Greater Cambridge Partnership

CAMBOURNE TO CAMBRIDGE

Environmental Statement
Appendix TR5.1: Aquatic Ecology Report 2022

Greater Cambridge Partnership

CAMBOURNE TO CAMBRIDGE

Aquatic Ecology Report 2022

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1 Introduction

1.1 Project background

1.1.1. The Cambourne to Cambridge project (C2C) is a proposed new 13.6km public transport route linking Cambourne and Cambridge. It will include a dedicated busway serving communities in Cambourne and the proposed Bourn Airfield development, as well as in Hardwick, Coton and the West Cambridge campus. A service road, to be used as a path for active travel, particularly by cyclists and pedestrians, will run alongside the busway. A new travel hub will be provided at Scotland Farm.

1.1.2. Scheme details are provided in the main report to the Environmental Statement (ES).

1.1.3. The Scheme Boundary and watercourses assessed are shown in **Figure TR5-1-1-1** and **Figure TR5-1-1-2**.

Figure TR5-1-1-1 – Aquatic ecology scoping area and Scheme Boundary (West).

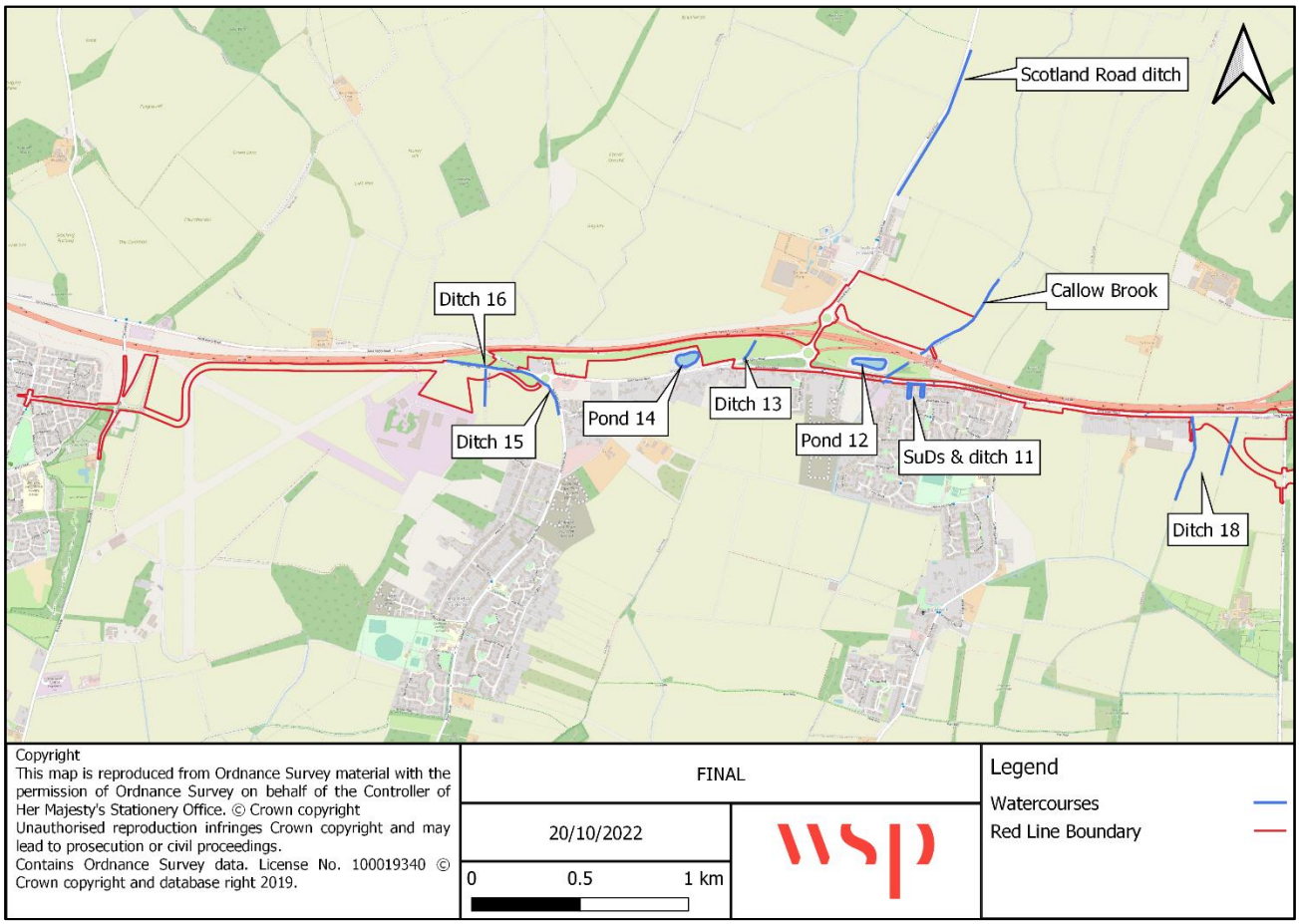
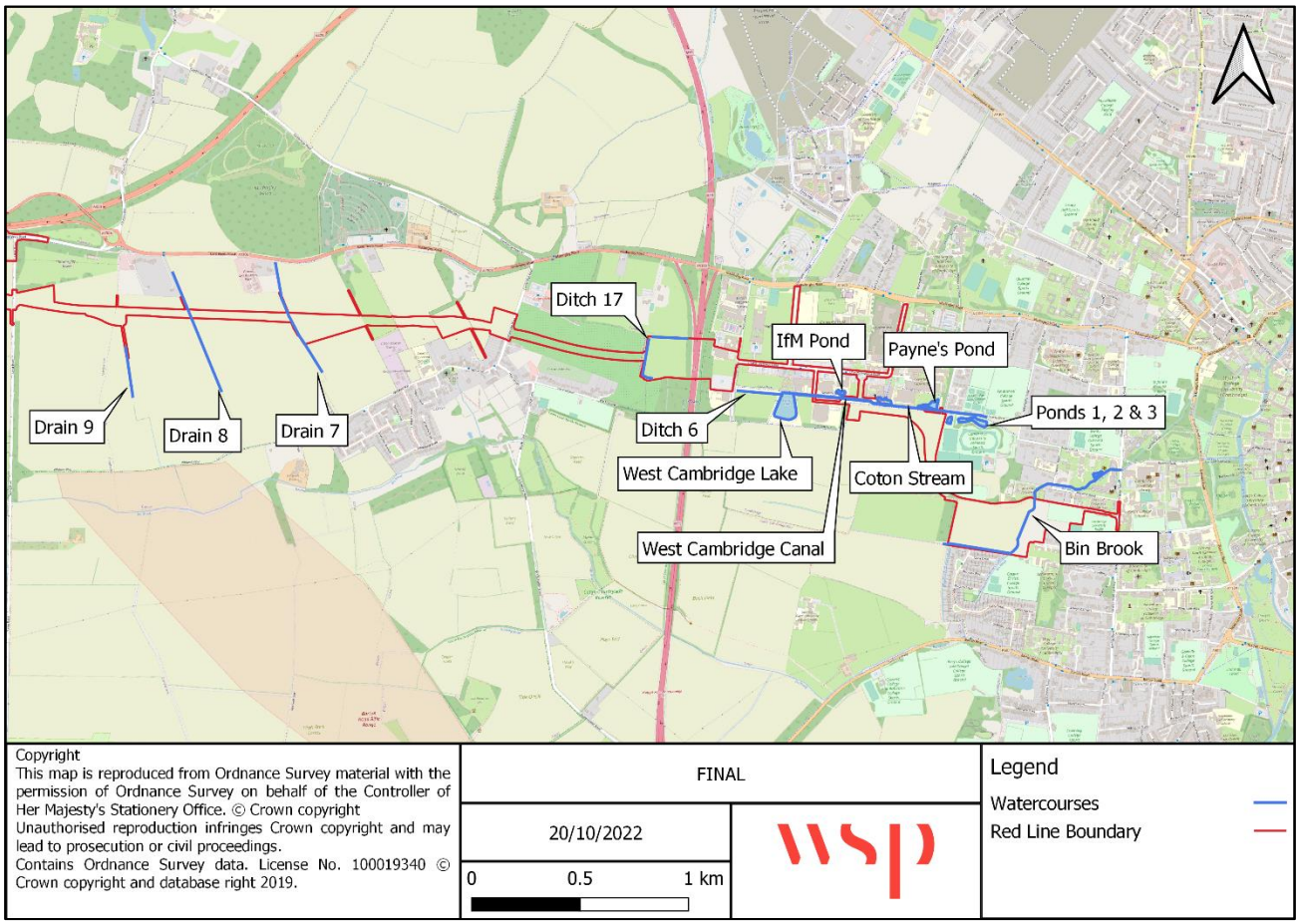


Figure TR5-1-1-2 – Aquatic ecology scoping area and Scheme Boundary (East).



1.2 Ecological background

1.2.1. The route of the Scheme runs through mainly arable land with some pasture and improved grassland. The watercourses in these agricultural areas mostly comprise man-made heavily engineered field drains or ditches, associated with arable field and road drainage. Pockets of broadleaf woodland exist, and much of the route passes through urban areas.

1.2.2. Notable aquatic habitats along the route of the Scheme include the Bin Brook (a WFD-designated water body), Callow Brook (a small semi-natural watercourse), as well as a number of ponds, field drains and ditches. While still of conservation value, the still waters in the area consist of mainly landscaped lakes and ponds, associated with residential, commercial and road scheme developments.

1.2.3. The ‘Survey Area’, as it is referred to hereafter, includes 19 aquatic features of interest, including ditches, watercourses or still waters, within 250m of the Scheme.

1.3 Brief and objectives

1.3.1. WSP UK Ltd was commissioned by GCP to:

- Complete a desk study of surface water features crossed or indirectly affected by the scheme that had the potential to support aquatic flora and fauna;
- Assess aquatic features as part of the scoping exercise and to identify areas for further survey; and
- Complete surveys of aquatic macroinvertebrate and white-clawed crayfish *Austropotamobius pallipes* in Bin Brook.

1.3.2. These actions were undertaken to fulfil the following objectives:

- To assess waterbodies and watercourses within the survey area, identifying suitable habitats in which protected or notable species may be present; and
- To establish a suitable ecological baseline for the Scheme, which will inform further assessments, mitigation and enhancement opportunities.

2 Methods

2.1 Desk study

Designated sites

2.1.1. A desk study of aquatic ecological information relating to statutory sites within 5km of the Survey Area was undertaken. Information was obtained from Multi Agency Geographical Information for the Countryside (MAGIC) website (Natural England, 2022).

Water Framework Directive

2.1.2. The current Water Framework Directive (WFD) status for the catchments within which the Scheme is located was obtained from the Environment Agency's Catchment Data Explorer website (Environment Agency, 2022a).

Environment agency records

2.1.3. Fish, aquatic macroinvertebrate, and macrophyte survey data for relevant watercourses was obtained from the Environment Agency's Ecology and Fish Data Explorer (Environment Agency, 2022b).

2.2 Aquatic ecology scoping assessment

2.2.1. The aquatic ecology scoping assessment were undertaken by a Senior Aquatic Ecologist who is 'capable-accomplished' in habitat/species survey design, planning and fieldwork; and species identification as per the CIEEM Competency Framework (CIEEM, 2022) between 17 January 2022 and 19 January 2022.

2.2.2. Aquatic Ecology scoping surveys were conducted on all watercourses and waterbodies within 250m of the Scheme's route. This included the Bin Brook, West Cambridge Canal, Callow Brook and a number of ponds, field drains and ditches. The watercourses and waterbodies assessed are outlined in blue in **Figure TR5-1-2-1** to **Figure TR5-1-2-4**.

2.2.3. A total of 19 aquatic features were assessed for habitat suitability, and their potential to support protected and notable aquatic species. Photographs were taken throughout the assessment, to record both general channel characteristics and any features of interest within the vicinity of the waterbody/watercourse. Surveyors also noted any pertinent watercourse access details in terms of suitability to carry out further in-channel surveys, including health and safety considerations. Invasive non-native species (INNS) were also recorded if encountered.

2.2.4. The requirement for further surveys to be undertaken on each watercourse was assessed through professional experience and field observations of various channel and bank characteristics. The characteristics recorded included substrate type and water depth, riparian vegetation, macrophyte presence, artificial modifications and notable features. Proximity to the route, potential impacts and considerations for further assessments (e.g., WFD assessment, Biodiversity Net Gain etc.) were also taken into account.

2.2.5. Detailed channel and bank characteristics were not recorded for waterbodies observed as dry, partially or fully colonised with terrestrial vegetation at the time of the scoping surveys.

Figure TR5-1-2-1 – Watercourses and Scheme Boundary (West).

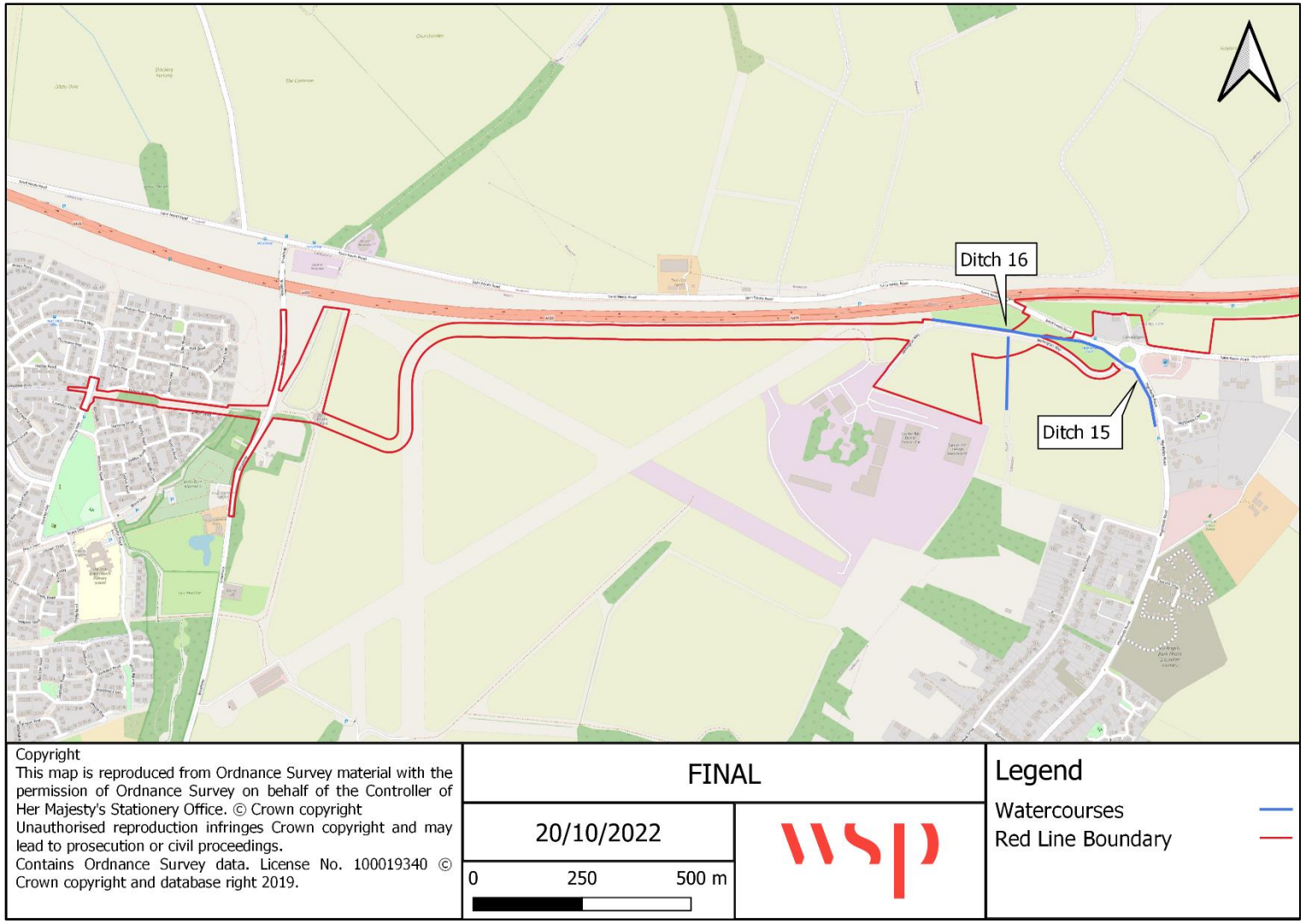


Figure TR5-1-2-2 - Watercourses and Scheme Boundary (Middle, West).

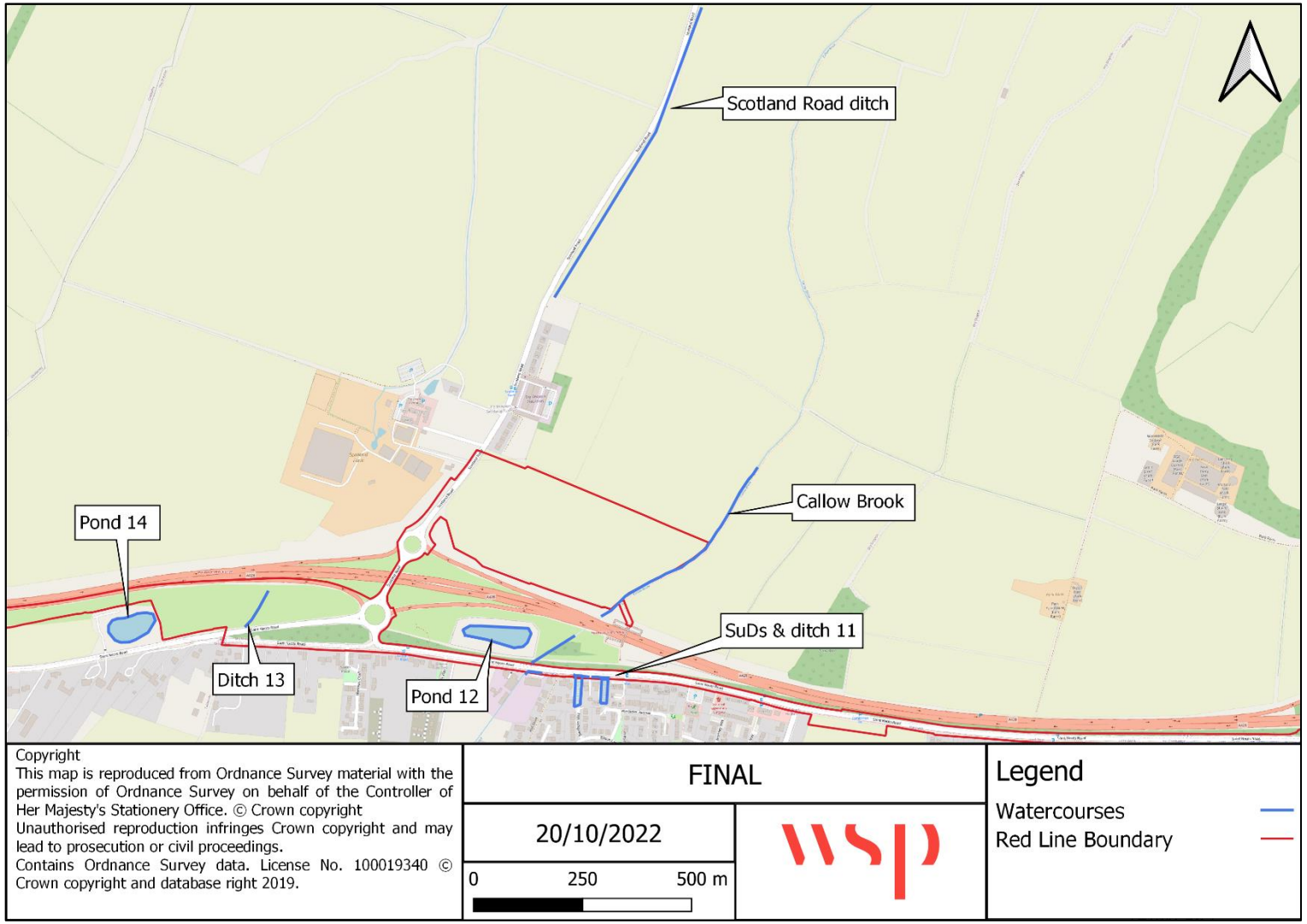


Figure TR5-1-2-3 – Watercourses and Scheme Boundary (Middle, East).

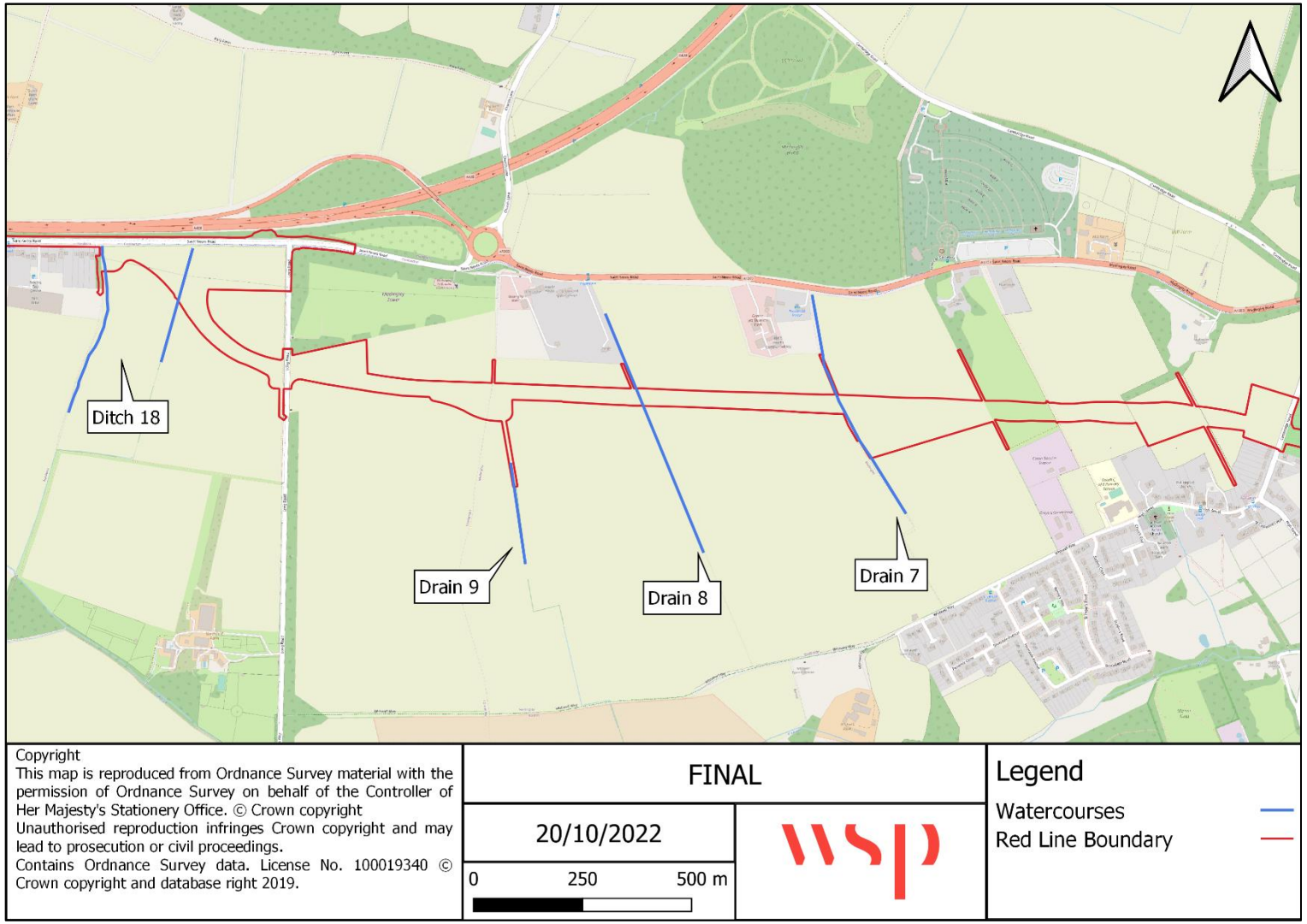
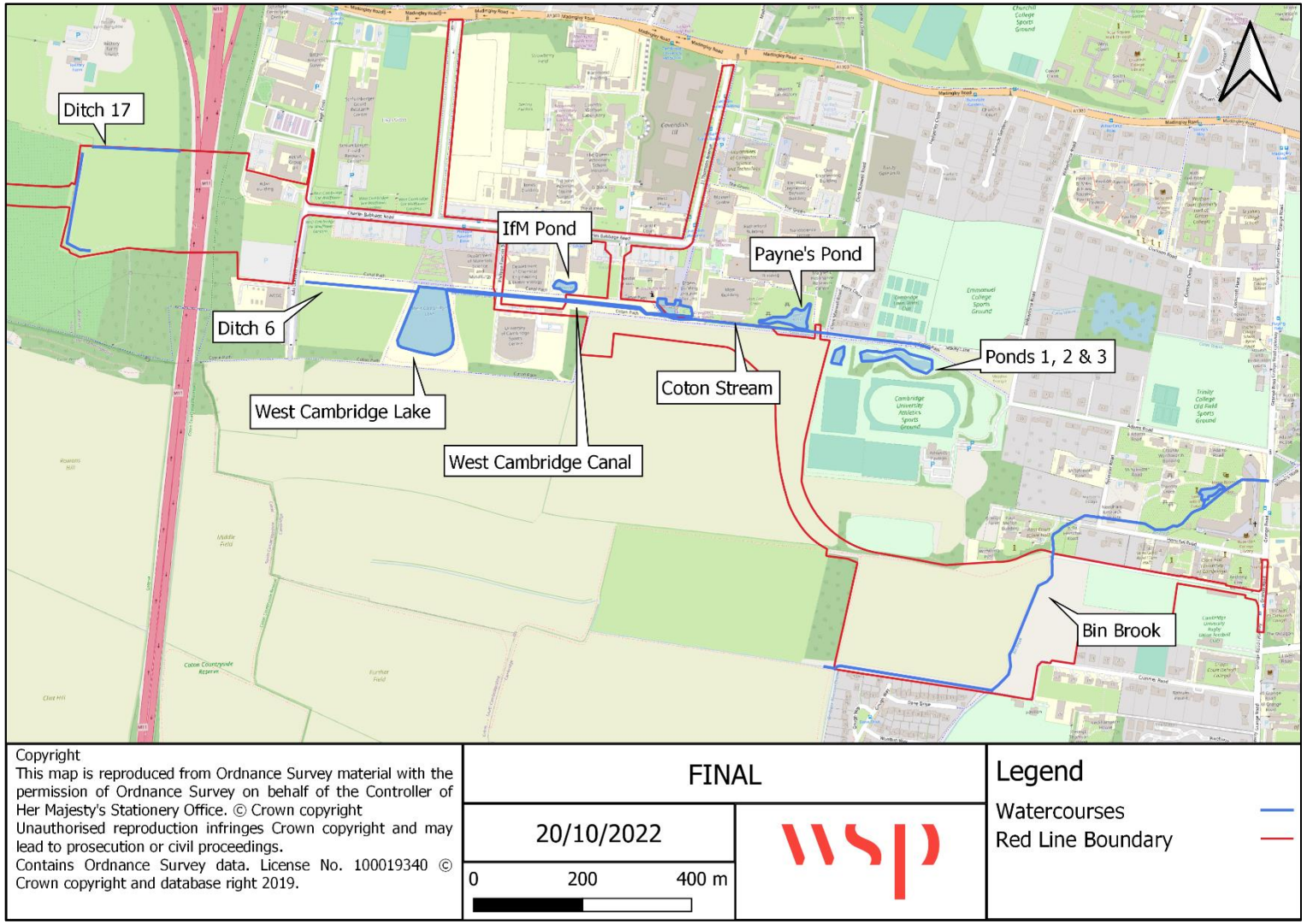


Figure TR5-1-2-4 – Watercourses and Scheme Boundary (East)



2.3 Aquatic macroinvertebrates

Field survey

2.3.1. The aquatic macroinvertebrate assessment was led by a Consultant Aquatic Ecologist who is 'capable-accomplished' in aquatic macroinvertebrate survey design, planning and fieldwork; and species identification as per the CIEEM Competency Framework (CIEEM, 2022). Surveys were carried out on two occasions in 2022; spring sampling was undertaken on 18 May 2022 and autumn sampling on 07 September 2022.

2.3.2. Survey locations for aquatic macroinvertebrate surveys on Bin Brook were chosen based on the proposed location of the Bin Brook crossing point. Other watercourses within the Survey Area were scoped out for aquatic macroinvertebrate surveys, with justification for each watercourse outlined in **Table TR5-1-4-5**.

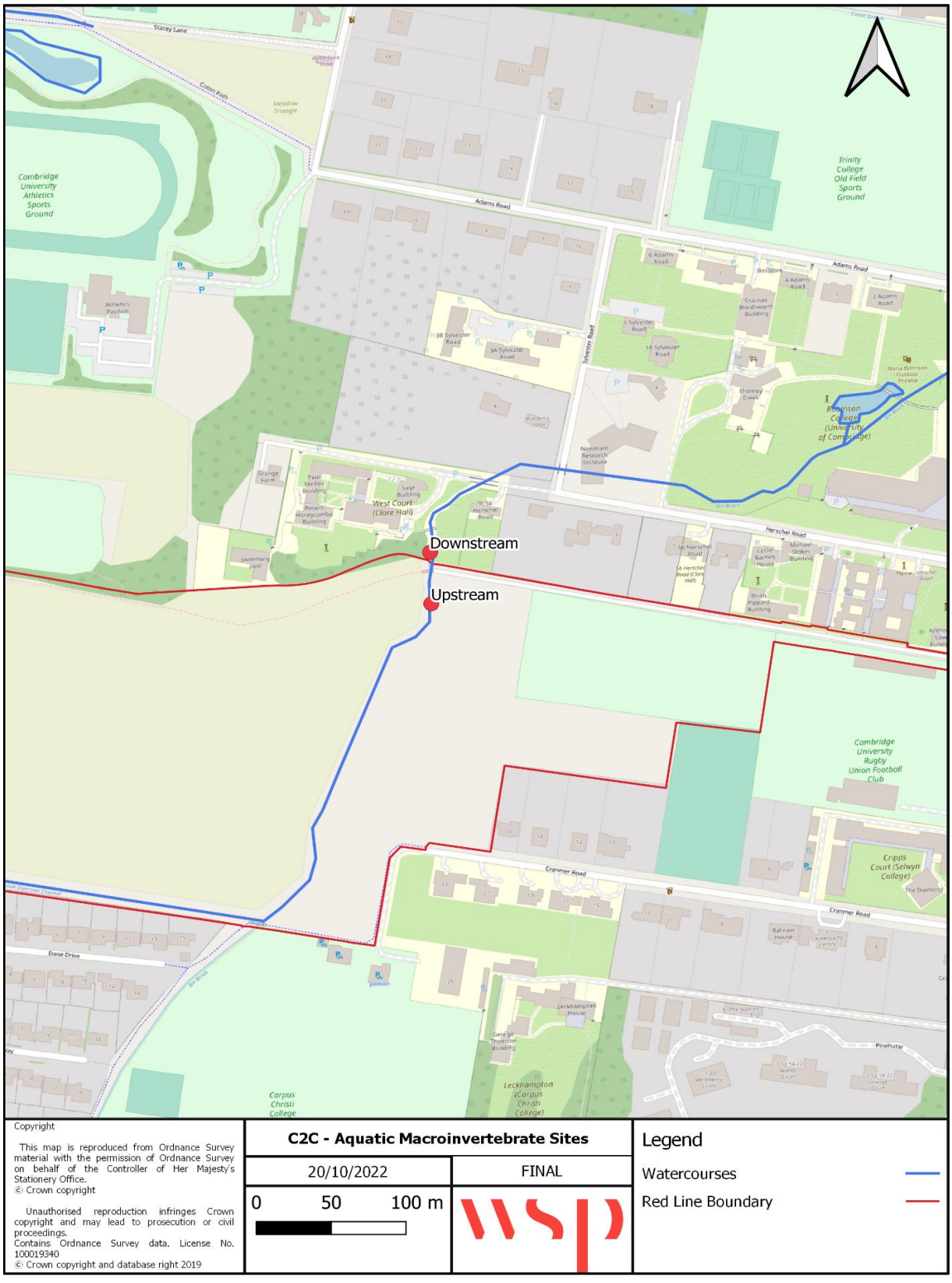
2.3.3. Aquatic macroinvertebrate sampling site locations were collected at NGR TL 43603 58322 and NGR TL 43570 58241, as shown in **Figure TR5-1-2-5**.

2.3.4. Aquatic macroinvertebrate samples were collected using standard three-minute kick sampling of all in-channel habitats in proportion to their occurrence. This was carried out using a standard sampling net (1mm mesh), with a one-minute timed hand search following the Environment Agency (2017) procedure. This sampling method conforms to BS EN ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and devices for benthic macroinvertebrates in fresh waters (British Standards Institution, 2012).

2.3.5. A standardised field sheet was completed that captures details of channel and bank physical habitat (material of banks and substrates, flow types, physical processes, bank structure), riparian land use, water quality parameters and potential sources of anthropogenic stress.

2.3.6. Samples were placed in one-litre sample pots, preserved in Industrial Denatured Alcohol (IDA) on site and transported to the laboratory for sorting and identification to Taxonomic Level 5 (Species level), in adherence with Environment Agency (2014) procedures.

Figure TR5-1-2-5 - Aquatic macroinvertebrate sampling sites.



Data analysis

2.3.7. The use of biological metrics allowed the assignation of ecological values to the aquatic macroinvertebrate communities observed and an assessment of pressures on those communities to be made. Details of the biological metrics used can be found in **Annex D**.

2.4 White-clawed crayfish habitat assessment

2.4.1. In 2021, Cambridge Ecology were commissioned by GCP to carry out a white-clawed crayfish survey of a section of Bin Brook that was considered to have potential to support the species, but for which no information on their presence was available. A section of Bin Brook was inaccessible during this survey. To conclude this assessment, a habitat assessment on a section to the north and downstream of the proposed Bin Brook crossing was carried out in 2022 by WSP.

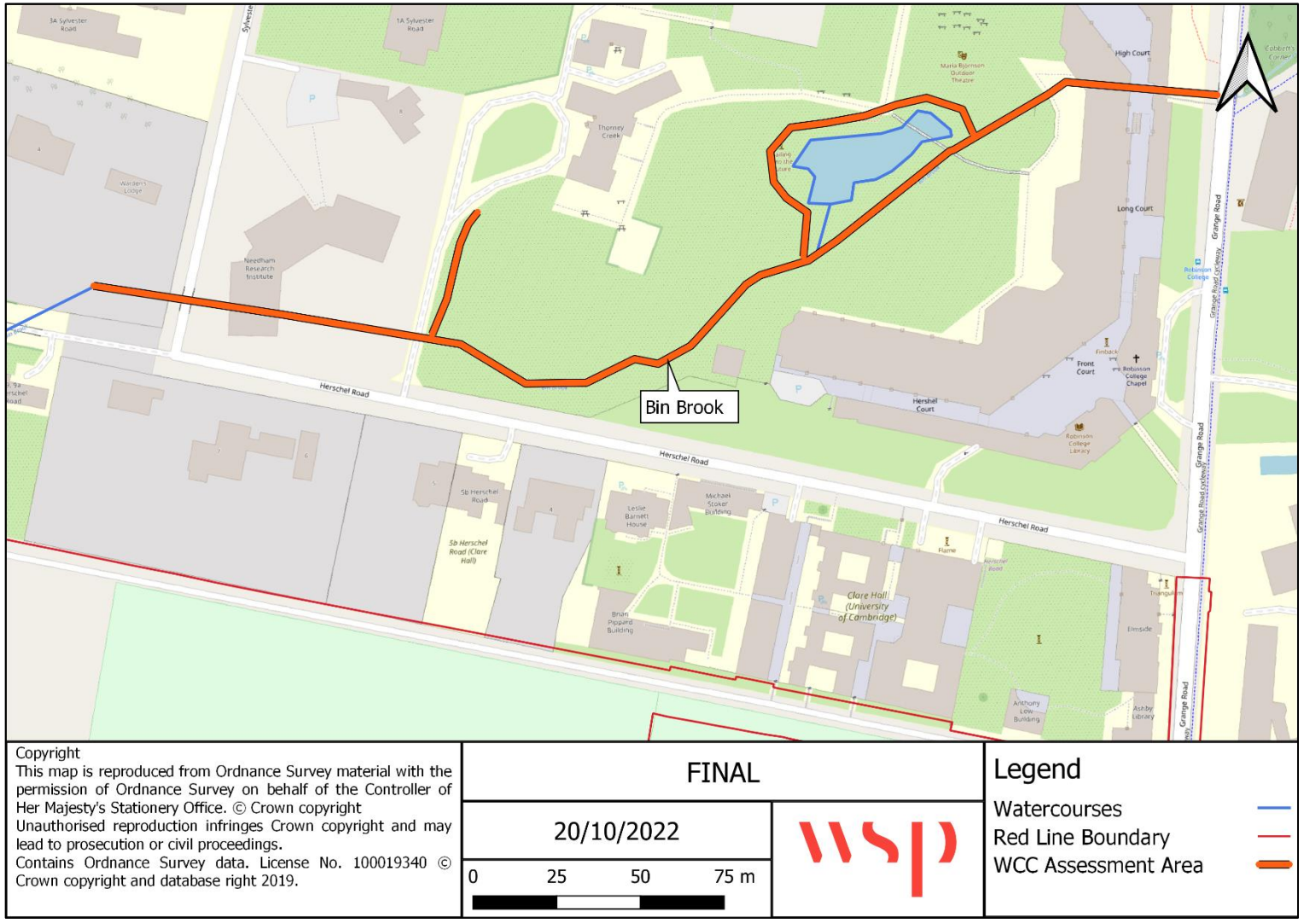
2.4.2. The potential for the Survey Area to support white-clawed crayfish (a protected species) was assessed through field observations made during an aquatic ecology walkover survey undertaken on 18 May 2022. The white-clawed crayfish habitat assessment was led by a suitably qualified Consultant Aquatic Ecologist. A white-clawed crayfish licence is not required for such habitat suitability assessments (CIEEM, 2013).

2.4.3. Surveyors assessed the downstream section of Bin Brook which ran through the grounds of Robinson College, Cambridge, between NGR TL 43660 58379 and NGR TL 43996 58443, as shown in **Figure TR5-1-2-6**.

2.4.4. The surveyors walked the banks of Bin Brook and any connected waterbodies in close proximity to assess the potential crayfish habitats within them. Habitat suitability was based on professional experience and judgement, supplemented by standard sources of guidance on habitat suitability assessment for white-clawed crayfish (Peay, 2003).

2.4.5. The physical features that were assessed included channel width, depth, substrate, bank profile and flow types. Other features offering suitable refuge habitat such as undercut banks, submerged tree roots and cobbles were also recorded. A detailed survey proforma can be found in **Annex C**.

Figure TR5-1-2-6 – White-clawed Crayfish Habitat Assessment Area.



2.5 Notes and limitations

2.5.1. Every effort has been made to provide a comprehensive description of the Survey Area; however, the following specific limitations apply to this assessment:

- Ecological survey data is typically valid for 12 to 18 months unless otherwise specified. The likelihood of surveys needing to be updated increases with time and is greater for mobile species or in circumstances where the habitat or its management has changed significantly since the surveys were undertaken. Factors to be considered include (but are not limited to): whether a site supports, or may support, a mobile species which could have moved on to site, or changed its distribution within a site (CIEEM, 2019);
- Turbidity in deeper waterbodies (West Cambridge Lake, West Cambridge Canal, Ponds 1-3) restricted the visual assessment of the substrate composition and macrophyte presence during scoping surveys. It is not anticipated that this impacted the assessment described within this report; and
- The aquatic macroinvertebrate sampling methods used were selected to provide the data necessary for the calculation of a range of biological quality indices. It is not intended that the sampling methods will capture a full list of all species present within the water body, which will vary according to season and abundance of individual species. Identification to species level is not always possible where juvenile or damaged specimens are present in the sample, or are not identified to species level as standard. Nevertheless, through the calculation of appropriate indices, it is possible to evaluate the biological quality of the waterbody in relation to others.

3 Relevant Legislation

Salmon and Freshwater Fisheries Act 1975 (SAFFA)

3.1.1. This Act covers regulation of fisheries in England and Wales and includes legislation that covers the introduction of polluting effluents, the obstruction of fish passage (screens, dams, weirs, culverts etc.) illegal means of fishing, permitted times of legal fishing and fishing licencing (which covers electric fishing).

3.1.2. Under this act any person who causes or knowingly permits to flow, or puts or knowingly permits to be put, into any waters containing fish or into any tributaries of waters containing fish, any liquid or solid matter to such an extent as to cause the waters to be poisonous or injurious to fish or the spawning grounds, spawn or food of fish, shall be guilty of an offence.

3.1.3. The act also requires that fish passes are installed on new and rebuilt barriers that affect waters frequented by salmon or migratory trout. In the future, it is likely that fish passage facilities will need to be designed to accommodate all fish species and life stages.

The Eels (England and Wales) Regulations 2009

3.1.4. The Eels (England and Wales) Regulations 2009 implement Council Regulation (EC) No 1100/2007 of the Council of the European Union, which required Member States to establish measures for the recovery of the stock of European eel. The regulations apply to England and Wales.

3.1.5. They give powers to the regulators (the Environment Agency and Natural Resources Wales) to implement recovery measures in all freshwater and estuarine waters in England and Wales. The aim of the regulations is to achieve 40 per cent escapement of adult eels relative to escapement levels under pristine conditions. The measures, as set out in the legislation, by which this is to be achieved is to reduce fishing pressures, improve access and habitat quality and reduce the impact of impingement and entrainment.

3.1.6. Under the Regulations, the regulators can serve notice to companies detailing their legal obligation to screen intakes and ouTRalls for eel and/or to remove or modify obstructions to eel migration. However, it is possible for companies to be granted with exemptions if the costs of works greatly exceeds the benefits. In such a situation it is likely the regulator will seek a package of more cost-effective, “alternative measures”.

4 Results

4.1 Desk study

Designated nature conservation sites

4.1.1. There are no designated sites with aquatic species as a primary reason for selection or as a qualifying feature within 5km of the Study Area; therefore, designated nature conservation sites are not considered further in the context of this report.

Water Framework Directive

Bin Brook

4.1.2. Bin Brook (GB105033042680: Bin Brook) is a WFD-designated water body (Environment Agency, 2022a). It is the only WFD-designated water body within the Survey Area.

4.1.3. The 2019 WFD ecological status of Bin Brook was Moderate overall. In 2019, aquatic macroinvertebrates were classified as Moderate. The reason for the aquatic macroinvertebrate element not achieving Good status was stated as physical modification, specifically; flood protection (water level management), land drainage and urban development. Macrophytes/phytobenthos and fish were not classified.

4.1.4. The 2019 WFD physico-chemical status of Bin Brook was classified as Moderate overall. Ammonia, pH and temperature was classified as high. Dissolved oxygen was classified as Good, and phosphate was classified as Poor.

Bourn Brook

4.1.5. Bourn Brook (GB105033042690: Bourn Brook) is a WFD-designated water body (Environment Agency, 2022a). Bourn Brook is outside the Scheme Boundary but is likely to be hydrologically connected to Callow Brook, therefore included within the desk study assessment.

4.1.6. The 2019 WFD ecological status of Bourn Brook was classified as Moderate overall. In 2019, aquatic macroinvertebrates were classified as Good, and fish were classified as Moderate. The reasons for the fish element not achieving Good status were stated as physical modification (flood protection and land drainage) and flow. Macrophytes/phytobenthos were not classified.

4.1.7. The 2019 WFD physico-chemical status of Bourn Brook was classified as Moderate overall. Ammonia, dissolved oxygen, pH, temperature and dissolved oxygen achieved High status. Phosphate was classified as Poor.

Protected and notable species

4.1.8. There are no records of white-clawed crayfish within the Survey Area and the watercourses present are generally unsuitable for white-clawed crayfish, offering limited in-channel refugia opportunities such as undercut banks, roots and boulders.

Fish records

4.1.9. A search of the Environment Agency's Ecology and Fish Data Explorer returned data from an Environment Agency survey carried out in 2019 on Bourn Brook.

4.1.10. No fish survey data from the past 10 years was found for Bin Brook or any other waterbodies and watercourses within the Survey Area.

Bourn Brook

4.1.11. Data from a 2019 Environment Agency catch depletion survey on the Bourn Brook, carried out at NGR TL 38352 54840, approximately 4.5km from the Scheme's route, are detailed in **Table TR5-1-4-1**.

4.1.12. A total of 46 fish were caught during the survey, with the majority being minnow *Phoxinus phoxinus.*

Table TR5-1-4-1 - Environment Agency Fish survey data from 05/04/2019.

Common Name	Latin Name	No. of individuals
Bullhead	*Cottus gobio*	12
Stone loach	*Barbatula barbatula*	1
Minnow	*Phoxinus phoxinus*	33
Total		46

Aquatic macroinvertebrate records

Bin Brook

4.1.13. A search of the Environment Agency's Ecology and Fish Data Explorer returned results from aquatic macroinvertebrate surveys carried out in spring and autumn 2019 on Bin Brook, at NGR TL 43006 57619, approximately 1km upstream of the Scheme's route (**Table TR5-1-4-2**).

Table TR5-1-4-2 - Environment Agency aquatic macroinvertebrate survey biological metrics from Bin Brook (NGR TL 43006 57619) during spring and autumn 2019.

Date	WHPT-ASPT	WHPT-NTAXA	LIFE (TL5)	PSI (TL5)	CCI
01/03/2019	4.13	16	6.67	31.03	3.75
04/11/2019	4.1	11	7	27.78	4.5

4.1.14. No protected species, nor any INNS were identified in the sample.

4.1.15. The WHPT-ASPT scores indicate no strong dominance by pollution tolerant or intolerant taxa.

4.1.16. The LIFE scores indicate the predominant presence of taxa primarily associated with slow, sluggish flows.

4.1.17. The PSI scores classify Bin Brook as Sedimented in both spring and autumn 2019.

4.1.18. The CCI scores identify Bin Brook as having aquatic macroinvertebrate communities of Low conservation value in both spring and autumn 2019.

Bourn Brook

4.1.19. Results from an Environment Agency aquatic macroinvertebrate survey carried out in 2019 on Bourn Brook at a location approximately 4km from the Scheme (NGR TL 34692 56087) are detailed in **Table TR5-1-4-3**.

Table TR5-1-4-3 - Environment Agency aquatic macroinvertebrate survey biological metrics from Bourn Brook (NGR TL 34692 56087) during autumn 2020.

Date	WHPT-ASPT	WHPT-NTAXA	LIFE (TL5)	PSI (TL5)	CCI
02/11/2020	5.18	26	6.91	27.66	6.92

4.1.20. No protected aquatic macroinvertebrate species were found in the sample. The INNS, the New Zealand mud snail *Potamopyrgus antipodarum* was identified in the sample. Additionally, the invasive non-native American signal crayfish *Pacifastacus leniusculus* was recorded.

4.1.21. WHPT-ASPT score indicates no strong dominance by pollution tolerant or intolerant taxa.

4.1.22. The LIFE score indicates the predominant presence of taxa primarily associated with slow, sluggish flows.

4.1.23. The PSI score classifies Bourn Brook as Sedimented in autumn 2020.

4.1.24. The CCI score identifies Bourn Brook at this monitoring location as having an aquatic macroinvertebrate community of Moderate conservation value.

Macrophyte records

4.1.25. A search of the freshwater river macrophyte surveys database returned data from Environment Agency macrophyte surveys carried out in 2012 on Bourn Brook (NGR TL 34574 56106), approximately 3.5km from the Scheme.

4.1.26. A total of 10 taxa were recorded; no protected species were noted, but the INNS Himalayan Balsam *Impatiens glandulifera* was recorded. The taxa identified were dominated by flowering macrophytes. The taxa recorded are detailed below in **Table TR5-1-4-4**.

Table TR5-1-4-4 - Environment Agency macrophyte taxon list from Bourn Brook 14/06/2012, including respective percentage cover band values.

Latin Name	Common Name	Percentage Cover Band
Typha latifolia	Reedmace	5
Cladophora sp.	Filamentous algae (reticulated)	4
Vaucheria sp.	Yellow-green algae	3
Phalaris arundinacea	Reed canary grass	2
Apium nodiflorum	Fool's watercress	1
Epilobium hirsutum	Great willowherb	1
Equisetum arvense	Field horsetail	1
Impatiens glandulifera	Himalayan balsam	1
Lemna minor	Common duckweed	1
Symphytum officinale	Common comfrey	1
	Total number of taxa	10

4.1.27. No records for macrophytes were found from the past 10 years for Bin Brook or the other water bodies and watercourses within the scoping area.

Cambridge Ecology white-clawed crayfish report

4.1.28. A review of the report on surveys that were commissioned to identify the presence of white-clawed crayfish within the survey area, completed by Cambridge Ecology, identified potential habitat for white-clawed crayfish on the Bin Brook. However, the report concluded no white-clawed crayfish or signs of their presence were found within the surveyed area. Consequently, based on the sampling regime used, the results of the survey indicated the likely absence of white-clawed crayfish in the Bin Brook.

4.1.29. In addition to the white-clawed crayfish survey of Bin Brook; the Cambridge Ecology survey assessed 18 other waterbodies within 250m of the Scheme's route. It was noted that many of the waterbodies comprised "man-made and/or heavily engineered features and

associated with arable field and road drainage ditches or landscaped lakes and ponds associated with residential, commercial and road scheme developments." Other ditches were not included in the assessment, due to them being "dry, partially or completely filled or overgrown with vegetation."

4.1.30. In addition to the information regarding white-clawed crayfish, the report also made observations of Bullhead *Cottus gobio* in and the INNS Himalayan Balsam in Bin Brook. It was also noted that access constraints were a factor affecting the survey. Bin Brook was not accessible downstream (north) of the proposed crossing point. An additional habitat assessment was carried out by WSP on this downstream section to conclude the assessment, the result of this survey is shown in **Section 3.4**.

4.2 Aquatic ecology scoping assessment

4.2.1. The aquatic ecology scoping assessment involved visual bankside assessments of a total of 19 sections, identified in a desk study as being within 250m of the Scheme's route. These sections included the watercourses Bin Brook and Callow Brook, as well as a number of ponds, field drains and ditches.

4.2.2. During the scoping assessment, suitability for further survey was assessed, considering factors such as depth, flow, habitat types and channel characteristics. It was determined that the habitat and channel characteristics of many of the field drains and ditches did not provide suitable habitat for aquatic species. Due to this conclusion and additional factors such as dry or low flows and hazardous access, such sites have been discounted from further survey.

4.2.3. Information regarding each site and the outcome of the scoping assessment is outlined in **Table TR5-1-4-5**.

Table TR5-1-4-5 - Summary of scoping survey sites with section details, habitat descriptions and further surveys carried out.

Waterbody Name	Section Number	Site Location	Habitat Description	Further Surveys
Bin Brook	1	Upstream extent: TL 43459 58032 Downstream extent: TL 43601 58324	Modified watercourse with steep banks, variety of flow types and habitats.	Aquatic Macroinvertebrates – 18/05/22 & 07/09/22 Crayfish Habitat Assessment – 18/05/22

Waterbody Name	Section Number	Site Location	Habitat Description	Further Surveys
Concrete channel and ditches	1	Upstream extent: TL 43133 58110 Downstream extent: TL 43466 58068	Heavily modified, concrete bank and bed along majority of reach. Stagnant and low flow. Overgrown vegetation on western section of ditch.	No – Unsuitable habitat and unlikely to be affected by the Scheme due to upstream location.
University Sports ground ponds (Ponds 1, 2 & 3)	2	Pond 1: TL 43352 58657 Pond 2: TL 43265 58670 Pond 3: TL 43208 58672	Medium sized ponds with suitable habitats for both fish and aquatic macroinvertebrates.	No – Unlikely to be affected by the Scheme due to distance and no hydrological connection.
Coton Stream	3a	Upstream extent: TL 43366 58691 Downstream extent: TL 42911 58740	Narrow, straightened channel. Heavily modified with multiple ouTRalls. Connected to both Payne's Pond and West Cambridge Canal. Variety of macrophytes present.	No – Unfavourable habitat and unsafe access.
Payne's Pond	3b	TL 43135 58740	Medium sized pond with variety of habitats present. High number of waterfowl observed. Muddy banks. High turbidity.	No – Unlikely to be affected by the Scheme due to distance.

Waterbody Name	Section Number	Site Location	Habitat Description	Further Surveys
West Cambridge Canal	3c	Upstream extent: TL 42895 58754 Downstream extent: TL 42502 58793	Heavily modified banks and barriers to movement in Canal. Progressively deeper from east to west. Reedbed and macrophytes present in eastern reaches.	No – Unsafe access. Presence of fish established.
IfM (Institute for Manufacturing) Pond	4	TL 42716 58797	Small pond with variety of habitats.	No – Unlikely to be affected by the Scheme due to distance and no hydrological connection.
West Cambridge Lake	5	TL 42454 58745	Large still water with a number of habitat features present around the edges. Large dark coloured goldfish/carp family observed.	No - Unsafe access. Presence of fish established.
Terrestrialised ditch	6	Upstream extent: TL 42233 58809 Downstream extent: TL 42424 58790	Dry ditch, possible overflow for West Cambridge Lake.	No – Unsuitable habitat to support aquatic species.
Field drain	7	Upstream extent: TL4011159342 Downstream extent: TL4038458723	Dug field drain, 2m deep. Straightened and uniform banks. Low flow and dry in areas. Poor habitats	No – Unsuitable habitat to support most aquatic species.

Waterbody Name	Section Number	Site Location	Habitat Description	Further Surveys
Field drain, terrestrialised ditch	8	Upstream extent: TL4011159342 Downstream extent: TL 39844 58816	Field ditch, shallow and terrestrialised in majority of reach.	No – Unsuitable habitat to support most aquatic species.
Field drain	9	Upstream extent: TL 39409 59012 Downstream extent: TL 39455 58697	Dug field drain, 2m deep in places. Overgrown vegetation in much of channel, low flow and likely dry most of the year. Limited habitat.	No – Unsuitable habitat to support most aquatic species.
Callow Brook	10	Upstream extent: TL 37233 59809 Downstream extent: TL 37627 60202	Brook within field. Straightened, modified and incised with steep banks. Variety of flow types and habitats present. Macrophytes present.	No – Significant effects not expected on Callow Brook.
SuDS 1, SuDS 2 and road ditch	11	Upstream extent: TL 37274 59663 Downstream extent: TL 37050 59672	SuDS – low water level and lack of habitat.	No – Unsuitable habitat to support most aquatic species, limited hydrological connectivity to the Scheme.
			Road ditch – low flow, Suitable habitat to support aquatic macroinvertebrates and macrophytes.	No – Poor habitat to support notable or protected aquatic species.

Waterbody Name	Section Number	Site Location	Habitat Description	Further Surveys
Pond 12	12	TL 36992 59761	Large pond, likely a created habitat as part of nearby road scheme. Heavy macrophyte cover around banks.	No – Unlikely to be affected by the Scheme due to distance and no hydrological connection.
Ditch	13	TL 36401 59777	Limited scope as access not given. Deep overgrown ditch. Low flow and overgrown with vegetation.	No – Unlikely to be affected by the Scheme due to distance and no hydrological connection.
Pond 14	14	TL 36142 59779	Large pond, likely a created habitat as part of nearby road scheme. Heavy macrophyte cover around banks.	No – Unlikely to be affected by the Scheme due no hydrological connection.
Ditch	15	Upstream extent: TL 35266 59730 Downstream extent: TL 35547 59525	Stagnant roadside ditch, heavily shaded. Dry in some areas.	No – Unsuitable habitat to support most aquatic species.
Field drain, terrestrialised ditch	16	Upstream extent: TL 35046 59769 Downstream extent: TL 35209 59545	Terrestrialised ditch in majority of reach. Some wet areas but poor habitat present.	No – Unsuitable habitat to support most aquatic species.
Field ditches at Rectory Farm	17	Upstream extent: TL 41933 59054 Downstream extent:	Dry or terrestrialised in majority of reach. Small pool that runs south in lower section.	No – Unsuitable habitat to support most aquatic species and poor access.

Waterbody Name	Section Number	Site Location	Habitat Description	Further Surveys
		TL 41830 58863		
Field drains	18	East drain: TL 38667 59453 West drain: TL 38455 59303	Dug field drains, 2m deep. Either dry or with small amount of water. Uniform banks and poor habitat. Vegetation cut back in area. Overgrown vegetation in other sections.	No – Unsuitable habitat to support most aquatic species and poor access.
Scotland Road ditch	19	TL 37106 60525	Ditch with wet areas to the south. Dry for most of accessible section. Steep bank roadside and hedgerow opposite.	No – Unsuitable habitat to support most aquatic species.

Bin brook

4.2.4. Upstream of the proposed crossing point, Bin Brook was on average 3m wide and was predominantly shallow in depth (5-30cm). Flow was low, with the channel consisting of glides, pools and riffles. The water was slightly turbid but the riverbed was still visible, with some suspended sediment observed.

4.2.5. The substrate was variable, with some areas of coarse sediment (boulder, pebble and gravel), but the majority consisted of fine sediment. Channel morphology was varied, containing gravel beds and deeper pools. Bank erosion and poaching was observed, a possible consequence of walkers, dogs and cyclists crossing the brook on the existing footbridge, and wildlife crossing the brook.

4.2.6. There were a number of drainage pipes and ouTRalls located on the banks of the brook, however none were discharging at the time of survey. There were various types of litter in the channel and other debris, including bricks and rubble.

4.2.7. The banks were steep and uniform, consisting of a simple vegetation structure on the left-hand bank. In places, the vegetation had been cut to ground level. Tall herbs and trees provided heavy channel shading on the right-hand bank. The general land use surrounding the watercourse was arable field in the upper reach, and urban deciduous woodland in the accessible lower reaches.

4.2.8. Submerged macrophyte species were observed in the brook, such as the water starwort *Callitriche spp*.

4.2.9. A small, modified tributary or drainage ditch (approximately 0.5m wide channel) joins Bin Brook just downstream of a small footbridge and housing estate. The ditch was fed by a concrete channel (Bin Brook Diversion Channel) which had very little flow at the time of the survey. Beyond the channel culvert (located at NGR TL 43202 58099) to the West, the channel is fed by a ditch from which it was not possible to ascertain flow type or if the ditch was dry, due to dense bramble and scrub cover.

4.2.10. Up to 30m downstream of the crossing point, Bin Brook displayed similar channel characteristics to that of the upstream section. Beyond this, the brook flowed through a more urban environment, with heavily modified banks and a wider, more uniform channel. Concrete banks and various ouTRalls were observed as the brook flowed through this urban area.

4.2.11. Overall, suitable habitat for both aquatic macroinvertebrates and fish was present throughout Bin Brook. However, features such as undercut banks, larger deep pools and exposed tree roots were limited in occurrence. Overhanging tree branches, gravel/cobble channel, small pools and riffle features were observed in multiple locations. These habitat types provide protection from potential predation and high flow refugia for juvenile and adult fish. Fish spawning habitats (such as in-channel vegetation and gravel beds) were present to a moderate extent.

4.2.12. A shell belonging to a species of freshwater mussel (species identification not possible) was recorded in the upstream section of the Bin Brook.

4.2.13. The INNS variegated yellow archangel *Lamiastrum galeobdolon* subsp. *argentatum* was found on the banks of the upstream section of Bin Brook, carpeting the southeast field corner.

4.2.14. Refer to **Annex A** and **Annex B**, **Figures TR5.1.A-1 - TR5.1.A-8** and **TR5.1.B-1 - TR5.1.B-12** for photographs.

West Cambridge Canal

4.2.15. The West Cambridge Canal is a heavily modified, straight and wide waterbody, with varying water levels with little to no flow.

4.2.16. Gabion baskets, heavily modified banks, barriers to fish passage and water level control structures (such as wooden sleepers placed across the channel) were common.

4.2.17. The canal was deep (~1m) and wide (~12m) towards the West Cambridge Lake, to the west of the Philippa Fawcett Drive crossing at NGR TL 42584 58786. Flow was obstructed by an accumulation of debris, detritus and leaf litter blocking the metal grates on the lake side of the crossing.

4.2.18. The western section of the canal is connected to the West Cambridge Lake, therefore fish inhabiting the lake can likely access the western section of the canal, and therefore fish inhabiting the canal can access the lake.

4.2.19. East of the road crossing the canal was shallow and narrow, the banks were uniform and had a shallow gradient. A footpath/cycleway runs parallel to the left hand bank, and dense scrub and trees run parallel to the canal along the right hand bank.

4.2.20. Emergent and submerged macrophytes were common throughout the shallow eastern section of the canal.

4.2.21. Refer to **Annex A**, **Figures TR5.1.A-25 - TR5.1.A-27** for photographs.

Callow Brook

4.2.22. Between the locations NGR TL 37250 59818 and NGR TL 37496 60009, Callow Brook had an average water width of 0.5m and was predominantly shallow in depth (5-20cm). Flow was variable, with the channel mainly consisting of shallow riffles.

4.2.23. The brook was semi natural, its character influenced by adjacent arable farming practice (e.g. field drainage pipes emptied into the brook, channel straightening, culverts) and highways work to the A428 dual carriageway.

4.2.24. The water was slightly turbid but the substrate was still visible, with some suspended sediment observed. The substrate was variable, with some areas of coarse sediments (boulder, pebble and gravel), and areas of fine sediments.

4.2.25. The banks were steep and uniform, consisting of a simple, low-height short vegetation structure of less than 0.2m on both banks. Willow trees were sparsely situated along both banks.

4.2.26. Woody debris was noted on the bank slopes and within the channel.

4.2.27. Refer to **Annex A**, **Figures TR5.1.A-39 - TR5.1.A-44** for photographs.

Drainage ditches and SuDs (section 11)

4.2.28. Much of section 11 consisted of roadside drainage ditches, located parallel to St Neots Road.

4.2.29. Callow Brook, after culverting under many roads to the north, confluences with these ditches at NGR TL 37053 59676, before culverting again and passing under a business park.

4.2.30. The ditches in section 11 had steep uniform banks, were shallow and had negligible flow. Multiple culverts were observed along the section to allow vehicle access to residential areas and businesses.

4.2.31. The substrate was variable, with some areas of coarse sediments (pebble and gravel), and areas of fine sediments. Detritus and leaf litter was abundant.

4.2.32. The ditches contained macrophytes such as fool's watercress *Apium nodiflorum* and sedges *Carex spp.*

4.2.33. To the south of the ditches, two mapped waterbodies, thought to be SuDS (Sustainable Drainage Systems) were observed to be mostly dry, with isolated pools of water. These still waters are likely to connect hydrologically with the ditches after heavy rain.

4.2.34. Access to the SuDS was restricted as they were enclosed by fencing, therefore assessment was restricted.

4.2.35. Refer to **Annex A**, **Figures TR5.1.A-45 - TR5.1.A-50** for photographs.

Field drains

4.2.36. Many of the watercourses within the boundary of the scoping assessment were deep field drains, often over two meters deep, with steep, uniform banks. The linear watercourses were heavily engineered, and their physical character influenced by management from either arable farming or road network schemes.

4.2.37. Linear waterbodies such as those found in Section 7, 8, 9, 16, 17, 18 and 19 were mostly dry, or contained low levels of slow-moving water, and are likely dry in summer periods. These drains lacked suitable habitat for both fish and aquatic macroinvertebrates.

4.2.38. Macrophytes were sparse but present in some of the drains with greater propensity to retain water, with species such as fool's watercress observed.

Ponds

4.2.39. The ponds surveyed as part of the scoping assessment were all artificially created or ornamental ponds, either as part of construction design or mitigation for road schemes.

4.2.40. Waterbodies 12 and 14 were constructed as part of the A428 dual carriageway development in approximately 2007 (as indicated by a review of historic aerial photographs online).

4.2.41. Ponds at a greater distance and hydrologically isolated from the Scheme's route were deemed to have a low probability of being impacted by it.

4.2.42. Ponds 12 and 14, Payne's Pond, and IfM Pond were in close proximity to the route and the potential impacts of run off, noise and vibration should therefore be a consideration for the development.

4.2.43. West Cambridge Lake contained large cyprinids (members of the carp family) with a dark colouration. An estimated 30-40 individuals of varying age classes were observed at the water's surface. These fish are likely stocked for an angling or ornamental purpose and would not occur here naturally.

Incidental observations

4.2.44. The presence of Kingfisher *Alcedo atthis* within the survey area was noted during the scoping assessment. An individual was observed both at the sports ground Ponds (Ponds

1, 2 & 3) and along Coton Stream towards the West Cambridge Canal. Presence of this protected species indicates presence of small fish species (a food source for kingfishers) in or close to the aforementioned waterbodies.

4.3 Aquatic macroinvertebrates

Biological metrics

4.3.1. The full aquatic macroinvertebrate taxon list is presented in **Annex D**. The biological metrics calculated for each site based on the aquatic macroinvertebrate communities present are displayed in **Table TR5-1-4-6**.

Table TR5-1-4-6 - Biological metrics from spring and autumn 2022 surveys carried out on Bin Brook upstream (TL 43570 58241) and downstream (TL 43603 58322).

Site	Season	WHPT-ASPT (TL2)	WHPT-NTAXA (TL2)	LIFE (TL5)	PSI (TL5)	CCI (TL5)
Bin Brook Upstream	Spring	4.58	16	6.61	28.95	1.08
	Autumn	4.40	15	6.33	23.53	4.00
Bin Brook Downstream	Spring	4.88	21	6.61	39.22	1.23
	Autumn	4.73	20	6.57	30.23	1.15

4.3.2. The LIFE scores indicate the predominant presence of taxa associated with slow flowing water at both sampling locations within Bin Brook, in both spring and autumn 2022. The PSI scores recorded in both spring and autumn 2022 classify both the upstream and downstream sampling locations in Bin Brook as being dominated by species tolerant of highly sedimented conditions. The CCI scores indicate that both the upstream and downstream sampling locations within Bin Brook support aquatic macroinvertebrate communities of Low conservation value in both spring and autumn 2022.

River Invertebrate Classification Tool (RICT)

4.3.3. RICT analysis was performed on all sites to produce WFD status classifications for aquatic macroinvertebrates; the output is presented in **Table TR5-1-4-7**.

Table TR5-1-4-7 - RICT WHPT Classification from spring and autumn 2022 surveys carried out on Bin Brook upstream (TL 43570 58241) and downstream (TL 43603 58322).

Site	Season	Index	EQR	Class	Confidence of Class (%)	Overall classification
Bin Brook Upstream	Spring	WHPT-ASPT	0.86	Moderate	48.88	Moderate
	Spring	WHPT-NTAXA	0.70	Good	36.09	
	Autumn	WHPT-ASPT	0.88	Good	46.39	
	Autumn	WHPT-NTAXA	0.68	Moderate	37.31	
Bin Brook Downstream	Spring	WHPT-ASPT	0.91	Good	54.08	Good
	Spring	WHPT-NTAXA	0.89	High	72.63	
	Autumn	WHPT-ASPT	0.93	Good	51.75	
	Autumn	WHPT-NTAXA	0.85	High	63.31	

4.3.4. Bin Brook achieved Moderate ecological status for the aquatic macroinvertebrate biological quality element at the upstream sampling location. The ecological status for the aquatic macroinvertebrate biological quality element at the downstream sampling location was classified as Good.

Aquatic macroinvertebrate assemblage and conservation status

4.3.5. The spring upstream and downstream sampling locations within Bin Brook were dominated by non-biting midges Chironomidae and freshwater shrimp *Gammarus pulex/fossarum* agg. In autumn, the most abundant taxa from both sampling locations were the bivalve mollusc *Pisidium* sp., and non-biting midges.

4.3.6. No species of conservation interest were recorded in either sample in either season. However, the INNS, the New Zealand mud snail was recorded at both sampling locations in both sampling seasons.

4.4 White clawed-crayfish crayfish habitat assessment

4.4.1. Bin Brook mostly comprised artificial, man-made structures, that provided limited suitable habitats for white-clawed crayfish. Within the grounds of Robinson College, Bin Brook was spilt by a weir system at NGR TL 43963 58445 potentially limiting the movement of aquatic fauna, including crayfish. It was concluded that this downstream section had limited potential to support a viable population of white-clawed crayfish. An eel pass was observed on this section, see **Annex B**, **Figure TR5.1.B-3**.

4.4.2. Further upstream, between NGR TL 43933 58434 and NGR TL 43662 58378, Bin Brook was turbid and the bed consisted of a thick layer of silt. There were limited locations that offered potential refuge from predation or elevated flows, and limited food sources. The water was heavily impounded, resulting in a slow flow with heavy sediment deposition. The channel was heavily shaded. From these observations it was concluded that this section of Bin Brook had limited potential to support a viable population of white-clawed crayfish.

4.4.3. A small unnamed ditch located within the grounds of Robinson College at NGR TL 43770 58390 was found to be dry, thus is unlikely to support populations of white-clawed crayfish.

5 Summary

5.1.1. The results of the desk study and scoping exercise indicated Bin Brook was a key watercourse being crossed by the scheme, requiring further survey to identify notable or protected species. Other watercourses within the Survey Area were scoped out from further assessment due to their ephemeral nature, limited connectivity or distance from the scheme. These watercourses were deemed unlikely to be adversely affected by the Scheme.

5.1.2. Although hazardous access prevented further surveys, mitigation measures outlined in the Code Construction Practise (CoCP) document will be adhered to which will prevent adverse effects on the aquatic habitats.

5.1.3. No notable or protected species of aquatic macroinvertebrate were identified in the two samples collected on Bin Brook. The taxa present are associated with slow flowing water and highly sedimented conditions, with a low conservation value.

5.1.4. Bin Brook is located a significant distance from any of the few remaining isolated populations of white-clawed crayfish present in Cambridgeshire. Therefore, and in agreement with the Cambridge Ecology assessment, the likelihood of white-clawed crayfish having colonised the surveyed sections of Bin Brook is considered unlikely.

5.1.5. Additionally, both the invasive non-native American signal crayfish and Himalayan Balsam have been recorded in Bin Brook or in the wider catchments, signifying a need for stringent biosecurity measures during the construction phase. Biosecurity measures are outlined within the CoCP document.

5.1.6. Likely significant effects on fish from the construction and operation of the Scheme are deemed unlikely based on the implementation of mitigation measures outlined within the CoCP document and current Scheme design.

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Annex A

Aquatic Ecology Scoping Survey – Photographs

Section 1 - Bin Brook

Figure TR5.1.A-1 – General Character 1

Figure TR5.1.A-2 – General Character 2

Figure TR5.A.1-3 - General Character 3

Figure TR5.1.A-4 – General Character 4

Figure TR5.1.A-5 – General Character 5

Figure TR5.1.A-6 – Bank Erosion

Figure TR5.1.A-7 – Submerged Macrophytes

Figure TR5.1.A-8 – Modified Channel

Section 1 – Bin Book Tributaries

Figure TR5.1.A-9 – Confluence with Bin Brook

Figure TR5.1.A-10 – Confluence ditch

Figure TR5.1.A-11 – Concrete Channel

Figure TR5.1.A-12 – Concrete Channel 2

Figure TR5.1.A-13 – Vegetation covered ditch/channel

Figure TR5.1.A-14 – Concrete Channel 2

Section 2 – Ponds 1, 2 and 3

Figure TR5.1.A-15 – Pond 1

Figure TR5.1.A-16 – Pond 1 East

Figure TR5.1.A-17 – Pond 2 West

Figure TR5.1.A-18 – Pond 3

Figure TR5.1.A-19 – Pond 3 (macrophytes)

Figure TR5.1.A-20 – Ditch between Pond 2 & 3

Section 3 – Coton Stream, Payne's Pond and West Cambridge Canal

Figure TR5.1.A-21 – Coton Stream

Figure TR5.1.A-22 – Coton Stream Macrophytes

Figure TR5.1.A-23 – Payne's Pond

Figure TR5.1.A-24 – Reedbed

Figure TR5.1.A-25 – West Cambridge Canal East

Figure TR5.1.A-26 – West Cambridge Canal East 2

Figure TR5.1.A-27 – West Cambridge Canal West

Figure TR5.1.A-28 – Section 4 - IfM Pond

Section 5 – West Cambridge Lake

Figure TR5.1.A-29 – Lake Overview

Figure TR5.1.A-30 – Cyprinids within Lake

Section 6 – Dry Ditch

Figure TR5.1.A-31 – General Characteristics

Figure TR5.1.A-32 – General Characteristics

Section 7 – Field Drain

Figure TR5.1.A-33 – General Characteristics

Figure TR5.1.A-34 – General Characteristics

Section 8 – Field Ditch

Figure TR5.1.A-35 – General Characteristics

Figure TR5.1.A-36 – Surrounding Land

Section 9 – Field Drain

Figure TR5.1.A-37 – General Characteristics

Figure TR5.1.A-38 – General Characteristics

Section 10 – Callow Brook South

Figure TR5.1.A-39 – General Characteristics

Figure TR5.1.A-40 – Surrounding Land

Section 10 – Callow Brook North

Figure TR5.1.A-41 – General Characteristics 1

Figure TR5.1.A-42 – General Characteristics 2

Figure TR5.1.A-43 – General Characteristics 3

Figure TR5.1.A-44 – General Characteristics 4

Section 11 – SuDs

Figure TR5.1.A-45 – West SuDS

Figure TR5.1.A-46 – East SuDS

Section 11 – Road drains

Figure TR5.1.A-47 – General Characteristics 1

Figure TR5.1.A-48 – General Characteristics 2

Figure TR5.1.A-49 – Grated Culvert

Figure TR5.1.A-50 – Drain Confluence

Section 12 – Highways Pond 1

Figure TR5.1.A-51 – General Characteristics 1

Figure TR5.1.A-52 – General Characteristics 2

Section 13 – Ditch

Figure TR5.1.A-53 – No access through gate

Figure TR5.1.A-54 – Overview of ditch from road

Section 14 – Highways Pond 2

Figure TR5.1.A-55 – Pond Overview

Figure TR5.1.A-56 – Pond Overview 2

Section 15 – Road ditch

Figure TR5.1.A-57 – General Characteristics 1

Figure TR5.1.A-58 – General Characteristics 2

Figure TR5.1.A-59 – General Characteristics 3

Figure TR5.1.A-60 – General Characteristics 4

Section 16 – Ditch

Figure TR5.1.A-61 – Terrestrialised Ditch

Figure TR5.1.A-62 – Dry Ditch

Figure TR5.1.A-63 – Field Ditch

Figure TR5.1.A-64 – Dense Vegetation

Section 17 – Rectory Farm Field Ditches

Figure TR5.1.A-65 – Dry Ditch

Figure TR5.1.A-66 – Dense Vegetation

Figure TR5.1.A-67 – Dry Ditch 2

Figure TR5.1.A-68 – Small Pool

Section 18 – Field Drains

Figure TR5.1.A-69 – Dry Drain

Figure TR5.1.A-70 – Drain Overview

Figure TR5.1.A-71 – Vegetated Drain

Figure TR5.1.A-72 – Evidence of rats using banks

Section 19 – Scotland Road

Figure TR5.1.A-73 – Wet Ditch

Figure TR5.1.A-74 – Dry Ditch

Annex B

White-Clawed Crayfish Habitat Assessment – Photographs

Bin Brook - Section 1

Figure TR5.1.B-1 – Man-made banks

Figure TR5.1.B-2 – Man-made banks

Figure TR5.1.B-3 – Weir (eel pass present)

Bin Brook - Section 2

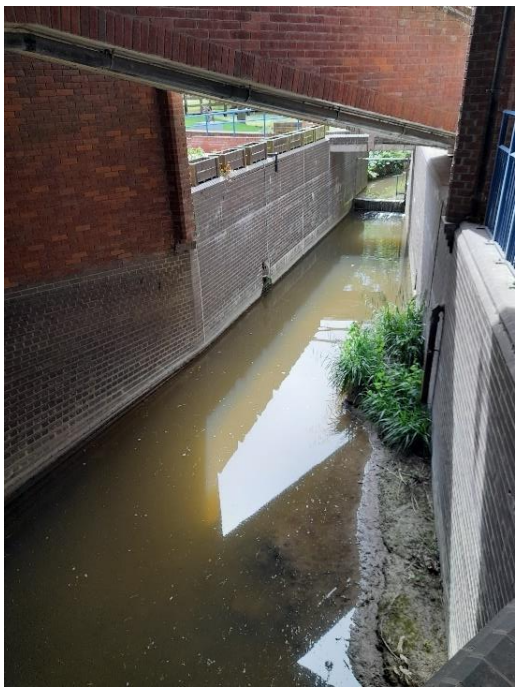

Figure TR5.1.B-4 – Man-made banks

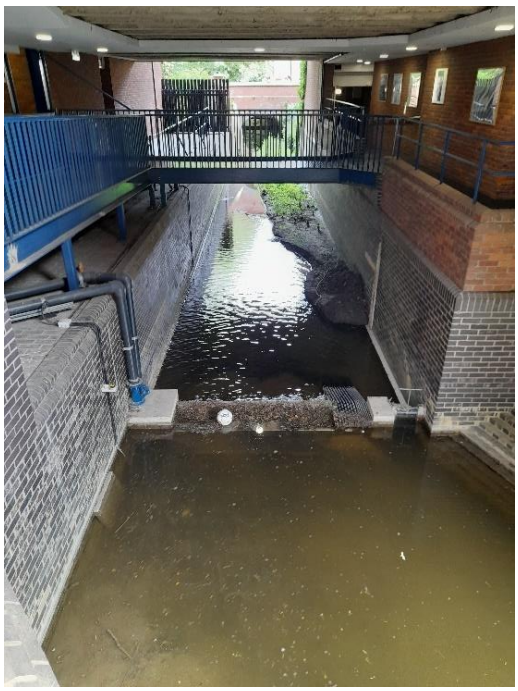

Figure TR5.1.B-5 – Weir and eel pass

Figure TR5.1.B-6 – Potential barrier to movement

Bin Brook - Section 3

Figure TR5.1.B-7 – General Characteristics 1

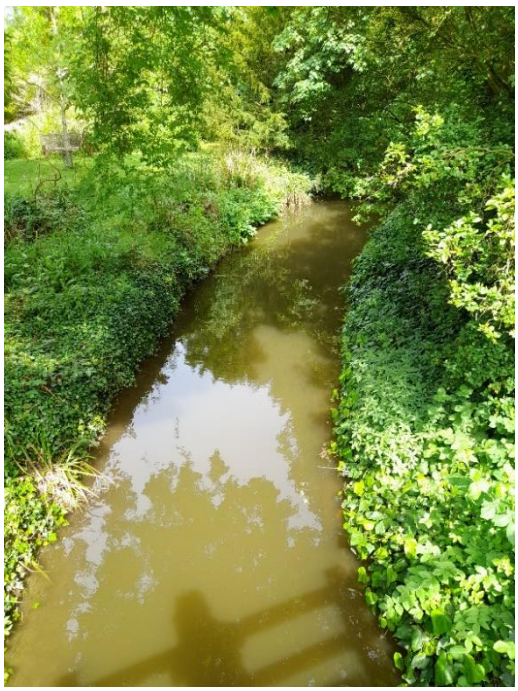

Figure TR5.1.B-8 – General Characteristics 2

Figure TR5.1.B-9 – General Characteristics 3

Bin Brook - Section 4

Figure TR5.1.B-10 – General Characteristics 1 **Figure TR5.1.B-11 – General Characteristics 2**

Figure TR5.1.B-12 – General Characteristics 3

Bin Brook - Section 5

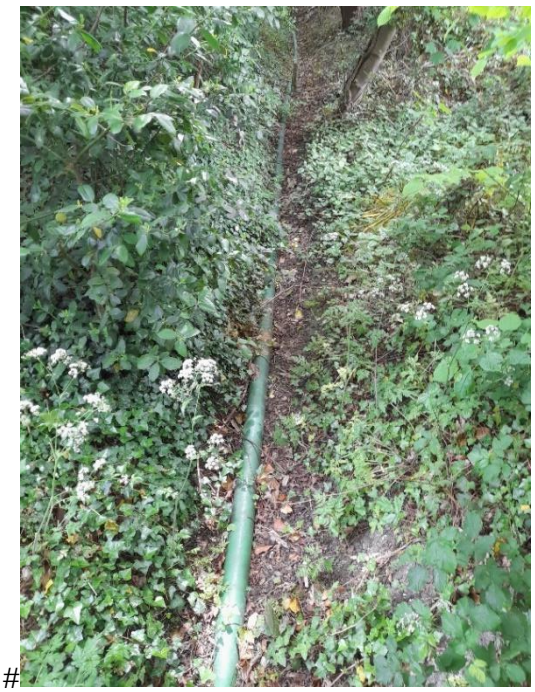

Figure TR5.1.B-13 – Dry ditch

Figure TR5.1.B-14 – Dry ditch

Annex C

Crayfish Survey Habitat Forms

Table TR5.1.C-1 – Crayfish Habitat Assessment proforma.

Crayfish Habitat Assessment					
Waterbody		Bin Brook			
Date	18/05/2022	**Surveyors**	Aidan Paul & Matthew Harwood		
Weather	Good	**Flow**	Normal	**Temperature**	16
	Section 1	**Section 2**	**Section 3**	**Section 4**	**Section 5**
Survey Method	View	View	View	View	View
Depth	0.2m	0.6m	0.5m	0.2m	0.0m
Features	Glide	Glide	Glide	Glide	Dry
Refuge in channel	No	No	No	No	No
Main Substrate Beneath	Silt	Silt	Silt	Silt	Dry
Refuge in bank	No	Some LHB	Some both	Some both	No
Shading Above	100%	50%	40%	70%	100%
Bullhead present	No	No	No	No	No
Pollution	Oxygen Poor	Oxygen Poor	Leaf litter present	Stagnant water	Dry

Annex D

Aquatic Macroinvertebrate Biological Metrics

Biological metrics

River invertebrate Classification Tool

5.1.7. The River Invertebrate Classification Tool (RICT) determines the ecological condition of a given location based on a comparison of aquatic macroinvertebrate communities observed at each study site, with aquatic macroinvertebrate communities observed at reference sites (Davy-Bowker *et al*, 2008). RICT reference sites are deemed to be as close as possible to pristine conditions and not impacted by environmental stressors such as pollution, habitat modification or flow stress. Reference sites provide an expected aquatic macroinvertebrate community score for that river type. The observed aquatic macroinvertebrate community score at a given study site is divided by the expected community score. Reference and bias adjustments are then applied to obtain the Ecological Quality Ratio (EQR). RICT can derive EQR scores for a number of biological metrics. These metrics are discussed further below.

Whalley, Hawkes, Paisley and Trigg

5.1.8. The Whalley, Hawkes, Paisley and Trigg (WHPT) metric (WFD-UKTAG, 2014) is based on the tolerance of different aquatic macroinvertebrates to organic pollution. Each aquatic macroinvertebrate family is assigned a score from -1.6 to 13, depending on their tolerance to pollution and abundance category (on a continuous scale, -1.6 is for highly abundant pollution-tolerant taxa, 13 is for highly abundant pollution-intolerant taxa) and an overall score is produced from the total. The WHPT index is widely used to determine the ecological water quality of running waters and specifically the detection of organic pollution. As such, any extrapolation of other water quality pressures should be undertaken with caution.

5.1.9. The Average Score Per Taxon (ASPT) is derived from the WHPT index. By dividing the total WHPT score by the number of scoring taxa present (NTAXA), the average score per taxon can be calculated. This metric is more easily comparable with other sites and permits an assessment of biological water quality that is less influenced by the presence of a greater proportion of low scoring taxa or sampling effort than the overall WHPT score. In both the case of WHPT score and ASPT, higher scores indicate better ecological quality.

Lotic-invertebrate Index for Flow Evaluation

5.1.10. Aquatic macroinvertebrates have specific requirements for flow conditions and can be used to determine not only predominant flow types (Extence *et al*., 1999), but also changes in flow character. The Lotic-invertebrate Index for Flow Evaluation (LIFE) metric uses abundance data to assign a flow preference score to aquatic macroinvertebrate families present in a sample and an overall score for the site can be interpreted as an abundance-weighted average score per taxon metric. The family-level LIFE score is calculated in RICT as a ratio of the observed/expected at reference sites (O/E) for the sample.

5.1.11. There are currently no WFD-related class boundaries for LIFE EQRs, but a threshold of 0.94 is used to indicate the presence of flow stressed aquatic macroinvertebrate

communities (Environment Agency, 2012). A LIFE score of less than 0.94 may indicate that flow is a possible pressure acting on an ecological community at a site.

Proportion of Sediment-sensitive Invertebrates

5.1.12. The Proportion of Sediment-sensitive Invertebrates (PSI) metric aims to act as a proxy for the quantity of fine sediment at a site (Extence *et al*., 2011). Aquatic macroinvertebrate species are assigned a fine sediment sensitivity rating that ranges from highly insensitive to highly sensitive to fine sediment. The PSI score is calculated as the percentage of sensitive taxa in the sample and used to indicate how sedimented a watercourse is, from minimally sedimented/unsedimented to heavily sedimented (see **Table TR5.1.D-1**).

5.1.13. There are currently no WFD-related class boundaries for PSI EQRs, but a threshold of 0.70 is used to indicate the presence of low stressed aquatic macroinvertebrate communities (Turley *et al*., 2016).

Table TR5.1.D-1 – Proportion of Sediment-sensitive Invertebrates (PSI) scores and interpretation.

PSI Score	River bed condition
81 – 100	Minimally sedimented/ unsedimented
61 – 80	Slightly sedimented
41 – 60	Moderately sedimented
21 – 40	Sedimented
0 – 20	Heavily sedimented

Community Conservation Index

5.1.14. The diversity and conservation interest of an aquatic macroinvertebrate community at each site can be represented by analysing species level data through the Community Conservation Index (CCI). The CCI incorporates elements of taxon rarity and richness to summarise the conservation value of aquatic macroinvertebrate communities (Chadd and Extence, 2004). Scores defined within Chadd and Extence (2004) are assigned to species within the sample to derive a total sample conservation score which infers a conservation value from the criteria listed in **Table TR5.1.D-2**.

Table TR5.1.D-2 – Community Conservation Index (CCI) scores and classification descriptions.

Conservation score	Conservation Classification	Description
0 ≤ 5	Low	Sites supporting only common species and/or a community of low taxon richness.
5 ≤ 10	Moderate	Sites supporting at least one species of restricted distribution and/or a community of moderate taxon richness.
10 ≤ 15	Fairly high	Sites supporting at least one uncommon species, or several species of restricted distribution and/or a community of high taxon richness.
15 ≤ 20	High	Sites supporting several uncommon species, at least one of which may be nationally rare and/or a community of high taxon richness.
> 20	Very high	Sites supporting several rarities, including species of national importance, or at least one extreme rarity (such as taxa included in the British RDBs) and/or a community of very high taxon richness (potentially of national significance and may merit statutory protection).

Water Framework Directive classification

5.1.15. The WFD uses the pollution sensitivity (WHPT ASPT) and aquatic macroinvertebrate richness (WHPT NTAXA) EQR scores to determine whether a watercourse meets Good Ecological Status, as required under the Directive.

5.1.16. There are five ecological status classes: Bad, Poor, Moderate, Good and High.

5.1.17. Where an aquatic macroinvertebrate community is recorded at, or above Good Ecological Status, then biological or physical pressures including flow and pollution are not assumed to be affecting aquatic ecology.

5.1.18. Watercourses failing to meet Good Ecological Status for aquatic macroinvertebrates may be influenced by a variety of stressors, and EQRs can be interrogated to determine the likely cause of failure to meet Good Ecological Status.

5.1.19. For WFD classification the lower scoring of these EQR scores determines the aquatic macroinvertebrate classification of a given site.

Annex E

Aquatic Macroinvertebrate Taxon List

Table TR5.1.E-1 – Full aquatic macroinvertebrate taxon list from spring and autumn surveys carried out on Bin Brook, 2022.

Family	Species	Conservation Score	Bin Brook Upstream		Bin Brook Downstream	
			Spring	Autumn	Spring	Autumn
Sphaeriidae	*Pisidium* sp.	-	60	129	16	62
Lymnaeidae	Lymnaeidae	-			1	1
Planorbidae	*Gyraulus albus*	1	4	2	6	4
Planorbidae	*Gyraulus crista*	2	1	1	3	4
Planorbidae	*Anisus vortex*	1	10	14	1	10
Planorbidae	*Hippeutis complanatus*	3		3		
Bithyniidae	*Bithynia tentaculate*	1			1	
Hydrobiidae	*Potamopyrgus antipodarum*	1	11	9	15	13
Oligochaeta	Oligochaeta	-	57	12	45	38
Glossiphoniidae	*Helobdella stagnalis*	1	2			1

Family	Species	Conservation Score	Bin Brook Upstream		Bin Brook Downstream	
			Spring	Autumn	Spring	Autumn
Glossiphoniidae	*Glossiphonia complanata*	1	4			5
Glossiphoniidae	*Theromyzon tessulatum*	2			1	
Isopoda	*Asellus aquaticus*	1	3	4	3	3
Gammaridae	*Gammarus pulex/fossarum* agg.		61	3	131	44
Ephemerellidae	*Serratella (Ephemerella) ignita*	1		1		
Caenidae	*Caenis* sp.	-			1	
Baetidae	*Baetis rhodani/atlanticus* agg.	-			26	
Baetidae	*Baetis* sp.	-	2	1		1
Elmidae	*Elmis aenea*	1	39	8	19	80
Elmidae	*Oulimnius* sp.	-	14			
Elmidae	*Oulimnius tuberculatus*	1		13	8	33

Family	Species	Conservation Score	Bin Brook Upstream		Bin Brook Downstream	
			Spring	Autumn	Spring	Autumn
Haliplidae	*Haliplus lineatocollis*	2		1		
Sialidae	*Sialis lutaria*	1		10		1
Glossosomatidae	*Agapetus fuscipes*	1	1		3	
Glossosomatidae	Glossosomatidae	-		1	6	1
Sericostomatidae	*Sericostoma personatum*	1				1
Leptoceridae	*Mystacides longicornis*	1	6			
Leptoceridae	*Mystacides* sp.	-			1	1
Limnephilidae	*Limnephilus lunatus*	1	2		2	1
Limnephilidae	Limnephilidae	-	8		11	
Simuliidae	Simuliidae	-			14	5
Tipulidae	*Tipula* sp.	-			1	
Tipulidae	Tipulidae	-				6

Family	Species	Conservation Score	Bin Brook Upstream		Bin Brook Downstream	
			Spring	Autumn	Spring	Autumn
Tipulidae/Limoniidae/ Cylindrotomidae	*Dicranota* sp.	-	10		16	
Chironomidae	Chironomidae	-	106	57	149	48
Ceratopogonidae	Ceratopogonidae	-	16	3	5	
Empididae	Empididae	-			1	
Muscidae	Muscidae	-				3
Psychodidae	Psychodidae	-	1		1	5
Stratiomyidae	Stratiomyidae	-				
Hydracarina	Hydracarina	-	18		4	1
Ostracoda	Ostracoda	-	1			1
Lepidoptera	Lepidoptera	-			4	

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