-17,18-21, 23-28, 30-50	-	No	No	No	No
Chelicorophium robustum	Malacostracan	15	6,11,12,33,38	-	No	No	No	No
Chelicophorium spp.	Malacostracan	13	6,9,26	-	No	No	No	No
Corophiidae	Malacostracan	26	2,4,6,9,13,17	-	No	No	No	No

**Applies to killer shrimp, D. villosus*
***Applies to quagga mussel, D. rostriformis bugensis*
****Applies to Corophium curvispinum*
†*Carapace only – no live captures*

The most abundant High Impact WFD UK TAG species recorded via the conventional survey methods were demon shrimp (*D. haemobaphes*, n = 4367), which were found at all sample locations within the River Thames, followed by the Asian clam (*C. fluminea*, n = 121), which were predominantly recorded at mid- to downstream sites (between sites 1 and 24). Zebra mussels (*D. polymorpha,* n = 6) were more abundant upstream (between sites 39 and 50) whereas bloody red mysid (*H. anomala,* n = 4) were only recorded at two sites (sites 16 and 17) in the mid-section of the survey reach (Figure 5).

Figure 5: Distribution of WFD UK TAG High Impact invasive macroinvertebrate species within the survey area for the Project.

Across all macroinvertebrate species recorded in the River Thames the New Zealand mudsnail (a Moderate Impact WFD UK TAG species) was the most abundant (n = 7513) and was found at 49 out of 50 sample locations (Figure 6).

The invasive flatworm species *Dendrocoelidae* spp. / *Dendrocoelum romanodanubiale* that is potentially new to the UK was found at three sites (sites 6, 13 and 22) along the River Thames survey reach (Figure 6).

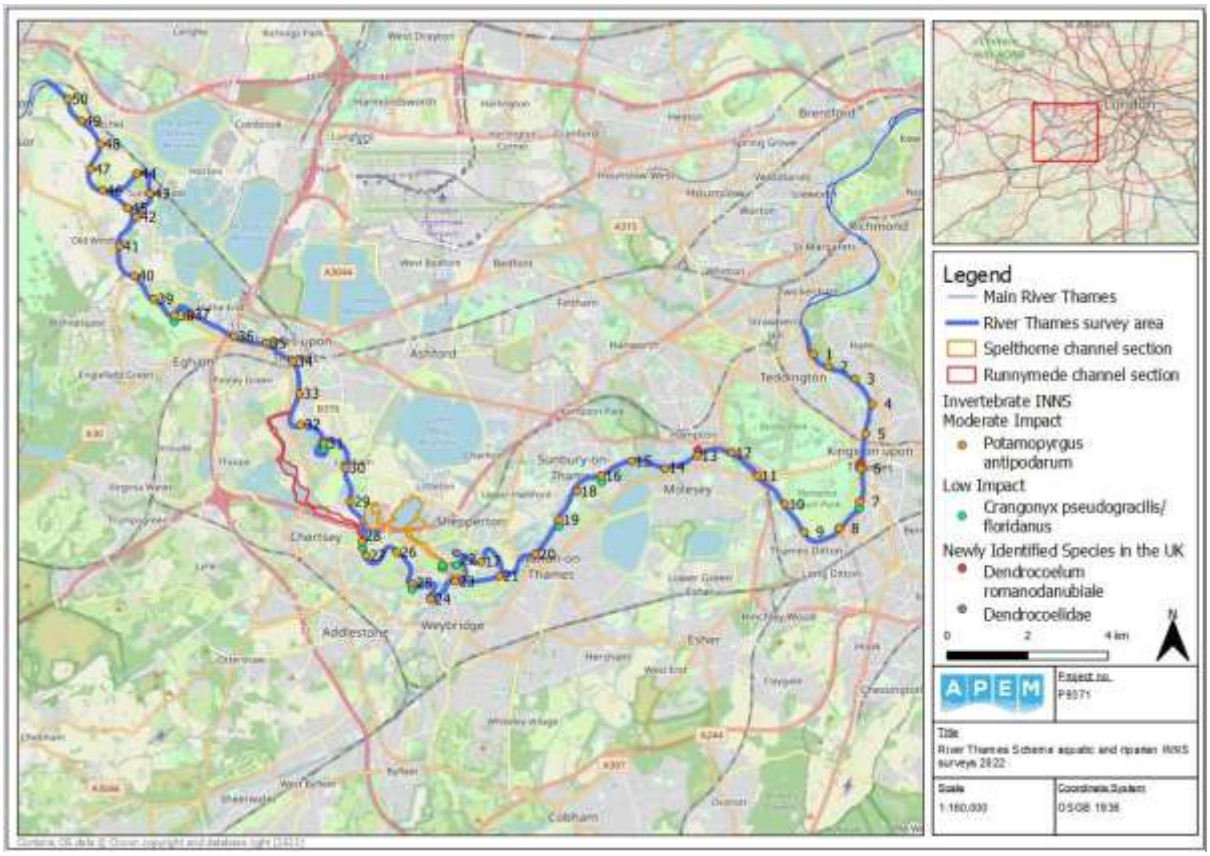


Figure 6: Distribution of Moderate Impact and Low Impact WFD UK TAG species and new non-native macroinvertebrate species within the survey area for the Project.

HCA Ponds

The malocastracan *C. pseudogracilis / floridanus,* a Low Impact WFD UK TAG species, was found in Chertsey Road Ponds 2 (n = 327) and 3 (n = 418). Freshwater snails belonging to the *Physella* genus were also found in Chertsey Road Pond 2 (n = 4) as well as in Laleham Pond (n = 5). Though listed as invasive, this genus of snail has an Unknown Impact classification according to the WFD UK TAG guidance.

Signal Crayfish qPCR

Though no crayfish were caught in any of the traps, invasive signal crayfish DNA was detected at 15 of the 50 sites along the River Thames survey reach (Figure 7). Signal crayfish are a High Impact WFD UK TAG species as well as being listed under Schedule 9 of the Wildlife and Countryside Act 1981 and being of Union Concern.

No signal crayfish DNA was detected in any of the three HCA ponds (Figure 7).

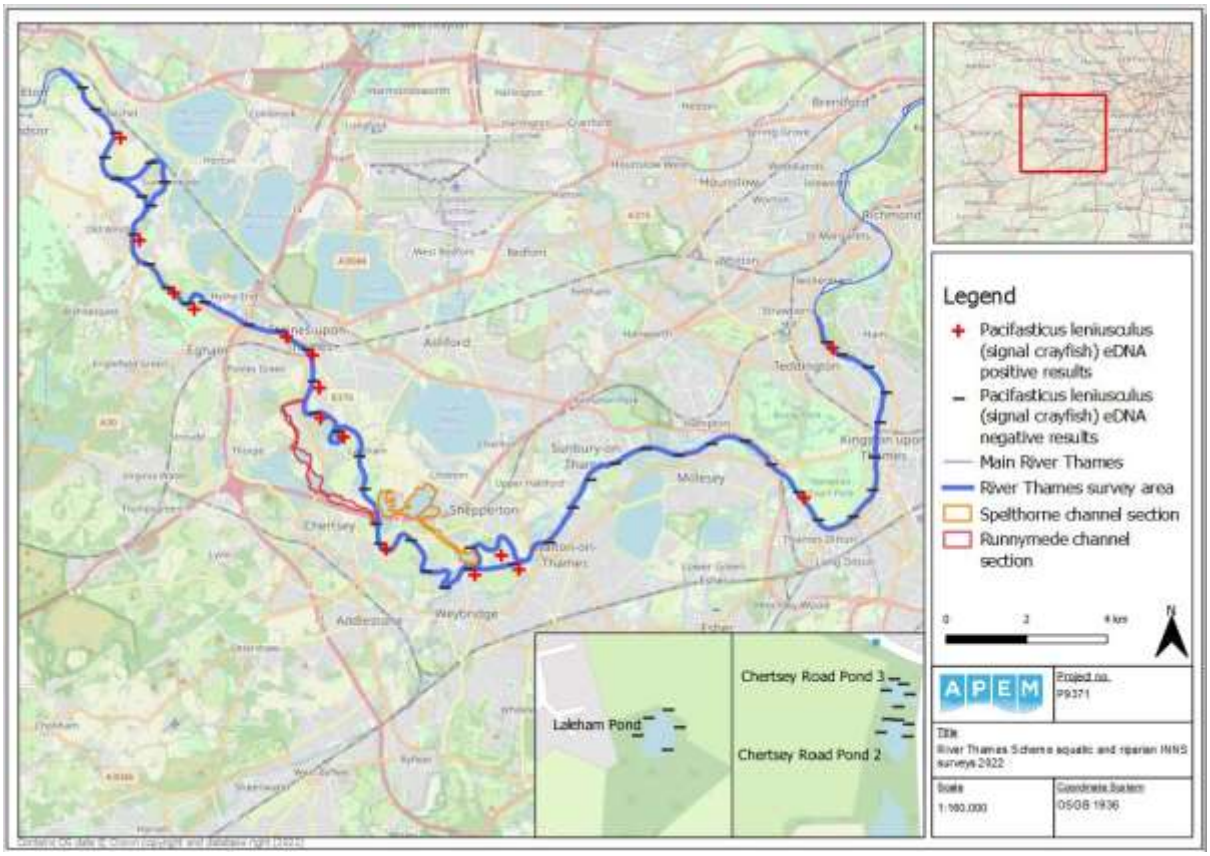


Figure 7: Signal crayfish eDNA positive and negative results within the Project survey area.

Driessenid Mussel Assays

All of the 50 samples collected from the River Thames were positive for both the general *Dreissenid* mussel and the zebra mussel specific qPCR assays (Figure 8). For Chertsey Road pond 2, three of the samples were negative for both assays, one of the samples was positive for both assays and one was only positive for the generic *Dreissena* assay. For Chertsey Road pond 3, three of the samples were negative for both assays, one of the samples was positive for both assays and one was only positive for the zebra mussel assay. For Laleham Reach pond, two of the samples were negative for both assays, two of the samples were positive for both assays and one was only positive for the generic *Dreissena* assay.

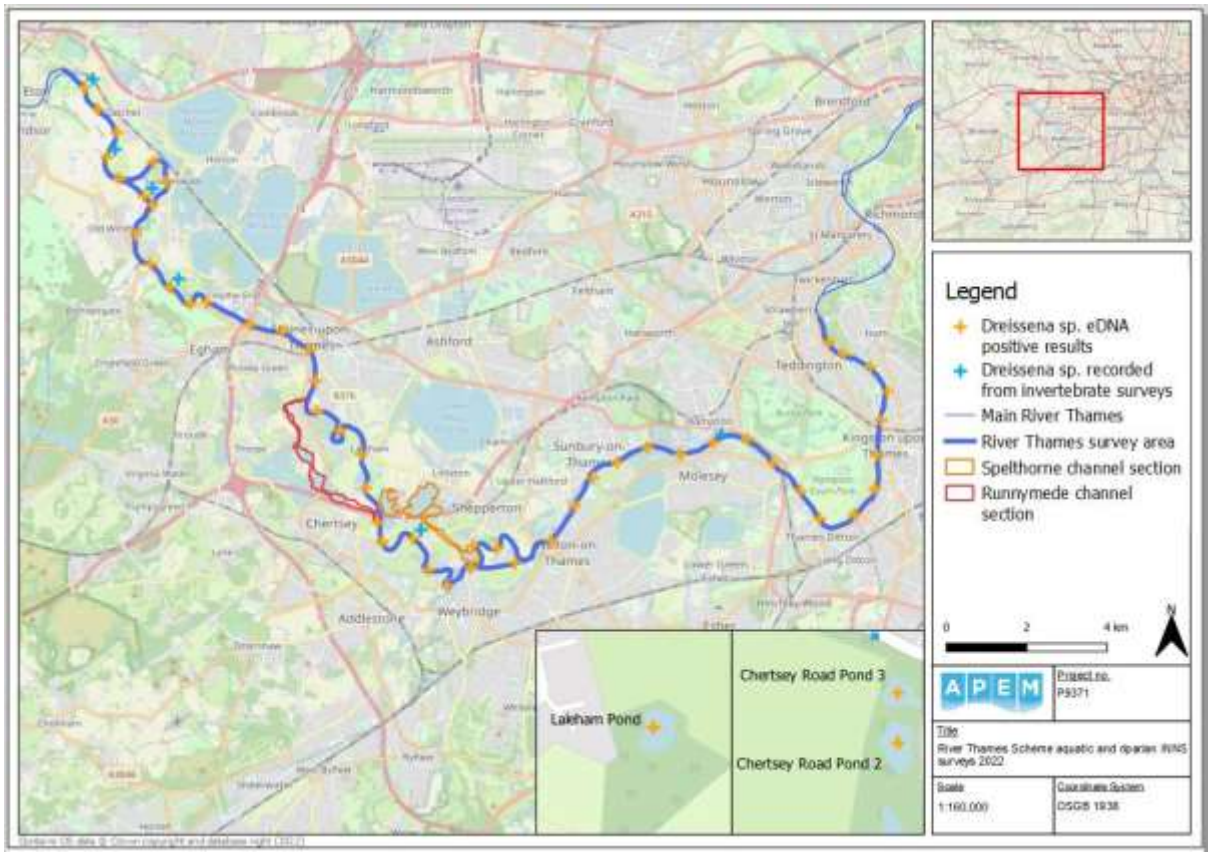


Figure 8: Positive Dreissena mussel species detections from conventional surveying and eDNA analysis within the survey area of the Project.

4 Interpretation

Terrestrial INNS (T-INNS) Survey

A number of T-INNS were recorded within the survey area, and there is a risk of these plant species being spread as a result of construction activities and from increased hydrological connectivity as a result of the Project.

Runnymede Channel

Himalayan balsam, Japanese knotweed, floating pennywort, goat's-rue, buddleia, and oak processionary moth were present within areas of the Channel.

Himalayan balsam and floating pennywort spread through waterways, facilitated by vehicles using the watercourse, animals, and human interaction. Japanese knotweed has likely spread through the watercourse from another site, and could be spread further through human activity, animal interaction, and through the watercourse. Goat's rue and buddleia are spread by wind, human activity, animals and vehicles.

Oak processionary moth (OPM) is known to present within the M25, and the distribution and spread of this species is being monitored. OPM can be spread by wind, by vehicles along roads and railways, through the horticultural and forestry trade, and by human activity. All occurrences of OPM have been reported to the Forestry Commission.

Spelthorne Channel

Himalayan balsam was recorded at various points within the channel and has spread through the waterways, facilitated by animals and human activity.

Japanese knotweed has most likely spread throughout the channel via transfer from human activity.

Cotoneaster, holm oak, green alkanet, cherry laurel and false acacia were recorded throughout the channel, the spread of which has likely come from planting or potential transfer from animals and members of the public.

Goat's rue and buddleia are spread by wind, human activity, animals and vehicles.

Land South of Wraysbury Reservoir HCA

Himalayan balsam was found just outside the boundary at the southwest of this site, the seeds of which have spread via the plant's natural explosion mechanisms between

the public footpath and the train track and the site. Given the nature and spread of this species, there is a risk that it will spread onto the site.

Laleham Reach HCA

False Virginia creeper and common snowberry were recorded along the fence line along the road, which has potentially spread from members of the public walking on the site, from vehicles driving on the roads parallel to the site, from neighbouring residential gardens, or may have been planted along the boundary.

Chertsey Road Tip (Sheepwalk) HCA

Japanese knotweed, buddleia, goat's-rue and green alkanet were recorded within the HCA.

The spread of these T-INNS has likely come from illegal fly tipping. The spread of Japanese knotweed around the site may be from excavators moving earth and the use of dirt bikes around the site, noted on the day of survey.

Land South of Chertsey Road HCA

New Zealand pygmyweed was observed on the site during the UKHab surveys but was not observed during the INNS surveys due to recent vegetation clearance and a very dry summer. This species will likely re-appear in favourable conditions. The spread of this species is through water and may also be spread within the site by machinery, animals and human activity,

Desborough Island HCA

Himalayan balsam recorded at the site has most likely been spread by the watercourse, and from human and animal activity at the site.

Holm oak, green alkanet and snowberry were also noted on the site, which could be from transfer via animals and members of the public using the site or intentional planting.

Japanese knotweed with signs of treatment was recorded at this site during 2021 T-INNS surveys but no evidence was seen during the 2022 surveys.

Land between Desborough Cut and Engine River HCA

There was no access to this site.

Laleham Golf Course HCA

Cherry laurel and cotoneaster were recorded at the site and could potentially be from the planting of the species. Buddleia was recorded throughout the site and has likely been spread by animals, human activity, vehicles and wind.

Himalayan balsam was recorded along Abbey River and at the edge of the wet woodland, which has spread from the watercourse.

Drinkwater Pit HCA

The presence of goat's rue and small balsam could be transferred from the multiple cars that visit R&W Motor Company. Small balsam was recorded outside of the site boundary, however there is high risk of this species spreading into the site through human, animal or vehicular transmission.

Grove Farm HCA

No access to most of the site, however Japanese knotweed was observed in the woodland by the dry pond. This may have spread through transfer from animals (particularly horses) or human activity within the site.

Littleton Lane HCA

Japanese knotweed, giant hogweed, buddleia and goat's-rue were recorded at this site.

The spread of these T-INNS has likely come from illegal fly tipping. The spread of these species will be aggravated by the aggregate works to the south, and by animals traversing the site.

Norlands Lane HCA

Goat's-rue was abundant along the footpath on Green Lane towards the site. This could have transferred via cars and members of the public using the road.

Buddleia, snowberry, and cherry laurel were recorded throughout the site which could have transferred by animals, wind, vehicles and human activity.

Japanese knotweed, green alkanet and goat's-rue were observed around the lake, to the northwest, which could have spread from members of the public using the fishing lake. Cotoneaster, holm oak and snowberry may have been planted.

Remaining EIA Scoping Boundary

T-INNS species listed in Schedule 9 of the WCA 1981 or Schedule 2 of the IAS Order that were recorded within the remaining Project boundary include: False virginia creeper, Himalayan balsam, Japanese knotweed, giant hogweed, cotoneaster, variegated yellow archangel, Japanese rose and montbretia. These are likely to have spread through a variety of different pathways, including members of the public, watercourse dispersal of seeds, contaminated soil, recreational fishing, garden escapes, fouling species and more.

Furthermore, three aquatic WCA 1918 Schedule 9 species were observed; Duck potato, floating pennywort and New Zealand pygmyweed. These may have spread via humans and animals using the waterways, for example people fishing or using water vehicles.

The LISI listed species buddleia, goat's-rue, holm oak, false acacia, green alkanet, cherry laurel and orange balsam may have spread through wind, intentional planting and by members of the public.

Oak processionary moth was observed in the remaining Project boundary. OPM can be spread by wind, by vehicles along roads and railways, through the horticultural and forestry trade, and by humans. All occurrences of OPM have been reported to the Forestry Commission.

Aquatic INNS (A-INNS) Survey

From the aquatic and riparian surveys carried out in 2022, a total of 36 INNS were identified, of which 19 were plants and 17 were macroinvertebrates. Of these 36 species, 20 are listed as High Impact or Moderate Impact according to the WFD UK TAG guidance[4,5] based on their propensity to become invasive and damage recipient ecosystems. Furthermore, seven plant and two macroinvertebrate species listed in Schedule 9 of the Wildlife and Countryside Act were detected as well as four plant and three macroinvertebrate species of Union Concern. Overall, this demonstrates that there are several INNS present within the survey area that could be considered high risk.

All of the High and Moderate Impact WFD UK TAG plant species located were found in the River Thames. Many of these species, including water fern, Nuttall's pondweed, Japanese knotweed, floating pennywort and Himalayan balsam, have previously been recorded in the survey area. All these species, except floating pennywort, were recorded upstream of both proposed flood channel locations meaning, should hydrological connections be created, there is potential for these species to be spread (although it should be considered that these species are already widespread

throughout the UK). Whilst floating pennywort was only detected upstream of one of the flood channels (Spelthorne) it is considered to be less widespread across the UK than the other High/Moderate Impact WFD UK TAG plant species detected. Therefore, the potential for increased spread of this species by the proposed new flood channels may have a greater consequence for the overall distribution of INNS in the UK.

As far as can be ascertained, three WFD UK TAG High Impact plant species (Himalayan knotweed, giant rhubarb and Chilean rhubarb) were recorded for the first time within the survey area as part of this study. All three of these species currently have limited distributions across the survey area.

All High and Moderate Impact WFD UK TAG macroinvertebrate species located were found in the River Thames and have previously been recorded in the survey area, including Asian clam, demon shrimp, zebra mussel, bloody red mysid, Chinese mitten crab, New Zealand mudsnail and signal crayfish. Several of these species (Asian clam, demon shrimp, zebra mussel and New Zealand mudsnail) were recorded across the River Thames survey reach, including upstream of the flood channels meaning that the Project may facilitate the dispersal of these species. Two of the species, bloody red mysid and Chinese mitten crab (carapace) were only found downstream of both proposed flood channel sections, making it less likely that these species could be spread by the Project (although it should be noted that Chinese mitten crabs are migratory and known to be prevalent in the Thames catchment[15]).

Whilst signal crayfish were detected across the survey reach by eDNA, the presence of this species could not be confirmed by conventional survey methods. The positive eDNA result but lack of live captures could be due there only being a small population of animals present, as eDNA is generally considered to be more sensitive than conventional surveying[16]. Alternatively, the eDNA detected could belong to a signal crayfish population upstream of sample locations in the wider catchment given that eDNA is known to be transported by the current.

No High or Moderate Impact WFD UK TAG species were detected by conventional monitoring at any of the HCA pond sites. Positive results were, however, obtained for both the general *Dreissena* and specific zebra mussel eDNA assays at all HCA ponds. Again, this could be related to small population size, which is perhaps supported by the fact that at least two of the samples collected from each site were negative for both

[15] Marine Biological Association Distribution | Mitten Crab Watch (mittencrabs.org.uk)

[16] Rees, H.C., Maddison, B.C., Middleditch, D.J., Partmore, J.R.M. and Gough, K.C. (2014). The detection of aquatic animal species using environmental DNA – a review of eDNA as a survey tool in ecology. Journal of Applied Ecology 51: 823-826.

assays. Furthermore, for those samples that were positive, the number of positive PCR replicates was low (1-2 out of 12) in most cases, potentially indicating low levels of target DNA (although it should be noted that the relationship between eDNA amount, and population density is unclear). It must be noted, however, that the positive eDNA results for zebra mussels in the ponds should only be used as tentative evidence of presence as this could not be confirmed via conventional sampling methods.

From the eDNA testing, one of the samples collected each from Laleham Reach Pond and Chertsey Road pond 2, were positive for the generic *Dreissena* assay but not the specific zebra mussel assay. Whilst it could be interpreted that this indicates the presence of a different *Dreissena* species it should be noted that in both cases only one of the 12 replicates returned positive. Therefore, it should not be ruled out that these positive results also relate to detection of zebra mussel DNA, and it is just stochastic change that this species was detected by one assay and not the other.

Macroinvertebrate species that have not been previously recorded in the survey area were also found and include *Dendrocoelidae* spp. and *Chelicophorium* / *Corophium* spp., neither of which are listed in WFD UK TAG, Schedule 9 or are of Union Concern. Of particular interest, *Dendrocoelidae* spp. has never been documented elsewhere in the UK prior to 2020 and efforts should be made to prevent its wider dispersal. A previous survey conducted in the River Thames on behalf of the EA in May 2020 also reported one record of another *Dendrocoelidae* species (*D. lacteum*). In that survey one *D. lacteum* was recorded at Teddington Weir which is near to site 1 (downstream extent) in this 2022 study[17].

[17] Wallace, N. (2022). River Thames Scheme: Teddington Weir 2020/2021 Survey Report. Project Code: TH37, Environment Agency.

5 Recommendations

Terrestrial INNS (T-INNS) Survey

T-INNS Recommendations

The following recommendations are made for the Project in relation to the findings of the T-INNS survey:

- Consider updating the 2022 INNS data gap analysis to accommodate the data from the 2022 surveys.
- Site-specific T-INNS management plans to be produced for species listed in Schedule 9 of the WCA 1981 or Schedule 2 of the IAS Order 2019 (including Japanese knotweed, Himalayan balsam and giant hogweed). These management plans are recommended to be devised and implemented three years before construction begins to allow for treatment and removal to be confirmed before large scale impacts occur. These management plans should be regularly updated throughout the whole life cycle of the Project.
- Removal/treatment of LISI listed species to be completed prior to the start of works.
- Identification and eradication of oak processionary moths.
- Further T-INNS walkover surveys to be conducted at all locations no later than three months before construction of the Project commences to determine if any T-INNS have spread into the HCA. Pre-construction survey is recommended in spring/summer when T-INNS are in growth/flower to aid in identification.

Buffer/avoidance zones are often used to identify the likelihood of spread/impact for T-INNS. For Japanese knotweed, 7 m is the standard buffer zone from the plant where soil could contain contaminated root material. Buffer zones of 7m for balsam species and 1 m for all other T-INNS species are used to limit unintentional spread of seeds. These recommended buffer zones are displayed in locations where T-INNS have been observed during the survey (Appendix A).

If designs change, then recommendations may need to be revised to reflect this. Ecological recommendations are likely to only be valid for 18 months after the completion of the survey. Beyond this, discussion with an ecologist on the validity of the results made in this report are advised. This could lead to an update to the T-INNS

survey and subsequent revised/additional recommendations. This approach is in line with guidance on the lifespan of ecology surveys, CIEEM, 2019.

General Good Practice Measures

RTS has the potential to result in some spread of T-INNS during construction. Therefore, some general good practice measures are recommended in relation to works involving T-INNS. These measures should be reviewed after the completion of pre-construction surveys, consultation and appropriate consents/permissions. Measures include:

- Appropriate measures should be in place to control the spread of T-INNS within RTS and wider area, these include boot and vehicle washes, control waste bins and demarking where invasive species are present;
- Appropriate permissions should be gained to use chemical treatments in waterbodies and within close proximity (5m) of watercourses;
- Appropriate Personal Protection Equipment should be used when conducting further surveys, mitigation and treatment for the removal of T-INNS; and
- Best construction practices and environmental management should be undertaken in accordance with the Environmental Damage (Prevention and Remediation) Regulations 2009.

Ecological Enhancements

Several ecological enhancements are recommended below, specifically in relation to INNS:

- replacement of areas affected by T-INNS treatment with native planting such as mixed scrub with a more species rich mix;
- new riparian planting along watercourse stretches that will be affected by treatment of T-INNS, to provide cover and food resources for a range of species such as: water voles, fish, eels, aquatic invertebrates.

Aquatic INNS (A-INNS) Survey

From this and previous studies, several high-risk INNS have been confirmed to be present within the survey area, and the proposed creation of new hydrological connections as part of the Project represents a risk for the increased dispersal of these, and subsequently introduced, species. As such, it is recommended that all data from this and previous studies are synthesised and a risk assessment conducted to determine the likelihood of spread and impact of each of the recorded INNS, and how this may be affected by the Project. Once risk assessments are in place, an appraisal of mitigation options should be conducted, and management plans developed where required.

With global invasion rates predicted to continue to increase[18], it is crucial that risk assessments consider species that may be introduced in the future, as well as those that are already present. Species that are currently absent from an area but are at a high risk of future introduction are often referred to as horizon species. The potential consequences of the Project on the likely introduction, establishment, spread and impact of horizon species has not been assessed thus horizon scanning should be incorporated into the recommended risk assessments to identify potential future invasive species[19].

Finally, there remains a gap in the INNS baseline data for the Project given that, as far as we are aware, no field surveys specifically for fish have been carried out in the last five years within any of the water bodies within the survey area. Several fish species, including common carp *Cyrpinus carpio*, topmouth gudgeon *Pseudorasbora parva*, goldfish *Carassius auratu*), pumpkinseed sunfish *Lepomis gibbosus* and zander *Sander lucioperca* are listed as High or Moderate Impact WFD UK TAG species, and it is important that bespoke fish surveys are carried out within the survey area to inform future risk assessments and management plans.

[18] Pyšek, P., Hulme, P.E., Simberloff, D., Bacher, S., Blackburn, T.M., Carlton, J.T., Dawson, W., Essl, F., Foxcroft, L.C., Genovesi, P., Jeschke, J.M., Kühn, I., Liebhold, A.M., Mandrak, N.E., Meyerson, L.A., Pauchard, A., Pergl, J., Roy, H.E., Seebens, H., van Kleunen, M., Vilà, M., Wingfield, M.J. and Richardson, D.M. (2020). Scientists' warning on invasive alien species. *Biol Rev*, 95: 1511-1534. https://doi.org/10.1111/brv.12627

[19] Roy, H.E. et al. (2014). Horizon scanning for invasive alien species with the potential to threaten biodiversity in Great Britain. *Global Change Biology* 20(12): 3859-3871

6 Conclusions

Eight T-INNS species listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) or Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019, and eleven additional species listed as concern on the LISI were recorded during the walkover T-INNS surveys. Additionally, three A-INNS listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) or Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019 were recorded during the terrestrial INNS survey. The Project has the potential to spread these INNS to areas where they are not currently present.

In the current A-INNS study, invasive aquatic / riparian plant and aquatic macroinvertebrate species, including several High and Moderate Impact WFD UK TAG species, were found across the length of the River Thames survey reach. Many of these species were found within the mid-section of the River Thames survey reach where the proposed flood channels will adjoin the main Thames, particularly near the Spelthorne channel, meaning that this channel has the potential to facilitate the spread of invasive species. High Impact WFD UK TAG species were also noted upstream of both channels with some less than 1 km from where the Runnymede channel (upstream from Spelthorne channel) is proposed and others further upstream (approx. 10 km from proposed channel locations). The species found upstream include aquatic and riparian plants as well as macroinvertebrate species, many of which are known to be highly dispersive and could be spread further via the proposed flood channels.

No High or Moderate Impact WFD UK TAG species were detected by conventional monitoring within any of the HCA ponds. High Impact WFD UK TAG *Dreissena* mussel species were, however, detected at all the ponds through eDNA meaning that there is a potential for these ponds to contribute to the spread of High Impact INNS should they be retained / developed as part of the Project.

Overall, the data collected as part of this terrestrial and aquatic /riparian INNS 2022 study will improve our understanding of existing INNS distribution in the Project survey area and potential spread under the Project. As this study used specialised sampling methods to target macroinvertebrate and plant INNS, there can be high confidence that target species, if present, were found. It is important to note, however, that capturing the full invasive species picture is challenging, as absence of INNS during sampling does not necessarily equate to actual absence of INNS throughout the entire study area year-round. As such, future assessments and management strategies should consider these records as conservative estimates of INNS present within the Project area, with species found previously and during these surveys considered as present where recorded.

7 References

APEM (2020) Aquatic invertebrate and aquatic/riparian plant INNS surveys.

APEM (2022) River Thames Scheme Aquatic INNS Survey 2022.

British Standards Institution (2013) Biodiversity. Code of practice for planning and development: 42020. BSI, London.

CIEEM (2017a) Guidelines for Preliminary Ecological Appraisal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.

CIEEM (2017b) Guidelines for Ecological Report Writing, 2nd Edition. Chartered Institute of Ecology and Environmental Management, Winchester.

CIEEM (2019) Advice Note – On the Lifespan of Ecological reports and surveys. Chartered Institute of Ecology and Environmental Management, Winchester.

CIEEM (2020) Guidelines for Accessing and using biodiversity data in the UK. Chartered Institute of Ecology and Environmental Management, Winchester. https://cieem.net/wp-content/uploads/2019/04/Advice-Note.pdf, accessed 01/09/21.

Connolly, S. & Charles, P. (2005) Environmental good practice pocketbook. CIRIA, London.

GBV (2016) River Thames Scheme (Datchet to Teddington) Capacity Improvements and Flood Channel Project. Preliminary Ecological Appraisal for the Flood Channel.

GBV (2020a) River Thames Scheme Capacity Improvements and Flood Channel Project. Phase One Habitat Survey for Land between Desborough Cut and Engine River.

GBV (2020b) River Thames Scheme Capacity Improvements and Flood Channel Project. Phase One Habitat Survey for Land South of Chertsey Road.

GBV (2020c) River Thames Scheme Capacity Improvements and Flood Channel Project. Phase One Habitat Survey for Land South of Wraysbury Reservoir.

GBV (2021a) River Thames Scheme Capacity Improvements and Flood Channel Project. Phase One Habitat Survey for Chertsey Tip.

GBV (2021b). River Thames Scheme Capacity Improvements and Flood Channel Project. Phase One Habitat Survey for Desborough Island.

GBV (2021c). River Thames Scheme Capacity Improvements and Flood Channel Project. Phase One Habitat Survey for Laleham Reach.

GBV (2021d) River Thames Scheme Capacity Improvements and Flood Channel Project. Water Vole Survey Report.

GBV (2021e) River Thames Scheme Capacity Improvements and Flood Channel Project. Invasive Non-Native Species desktop study. IMSE500260-GBV-ZZ-3ZZ-RP-00014.

GBV (2022) Aquatic and Terrestrial Invasive Non-Native Species Gap Analysis. ENVIMSE500260-GBV-ZZ-3ZZ-RP-EN-10046.

GBV (2022) Preliminary Ecological Appraisal (in progress).

JNCC (2010) Handbook for Phase 1 Habitat Survey – A Technique for Environmental Audit. England Field Unit, Nature Conservancy Council. Reprinted by Joint Nature Conservation Committee, Peterborough.

MAGIC (2018) Multi-Agency Geographic Information for the Countryside.

Ministry of Housing, Communities and Local Government (2021) National Planning Policy Framework. Controller of Her Majesty's Stationery Office, London.

Natural England, Defra & Environment Agency (2016) Environmental Management Guidance; Harmful Weeds and Invasive, Non-native Plants: Prevent them Spreading.

Stace, C.A. (2019) New Flora of the British Isles (4th Ed.). Cambridge University Press, Cambridge.

Appendices

Appendix A – Terrestrial INNS Maps
ENVIMSE500260-GBV-ZZ-3ZZ -DR-EN-10121 (Sheets 1-14)

Appendix B – eDNA Survey Results

Appendix C – Legislation and Planning Policy

Appendix A – Terrestrial INNS Maps ENVIMSE500260-GBV-ZZ-3ZZ -DR-EN-10121 (Sheets 1-14)

Appendix B: eDNA Survey Results

Table 7: eDNA results for mussel (Dreissenid spp.), zebra mussel (Dreissenid polymorpha) and signal crayfish (Pacifasticus leniusculus) assay replicates

Site	*Dreissenid* spp. Positive (n/12)	*Dreissenid* spp. Negative (n/12)	*Dreissena polymorpha* Positive (n/12)	*Dreissena polymorpha* Negative (n/12)	*Pacifasticus leniusculus* Positive (n/12)	*Pacifasticus leniusculus* Negative (n/12)
River Thames 001	12	0	12	0	1	11
River Thames 002	12	0	12	0	0	12
River Thames 003	12	0	11	1	0	12
River Thames 004	12	0	3	9	0	12
River Thames 005	12	0	12	0	0	12
River Thames 006	12	0	7	5	0	12
River Thames 007	12	0	6	6	0	12
River Thames 008	12	0	12	0	0	12
River Thames 009	12	0	12	0	0	12
River Thames 010	12	0	12	0	3	9
River Thames 011	12	0	12	0	0	12
River Thames 012	12	0	12	0	0	12
River Thames 013	12	0	12	0	0	12
River Thames 014	12	0	12	0	0	12
River Thames 015	12	0	12	0	0	12
River Thames 016	12	0	12	0	0	12
River Thames 017	12	0	12	0	1	11
River Thames 018	12	0	12	0	0	12
River Thames 019	12	0	12	0	0	12
River Thames 020	12	0	12	0	0	12
River Thames 021	12	0	12	0	1	11

Site	*Dreissenid* spp. Positive (n/12)	*Dreissenid* spp. Negative (n/12)	*Dreissena polymorpha* Positive (n/12)	*Dreissena polymorpha* Negative (n/12)	*Pacifasticus leniusculus* Positive (n/12)	*Pacifasticus leniusculus* Negative (n/12)
River Thames 022	12	0	12	0	0	12
River Thames 023	12	0	12	0	2	10
River Thames 024	12	0	12	0	0	12
River Thames 025	12	0	12	0	0	12
River Thames 026	12	0	12	0	0	12
River Thames 027	12	0	12	0	3	9
River Thames 028	12	0	12	0	0	12
River Thames 029	12	0	12	0	0	12
River Thames 030	12	0	12	0	0	12
River Thames 031	12	0	12	0	1	11
River Thames 032	12	0	12	0	1	11
River Thames 033	12	0	12	0	2	10
River Thames 034	12	0	12	0	1	11
River Thames 035	12	0	12	0	1	11
River Thames 036	12	0	12	0	0	12
River Thames 037	12	0	12	0	0	12
River Thames 038	12	0	12	0	1	11
River Thames 039	12	0	12	0	1	11
River Thames 040	12	0	12	0	0	12
River Thames 041	12	0	12	0	2	10
River Thames 042	12	0	12	0	0	12
River Thames 043	12	0	12	0	0	12
River Thames 044	12	0	12	0	0	12
River Thames 045	12	0	12	0	0	12

Site	*Dreissenid* spp. Positive (n/12)	*Dreissenid* spp. Negative (n/12)	*Dreissena polymorpha* Positive (n/12)	*Dreissena polymorpha* Negative (n/12)	*Pacifasticus leniusculus* Positive (n/12)	*Pacifasticus leniusculus* Negative (n/12)
River Thames 046	12	0	12	0	0	12
River Thames 047	12	0	12	0	0	12
River Thames 048	12	0	12	0	1	11
River Thames 049	12	0	12	0	0	12
River Thames 050	12	0	12	0	0	12
Chertsey Road Pond 2	0	12	0	12	0	12
Chertsey Road Pond 2	0	12	0	12	0	12
Chertsey Road Pond 2	3	9	5	7	0	12
Chertsey Road Pond 2	1	11	0	12	0	12
Chertsey Road Pond 2	0	12	0	12	0	12
Chertsey Road Pond 3	0	12	0	12	0	12
Chertsey Road Pond 3	0	12	0	12	0	12
Chertsey Road Pond 3	1	11	2	10	0	12
Chertsey Road Pond 3	0	12	1	11	0	12
Chertsey Road Pond 3	0	12	0	12	0	12
Laleham Reach Pond	0	12	0	12	0	12
Laleham Reach Pond	1	11	0	12	0	12
Laleham Reach Pond	2	10	1	11	0	12
Laleham Reach Pond	1	11	0	12	0	12
Laleham Reach Pond	0	12	0	12	0	12

Appendix C: Legislation and Planning Policy

Legislation and Planning Policy

Note that the details provided in this appendix are for general guidance only and should not be relied upon as a definitive statement of the law. The legislation is applicable in England only. Only legislation applicable to this scheme is provided here.

Legislation Afforded to Species

Legislation Overview

The EC Habitats Directive requires Member States to take measures to maintain or restore wild species listed on the Annexes to the Directive at a favourable conservation status, introducing robust protection for those species of European importance. The Directive was transposed into English and Welsh law (up to the seaward limits of territorial seas) by The Conservation of Habitats and Species Regulations 2017 (Habitats Regulations).

When the United Kingdom left the European Union, the Habitats Regulations were amended by the Conservation of Habitats and Species Regulations (Amendment) (EU Exit) Regulations 2019. These amendment regulations transferred functions from the European Commission to English and Welsh government but retained the levels of protection to the identified species of European importance.
The following notes are relevant for all species protected under the Habitats Regulations 2017 (as amended):

- The term ‘deliberate’ is interpreted as being somewhat wider than ‘intentional’ and may be thought of as including an element of recklessness. The Habitats Regulations do not define the act of ‘migration’ and, therefore, as a precaution, it is recommended that short distance movement of animals for e.g. foraging, breeding or dispersal purposes are also considered.
- In order to obtain a European Protected Species Mitigation licence, the application must demonstrate that it meets all of the following three ‘tests’:
- the action(s) are necessary for the purpose of preserving public health or safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequence of primary importance for the environment;
- there is no satisfactory alternative; and
- the action authorised will not be detrimental to the maintenance of the species concerned at a favourable conservation status in their natural range.

The Wildlife and Countryside Act 1981 (as amended) is the principle mechanism for the legislative protection of wildlife in Great Britain. It does not extend to Northern Ireland, the Channel Islands or the Isle of Man. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') is enacted in Great Britain, and was also how the provisions of the European Union Directive on the Conservation of Wild Birds (79/409/EEC) were originally enacted in Great Britain.

The Wildlife and Countryside Act 1981 (as amended) has been subject to a number of amendments, the most important of which are through the Natural Environment & Rural Communities (NERC) Act 2006 and the Countryside and Rights of Way (CRoW) Act (2000).
Other legislative Acts affording protection to wildlife and their habitats include:

- Natural Environment and Rural Communities Act (NERC) 2006.

Invasive non-native weeds

Part II of Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), and Part 2 of Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019, list invasive non-native plant species for which it is a criminal offence in England and Wales to plant or cause to grow in the wild due to their impact on native wildlife. Species listed under the Wildlife and Countryside Act 1981 (as amended) include Japanese knotweed *Fallopia japonica* and various cotoneaster species including *Cotoneaster horizontalis*. Species listed under the Invasive Alien Species (Enforcement and Permitting) Order 2019 include Himalayan balsam *Impatiens glandulifera*, giant hogweed *Heracleum mantegazzianum*, floating pennywort *Hydrocotyle ranunculoides*.

Part I of Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), and Part 1 of Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019, list invasive non-native species of animal for which it is a criminal offence in England and Wales to release or allow to escape into the wild due to their impact on native wildlife.

Species that have previously been listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), but that which are now listed under Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019, have been removed from the WCA 1981 Schedule 9.

The Invasive Alien Species Regulation (Regulation (EU) 1143/2014) includes a set of measures to be taken across the EU in relation to invasive alien species. The core of the Regulation is the list of Invasive Alien Species of Union concern (Union List). The species included on this list are subject to restrictions and measures set out in the Regulation. These include restrictions on keeping, importing, selling, breeding, growing and releasing into the environment.

Member States are required to

- take action on pathways of unintentional introduction (i.e. prevention)
- take measures for the early detection and rapid eradication of these species
- manage species that are already widely spread in their territory

Effects of legislation on the Proposed Development

It is not an offence for plants listed in Part II of Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) or Part 2 of Schedule 2 of the Invasive Alien Species (Enforcement and Permitting) Order 2019, to be present on the development site; however, it is an offence to cause them to spread. Therefore, if any of the species are present on site and construction activities may result in further spread (e.g. earthworks, vehicle movements) then it will be necessary to design and implement appropriate mitigation prior to construction commencing.

Injurious weeds

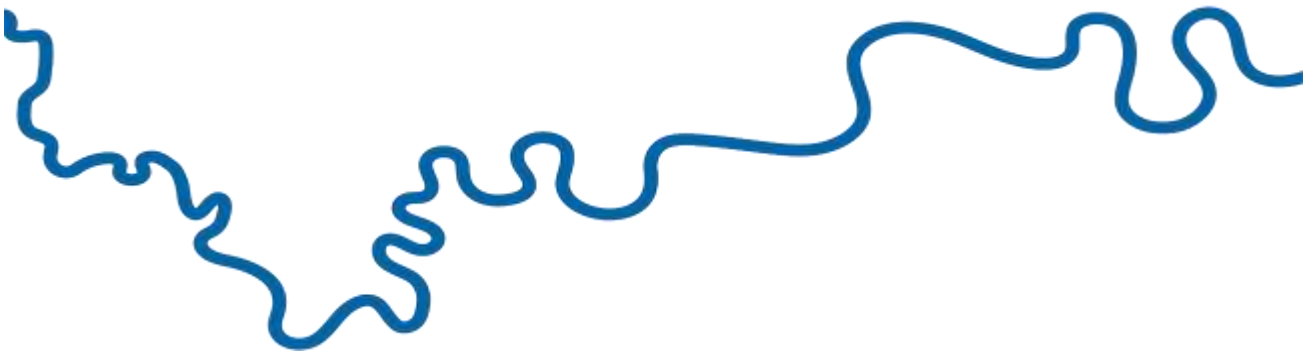
Under the Weeds Act 1959 any land owner or occupier may be required prevent the spread of certain 'injurious weeds' such as spear thistle Cirsium vulgare, creeping thistle *Cirsium arvense*, curled dock *Rumex crispus*, broad-leaved dock *Rumex obtusifolius* and common ragwort *Senecio jacobaea*. It is a criminal offence to fail to comply with a notice requiring such action to be taken. The Ragwort Control Act 2003 establishes a ragwort control code of practice as common ragwort is poisonous to horses and other livestock. This code provides best practice guidelines and is not legally binding.

National Planning Policy

The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2021) states that planning policies and decisions should contribute to and enhance the natural and local environment, minimizing impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures (Section 15).

Guidance

The London Invasive Species Initiative (LISI) is hosted by Greenspace Information for Greater London CIC (GiGL) and receives day to day direction from the LISI business group, which is currently chaired by the Environment Agency. The LISI sets out a list of Invasive Non-native species and species that have been used domestically that are affecting London's landscapes and public areas. It has a comprehensive list that sets out a range of priority categories for these species.



SURREY COUNTY COUNCIL

Environment Agency

The River Thames Scheme, delivered in a partnership led by the Environment Agency and Surrey County Council, will reduce flood risk for residents and businesses and improve the surrounding area.