A46 Coventry Junctions (Walsgrave)
Scheme Number: TR010066

6.3 Environmental Statement Appendices
Appendix 13.5 Hydromorphological Report

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6

November 2024

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A46 Coventry Junctions (Walsgrave) Development Consent Order 202[x]

ENVIRONMENTAL STATEMENT APPENDICES
Appendix 13.5 Hydromorphological Report

Regulation Number	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010066
Application Document Reference	TR010066/APP/6.3
Author	A46 Coventry Junctions (Walsgrave) Project Team, National Highways

Version	Date	Status of Version
Rev 0	November 2024	Application Issue

Table of contents

Figures

1. Introduction

1.1.1. This report outlines the baseline condition of hydromorphological features and processes and assesses the potential impacts resulting from the A46 Coventry Junctions (Walsgrave) (the Scheme).

1.1.2. The Scheme will be constructed in close proximity to a range of hydromorphological features and processes; therefore, an assessment upon the Scheme's impact to these features and processes is required. Hydromorphology is defined by the European Committee for Standardisation (CEN) standard (CEN, 2004) as the physical and hydrological characteristics of rivers including the underlying processes from which they result. As such, this assessment will assess the impacts to in channel morphology, riverbanks, riparian zones and floodplains and their impact to the hydromorphological features and processes of each river as a result of the Scheme. The hydromorphological impact of the Scheme is assessed in terms of proposed infrastructure in the vicinity of the watercourse, with construction and operational impacts discussed and mitigation measures proposed, where required.

1.1.3. The receptors have been identified based on a 1km buffer of the Order Limits (the study area) and therefore the scope of this assessment includes Coombe Pool, the River Sowe, Smite Brook, Withy Brook, and Birchley Beck and its unnamed tributary.

1.1.4. The hydromorphological assessment of the Scheme has been supported by a site walkover which assessed the conditions of Coombe Pool, the River Sowe, Smite Brook, Withy Brook, and Birchley Beck and its unnamed tributary.

1.1.5. Consultation with the Environment Agency, and the two Lead Local Flood Authorities (LLFAs), (Coventry City Council and Warwickshire County Council) remains on-going and focuses on agreeing the impacts and mitigation requirements of the Scheme, an update will be provided in the relevant Statement of Common Ground(s).

1.1.6. This report should be read in conjunction with Environmental Statement (ES) Appendix 13.2 (Water Framework Directive (WFD) Compliance Assessment) (**TR010066/APP/6.3**).

2. Scheme information

2.1. Scheme location

2.1.1. The Scheme is located in the West Midlands, approximately 5km to the east of Coventry city centre. ES Figure 2.1 (Location Plan) (**TR010066/APP/6.2**) shows the location of the Scheme. The Scheme involves improvements to the B4082 which runs eastwards from Clifford Bridge Road to the existing Walsgrave Junction and the A46 which runs north-south to the east of Coventry. Binley Junction, located on the A46, is approximately 1.7km to the south of the existing Walsgrave Junction and the M6 and M69 junctions are approximately 2.5km to the north of the existing Walsgrave Junction. ES Figure 2.2 (Order Limits) (**TR010066/APP/6.2**) shows the principal elements of the Scheme and the Order Limits. A Location Plan (**TR010066/APP/2.1**) is also provided with the application, which shows the location of the Scheme in its wider geographical context.

2.1.2. The Scheme is situated within the Coventry City Council and Rugby Borough Council administrative areas (ES Figure 1.1 (Regional Context) (**TR010066/APP/6.2**)). The boundary between these two administrative areas is along the western side of the A46. Rugby Borough Council's administrative area also forms part of Warwickshire County Council's administrative area, which shares the same border with Coventry City Council. The Leicestershire County Council boundary is approximately 12.5km north and east of the existing Walsgrave Junction.

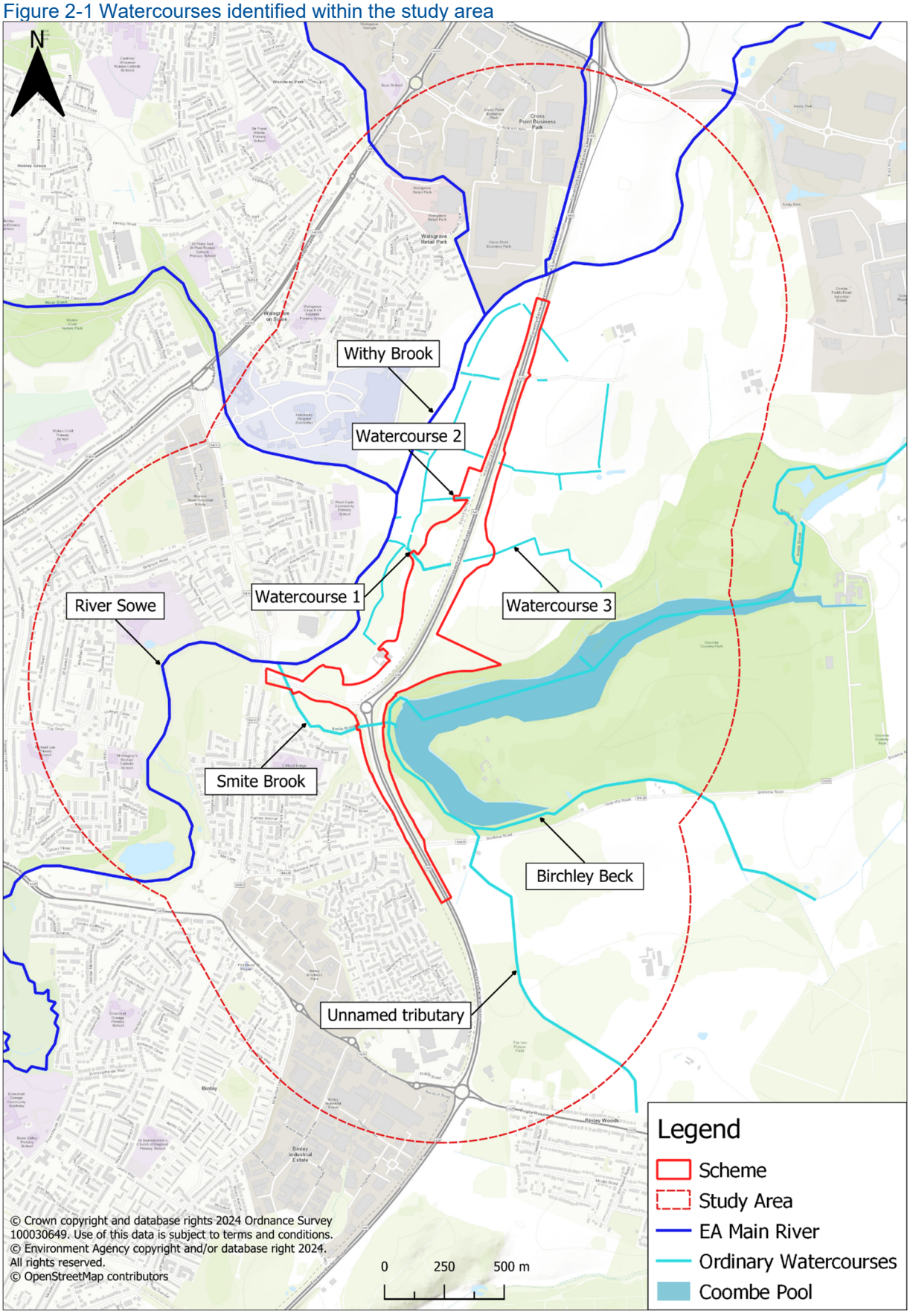
2.2. Study area overview

2.2.1. The study area contains several watercourses which include Coombe Pool, the River Sowe, Smite Brook, Withy Brook, Birchley Beck and unnamed watercourses (Figure 2-1). The River Sowe is a tributary of the River Avon which ultimately flows into the River Severn at Tewkesbury. The existing Walsgrave Junction is located 9km in a straight line upstream of the confluence with the River Avon. The catchment area of the River Sowe at the confluence of the River Avon is 265km^2 and is predominately characterised by a mixture of arable land use and the urban areas of East Coventry.

2.2.2. This report provides a high level summary of the geology and soils, hydrology, land use, biogeomorphology, historical channel change and in-channel structures impacting geomorphology and designations identified for each watercourse identified for assessment. Further information is provided in Section 4 of this document.

2.2.3. Coombe Pool is a 32-hectare (ha) designated raised reservoir under the Reservoirs Act 1975, located 100m to the east of the existing Walsgrave Junction. Coombe Pool is part of the wider Coombe Abbey Park and Abbey. A bellmouth structure, sluice gates and a spillway discharge overflows into Smite Brook and Birchley Beck. This is a heritage feature that was designed by the famous 18th century landscape gardener, Capacity Brown. It is likely that the hydromorphological receptors identified in this report have been and will continue to be influenced by this feature.

Figure 2-1 Watercourses identified within the study area



3. Methods

3.1. Approach

3.1.1. A desk-based assessment and a site walkover were carried out in accordance with Appendix E of the Design Manual for Roads and Bridges (DMRB) LA 113 road drainage and the water environment (National Highways, 2020). An assessment of the baseline hydromorphological features and processes and the impacts due to the Scheme are described within this report. This assessment has been completed using the CEN standard guidance (CEN, 2004) and was undertaken in line with Advice Note 18 (The Planning Inspectorate, 2017). This report is a qualitative assessment only.

3.2. Desktop review

3.2.1. A desktop review of background and historical information related to the watercourses affected by the Scheme was undertaken. This aimed to characterise the hydromorphological setting of the watercourses and their catchments.

3.2.2. The following data sources have been used to inform this assessment:

- Environment Agency catchment data explorer (Environment Agency, 2024a)
- Highways England Water Risk Assessment Tool (HEWRAT) (National Highways, 2020)
- Environment Agency statutory main river map (Environment Agency, 2024b)
- Highways Agency Drainage Data Management Systems (DDMS) (National Highways, 2024)
- Department for Environment, Food and Rural Affairs (DEFRA) MAGIC online Mapping (DEFRA, 2024)
- Ordnance Survey (OS) maps (Ordnance Survey Maps, 2023)
- Catchment Geology data (BGS, 2024)
- Hydrology data (NRFA, 2024a)
- Land use data (NRFA, 2024b)
- Biogeomorphology data (NBN Atlas, 2024)
- Historical channel change data (National Library of Scotland, 2024)

3.3. Site walkover

3.3.1. A site walkover of watercourses identified as requiring assessment was undertaken on the 24 and 25 October 2023. The site walkover included a visual

hydromorphological assessment of the watercourses within the Scheme extent. The walkover collated information on the form of the channels, the flow types, and the characteristics of the riparian zone within the study area. Photographs of the water features were collected during the site visit to inform the hydromorphological assessment. The survey was undertaken after a period of heavy rainfall over multiple days and there was evidence of Smite Brook and the River Sowe breaching its banks. Due to this, and the high turbidity of the watercourses it was difficult to determine the riverbed composition and condition in certain areas.

3.3.2. Due to the water bodies flowing across private land there were areas that could not be surveyed due to access restrictions and therefore the hydromorphological conditions of these areas have been assumed to be the same as the upstream conditions assessed. This was supported by the desktop review to assist where physical activity was not possible. The watercourses that could not be surveyed are:

- The River Sowe downstream of the confluence between the River Sowe and Smite Brook. (Figure 2-1)
- Withy Brook upstream of Farber Road (Figure 2-1)

3.3.3. A second site walkover was undertaken on the 19 and 20 June 2024. This site walkover was completed for sections of Smite Brook, upstream and downstream of the A46 culvert and upstream and downstream of the B4082 culvert. The site walkover also included visual assessment of field drains which connect to the River Sowe or will require in channel works as a result of the Scheme. The site walkover was undertaken after approximately a week of dry, high temperatures as a resulted the watercourses were observed during low flow conditions and many field drains were dry. Currently there is no requirement to repeat the site walkover at this stage.

3.4. Impacts assessment

3.4.1. The potential hydromorphological impacts as a result of the Scheme have been assessed at a water body and local level. The assessment considers:

- flow processes
- sediment movement
- boundary conditions (channel bed and banks)
- riparian zones
- floodplains
- downstream and catchment-channel connectivity

- the general form and function of the channel and near-channel zones
- the setting of the watercourse within the wider catchment

3.4.2. Where potentially significant hydromorphological impacts to the water body and local level have been identified, appropriate recommendations for mitigation have been proposed for consideration and inclusion at the detailed design stage. The proposed mitigation forms part of the First Iteration Environmental Management Plan (EMP) (**TR010066/APP/6.5**) to reduce the impact of construction activities and requirements incorporated into the detailed design of the scheme. An assessment of pollution impacts from routine runoff to surface waters was undertaken using HEWRAT.

Construction impacts

3.4.3. DMRB LA 113 states that any construction impacts should be considered using the source–pathway–receptor approach. The potential hydromorphological impacts from construction of the Scheme have been assessed. Where construction methods of the Scheme are not yet available, standard construction practices have been assumed.

Operation impacts

3.4.4. A qualitative assessment of potential hydromorphological impacts of the watercourses has been undertaken. The potential operational impacts on flow dynamics, sediment transport processes, and the impacts upon the ecology of the watercourse have been assessed.

3.4.5. The assessment has been carried out using professional judgement, experience and reasonable skill. The operational impacts are focused upon areas where the Scheme comes within close proximity of watercourses within the study area. An assessment at a water body scale has also been undertaken alongside local level.

4. Baseline hydromorphology

4.1.1. The following section describes the existing hydromorphological forms and processes within the study area. This section is based on the desk study only and the findings of the walkover are reported in Section 5 of this document.

4.2. Geology and soils

4.2.1. The wider catchment is largely underlain by Mercia Mudstone Group with areas west of the study area underlain by Helsby Sandstone Formation. There is a range of superficial deposits including Thrussington Member, Alluvium deposits, Baginton Sand and Gravel Formation, River Terrace Deposits and Bosworth Clay Member. The study area is predominantly underlain by Mercia Mudstone Bedrock with superficial alluvium deposits. Details of this can be found in ES Chapter 9 (Geology and Soils) (**TR010066/APP/6.1**).

4.3. Hydrology

4.3.1. The study area encompasses a 32ha reservoir and multiple watercourses and two main rivers. The nearest Environment Agency gauging station to the Scheme is located approximately 13.5km downstream of the Scheme, along the River Sowe at Stoneleigh (54004). Groundwater pumping and bulk imports lead to low flows being dominated by Coventry sewage effluent. This is due to the Finham wastewater treatment works located 1km north of the River Sowe at Stoneleigh (54004) gauging station. With a Base Flow Index (BFI) of 0.61 there is a contribution from groundwater during low flows. The gauged Q_{95} (the flow that is exceeded 95% of the time) is 1.2m^3/s (NRFA, 2024a). The gauged Q_5 (the flow that is exceeded 5% of the time) is 8.16m^3/s, resulting in a mean flow of 3.1m^3/s. The calculated QMED was 30.7m^3/s and max gauging flow was 25.4m^3/s. The period of record was between 1952 and 2022. Areal scaling at this gauging station was undertaken to estimate the Q_{95} flows for the River Sowe at the Scheme and was calculated to be 0.6m^3/s.

4.4. Land use

4.4.1. The surrounding land use of the study area and wider catchment is predominantly arable farmland making up 34.06% of the land cover (NRFA, 2024a). There are areas of urban catchments to the west of the study area which enters the eastern edge of Coventry. Due to expansion of Coventry, the nature of the surrounding watercourses and land use cover have substantially changed over time, this is visible on historic OS mapping (earliest date available 1840). The A46 and associated road links travel directly through the middle of the study area. Surface water runoff is discharged to nearby watercourses.

4.5. Biogeomorphology

4.5.1. Biological and natural geomorphological processes are closely interlinked and some species are able to influence the geomorphology at a range of scales. These species are referred to as ecosystem engineers or biogeomorphic agents. In the study area, an Invasive Non-Native Species (INNS) species has been identified on the National Biodiversity Network atlas database; Himalayan Balsam *Impatiens glandulifera*. This species is a known biogeomorphic agent and can contribute to a reduction in bank stability (through outcompeting native vegetation and shallow rooting and by leaving river banks exposed during winter periods). Rhododendron *Rhododendron ponticum* is also extensive throughout the Coombe Abbey Park woodland to the south-east of the existing A46 Walsgrave Junction, including within the area of woodland which is partially within the Order Limits. As a result of this, INNS management plans will be produced at the detailed design stage and included in the Second Iteration EMP. For further information see ES Chapter 8 (Biodiversity) (**TR010066/APP/6.1**).

4.6. Historical channel change and in-channel structures impacting geomorphology

4.6.1. Due to the evolution and expansion of Coventry, watercourses such as the River Sowe and Smite Brook have been extensively straightened both in the wider catchment and within the study area. This could have had implications on flow and connectivity of the watercourses. Coombe Pool has historically been created and the watercourse heavily modified (including construction of a dam) by the landscaping works of Capability Brown. There are multiple in-channel structures across the wider catchment and study area including multiple culverts, weirs and outfalls of identified water bodies such as the River Sowe, Smite Brook and Birchley Beck and its unnamed tributary. This has the potential to reduce sediment connectivity, trapping sediment supply to downstream receptors.

4.7. Designations

Statutory designations

4.7.1. Surface water dependent designated conservation sites within the study area include:

- Coombe Pool, a Site of Special Scientific Interest (SSSI) (1014505) is located 100m east of the existing Walsgrave Junction. Coombe Pool is designated for its wildlife; including herons, other breeding waterfowl and wintering wildfowl.
- Floodplain Grazing Marshes within the Priority Habitat Inventory located approximately 350m west of the A46.

- Stoke Floods Local Nature Reserve (LNR) located 1km southwest of the Scheme is just outside the study area.

Water Framework Directive

4.7.2. Five WFD surface water bodies have been included within ES Appendix 13.2 (WFD Compliance Assessment) (**TR010066/APP/6.3**) for assessment:

- Withy Brook - source to confluence River Sowe Water Body (GB109054044640) identified as having moderate ecological status.
- Smite Brook - source to confluence Rive Sowe (GB109054044630) identified as having poor ecological status.
- Sowe - confluence Withy Brook to confluence River Avon (GB109054044540) identified as having poor ecological status.
- Sowe - confluence Breach Brook to confluence Withy Brook (GB109054044660) identified as having moderate ecological status.
- Coombe Pool (GB30937926) identified as having moderate ecological potential.

4.7.3. Groundwater bodies have been assessed within ES Chapter 13 (Road Drainage and the Water Environment) (**TR010066/APP/6.1**). The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (UK Government, 2017) requires that all groundwater and surface waterbodies achieve 'Good' ecological status. To achieve 'Good' overall status, a water body must achieve Good status for all quality elements (biological, hydromorphological, physio-chemical and chemical quality), therefore, a deterioration in one of these elements may result in the water body failing to meet the WFD objectives. As well as this, heavily modified water bodies must maintain a good ecological potential.

4.8. Identified water bodies

4.8.1. The below information has been used to identify the characteristics of each watercourse or WFD water body being assessed.

Coombe Pool

4.8.2. Coombe Pool is a large artificial reservoir and WFD water body (GB30937926), approximately 32ha in size, located 100m to the east of the the existing Walsgrave Junction and is fed by Smite Brook which originates to the east of the study area. Coombe Pool discharges into Smite Brook at its confluence with Birchley Beck. Coombe Pool is an abnormal shape, likely due to the design influence of Capability Brown. The lake ranges from widths of 18m to 200m and curves around the Coombe Abbey Park. Coombe Pool is underlain by Mercia

Mudstone Bedrock. Coombe Pool is designated as a SSSI due to the presence of breeding and wintering birds. Two types of INNS were recorded within the study area, Rhododendron and Himalayan balsam. The predominant land use surrounding Coombe Pool is woodland.

River Sowe

4.8.3. The River Sowe is an Environment Agency designated main river and WFD waterbody (GB109054044660 and GB109054044660) that flows through Coventry to the west of the Scheme. The River Sowe is connected to surrounding drainage systems. These ordinary watercourses receive discharges from outfalls and field drains which then connect to the River Sowe. There are also minor unnamed tributaries which connect and discharge into the River Sowe via culverts. The majority of discharges into the River Sowe is supplied by runoff from arable land into field drains, east of the River Sowe. However, the River Sowe also receives discharges from Smite Brook, and runoff from the existing A46 and B4082.

4.8.4. The River Sowe is predominantly underlain by Mercia Mudstone Bedrock within the study area, with superficial alluvium deposits. The nearest Environment Agency gauging station to the Scheme is located approximately 13.5km downstream of the Scheme, along the River Sowe at Stoneleigh. The gauged Q_{95} (the flow that is exceeded 95% of the time) is 1.2m^3/s (NRFA, 2024a). Areal scaling at this gauging station was undertaken to estimate the Q_{95} flows for the River Sowe at the Scheme and was calculated to be 0.6m^3/s. The predominant land use surrounding the River Sowe within the Scheme is a mixture of urban and arable land. The River Sowe within the study area includes an area of priority habitats for Coastal and Floodplain Grazing Marshes. There is no historic channel change of the River Sowe within the study area identified from historic OS maps.

Smite Brook

4.8.5. Smite Brook is an ordinary watercourse and a WFD water body (GB109054044630) that connects Coombe Pool to the River Sowe.

4.8.6. Smite Brook is underlain by Mercia Mudstone Bedrock within the study area, with superficial alluvium deposits. Areal scaling of the flows at the River Sowe at Stoneleigh gauging station (NRFA, 2024a) was undertaken to estimate the Q_{95} flows for Smite Brook and was calculated to be 0.2m^3/s. The predominant land use surrounding Smite Brook is urban. There is no historic channel change of Smite Brook within the study area identified from historic OS maps.

Withy Brook

4.8.7. Withy Brook is an Environment Agency designated main river and WFD water body (GB109054044640) that flows in a southwest direction for 3km before its confluence with the River Sowe. Withy Brook originates northeast of the Scheme and flows southwest where it enters the study area.

4.8.8. Withy Brook is underlain by Mercia Mudstone Bedrock within the study area, with superficial alluvium deposits. Areal scaling of the flows at the River Sowe at Stoneleigh gauging station (NRFA, 2024a) was undertaken to estimate the Q_{95} flows for Withy Brook and was calculated to be 0.1m^3/s. The predominant land use surrounding Withy Brook is a mixture of urban and arable land. There is no historic channel change of Withy Brook within the study area identified from historic OS maps.

Birchley Beck and its unnamed tributary

4.8.9. Birchley Beck is classified as an ordinary watercourse. However, its ecological and chemical status has the potential to have an indirect impact on the Smite Brook WFD water body (GB109054044630) status.

4.8.10. Birchley Beck and its unnamed tributary are underlain by Mercia Mudstone Bedrock within the study area. The predominant land use surrounding Birchley Beck and its tributary is arable land. There is no historic channel change of Birchley Beck and its unnamed tributary identified from historic OS maps.

5. Hydromorphological walkover

5.1.1. This section describes the conditions found on the hydromorphological walkover survey undertaken in October 2023.

Coombe Pool

5.1.2. The majority of Coombe Pool is located within the study area. The hydromorphological assessment of Coombe Pool was taken at points highlighted in Figure 5-1. Due to access issues across private land, the hydromorphological assessment of the water body was taken at national grid reference SM 84513 23993. Figure 5-1 shows the photograph locations of Coombe Pool, taken during the walkover.

5.1.3. Smite Brook and Birchley Beck receive discharges from Coombe Pool via a sluice gate (Figure 5-2, photo A), a bell-mouth spillway (Figure 5-2, photo B) and an emergency drawdown spillway (Figure 5-2, photo C). Coombe Pool is a WFD water body (GB30937926). The reservoir is defined as heavily modified with a moderate ecological status, limited to moderate due to moderate physicochemical quality elements. Coombe Pool's chemical classification no longer requires assessment.

5.1.4. Coombe Pool and its connected watercourses are not directly modified by the Scheme but could receive overland runoff from construction works areas such as the reprofiling of the A46 southbound embankment. During the walkover there were no signs of erosion, instability or fallen trees in the reservoir.

5.1.5. At the time of the survey, the reservoir embankments are surrounded by woodland with pasture located to the north. Open arable fields are located to the east which form the Coombe Abbey Park. Coombe Pool is used for angling and navigation activities. Canada Geese presence was not observed during this survey. However, there were recordings of Canada Geese presence during wintering bird surveys in October and November 2023 and January and February 2024.

Figure 5-1 Photograph locations of Figure 5-2

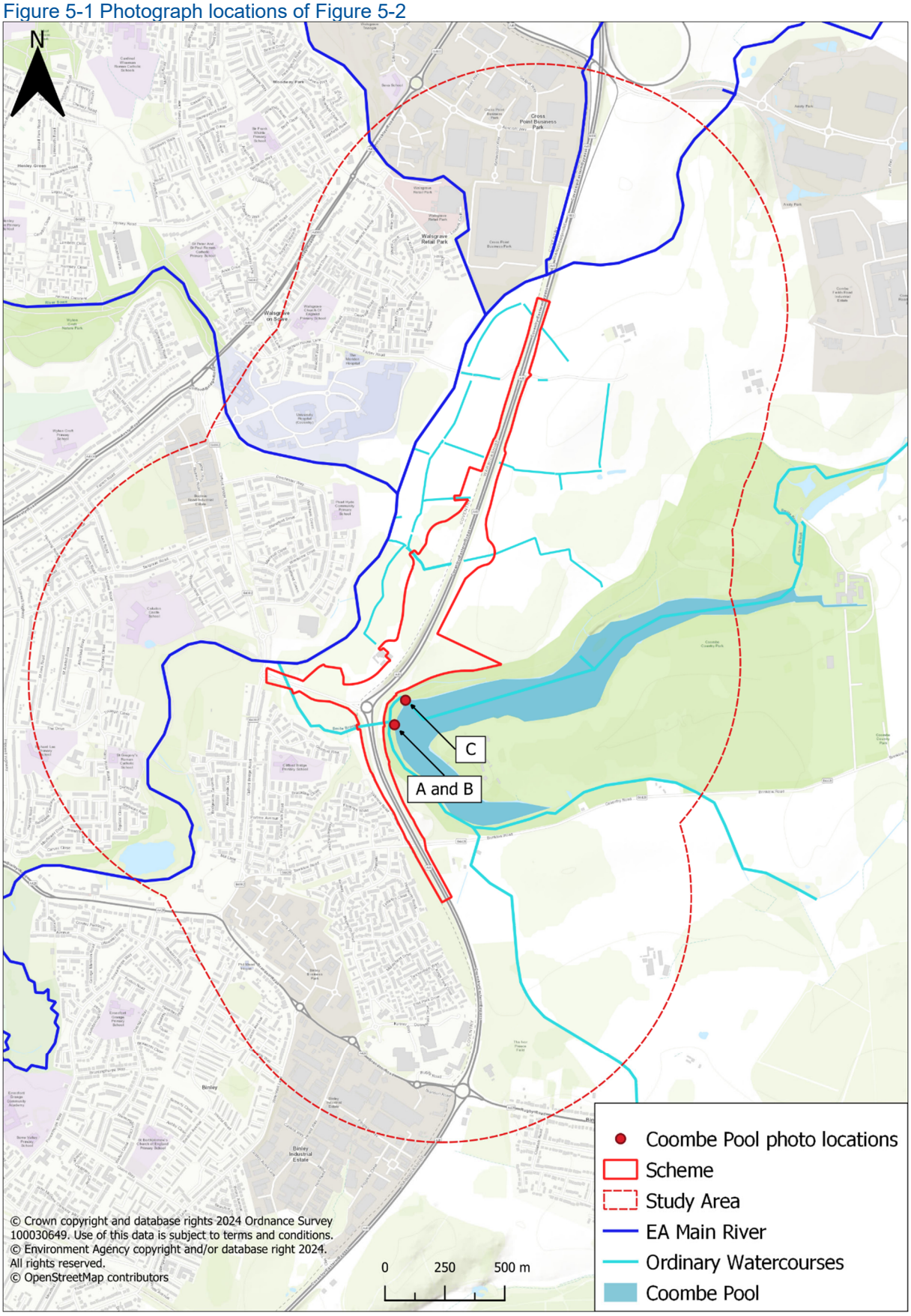
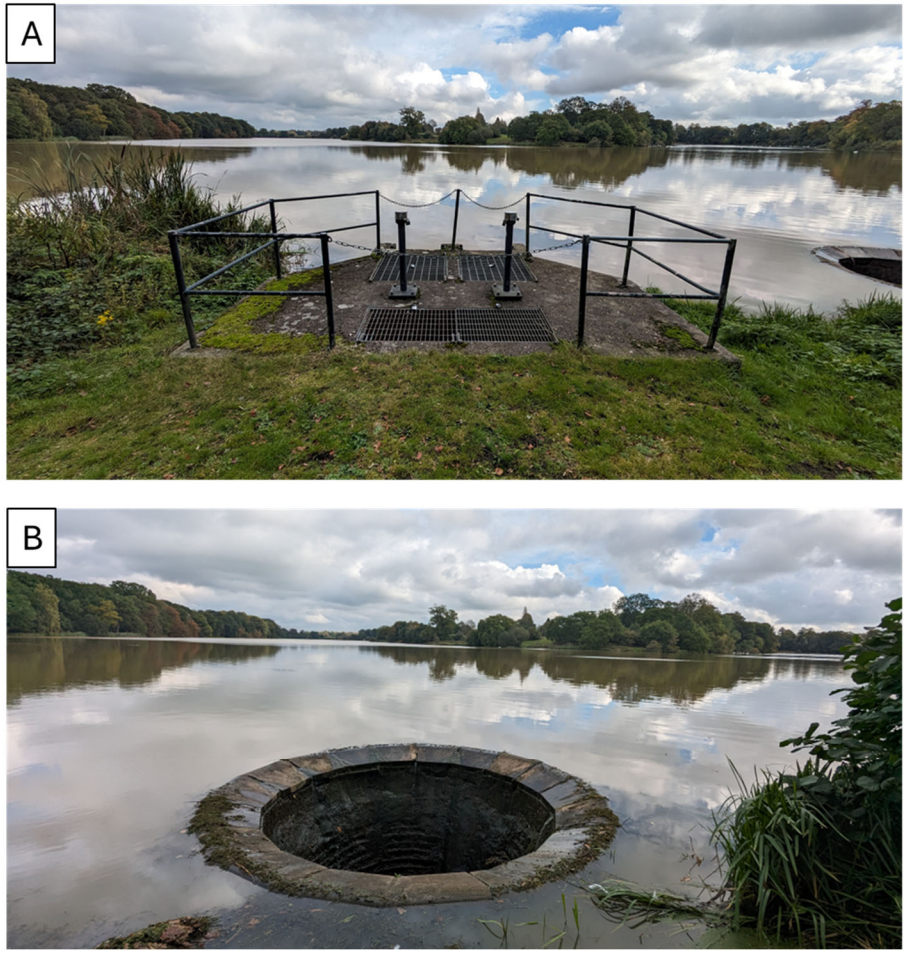


Figure 5-2 Photographs of the structures of Coombe Pool facing north for photos A-B and south for photo C



River Sowe

5.1.6. The River Sowe spans 3.6km within the study area. The hydromorphological assessment of the River Sowe was taken at points highlighted in Figure 5-3. Due to access constraints, the last hydromorphological assessment of the water body was taken at national grid reference SP 37943 79490. Figure 5-3 shows the photograph locations of the River Sowe taken during the walkover.

5.1.7. The River Sowe is approximately 5-6m wide and 1-1.5m deep within the study area and flows within an area of wooded/vegetated embankments and agricultural land (Figure 5-4). The riverbed is dominated by coarse pebbles and gravel in areas that the riverbed could be seen clearly. The watercourse is heavily vegetated with both in-channel and riparian vegetation at points (Figure 5-4, photos C and G) and is heavily modified by steep stone wall banks passing under the B4082. During the site walkover there were instances of minor bank erosion and instabilities as well as heavy vegetation and fallen trees in the watercourse. The turbid, silty water seen in Figure 5-4 is possibly due to recent storm events at the time of the walkover where there was evidence of the river breaking its banks as a result. This is evidence of floodplain connectivity between the River Sowe and surrounding fields.

5.1.8. A number of field drains and watercourses feed into the River Sowe, either via culverts or open ditch connections, along this stretch. These field drains are considered to be man-made due to the shape. This includes watercourse 1 and 2 (identified in Figure 2-1). During the walkover, these watercourses were dry or had shallow pools of standing water in them. Surveys undertaken from Ecologists throughout the year observed the same level and flow, and it has been considered theses watercourses are ephemeral, and just flow following heavy rainfall.

Figure 5-3 Photograph locations of Figure 5-4

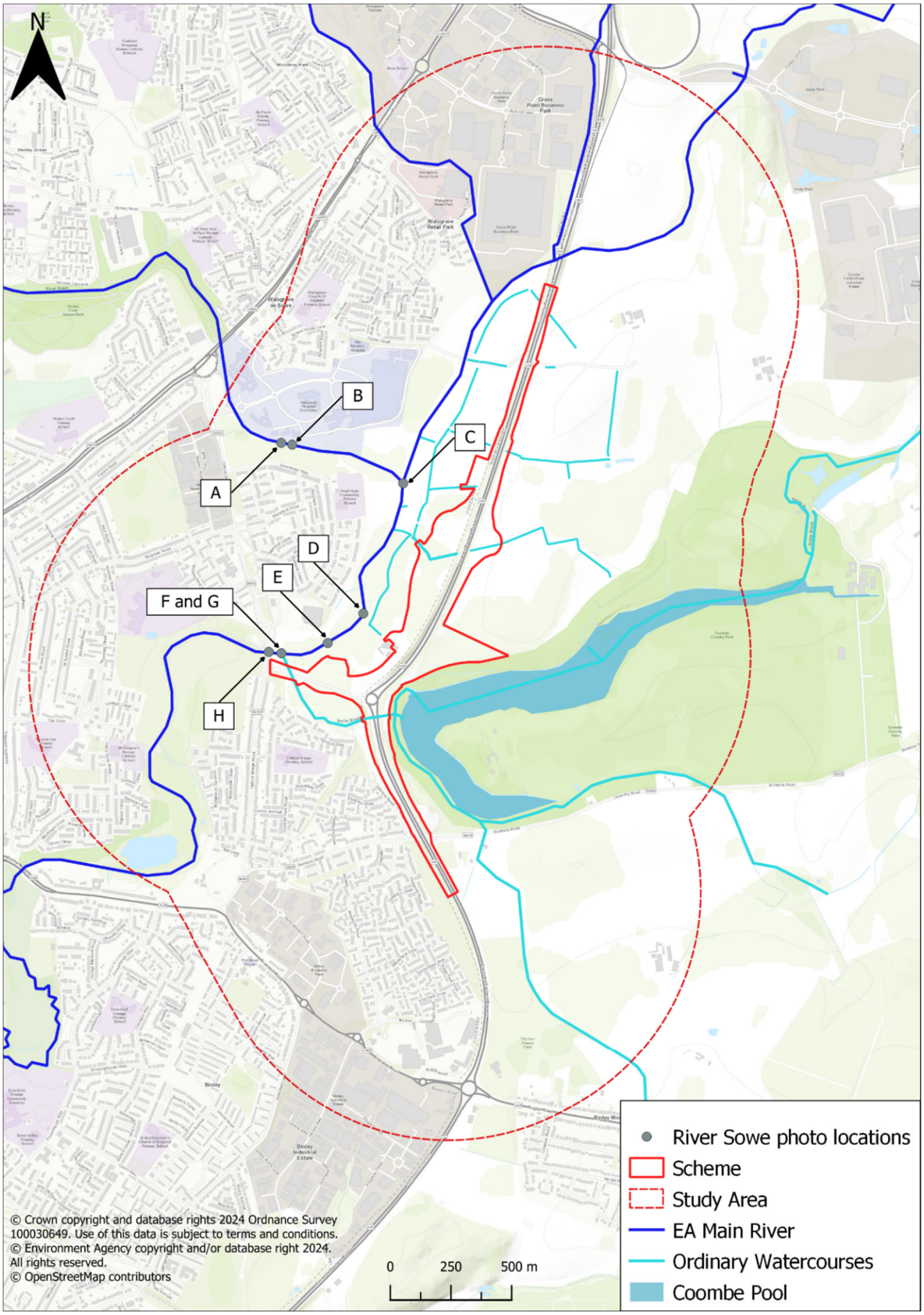
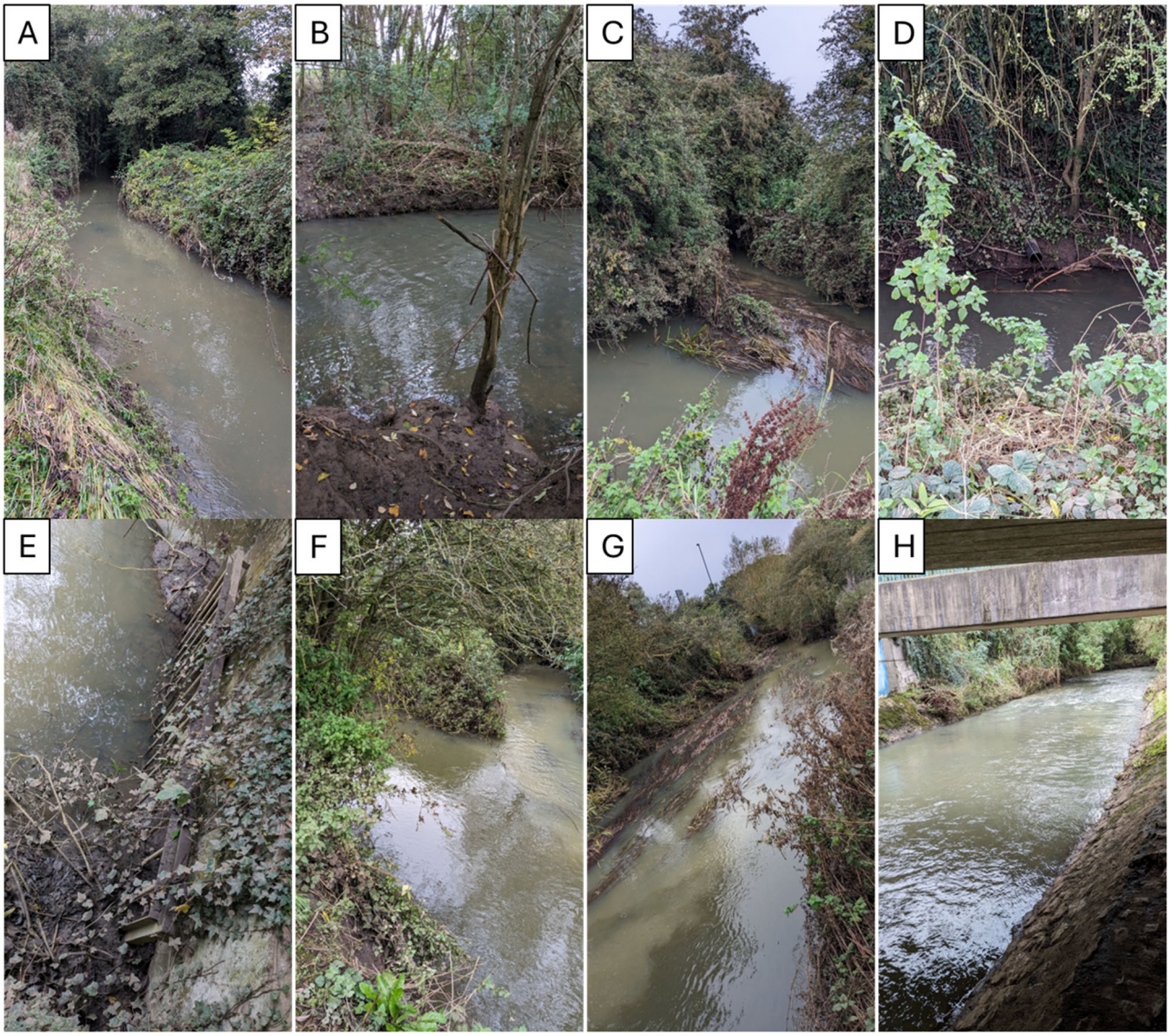


Figure 5-4 Photographs along the River Sowe



Smite Brook

5.1.9. Figure 5-6 shows the Smite Brook and Birchley Beck confluence downstream of the Coombe Pool before passing beneath the A46 highway via the A46 culvert. Figure 5-6 highlights the turbidity of Smite Brook caused by the merging of discharges from Coombe Pool, flow from Smite Brook and flow from Birchley Beck.

5.1.10. Smite Brook flows north-west through an area of pastureland (right bank) and an area with heavily terrestrial vegetated embankments about 0.5m high (left bank). The watercourse contains several areas of in-channel vegetation and fallen trees (Figure 5-7, photos D and E). Smite Brook is approximately 5m wide upstream of the A46 culvert with a higher bank and approximately 7m wide downstream of the A46 culvert with a lower bank.

5.1.11. The watercourse features several poaching areas for animals such as cattle as well as culverts, outfalls and an artificial wall which may have formed part of an old bridge (Figure 5-7, Photos D, F and G). Though this could not be confirmed through a comparison with historical mapping. The watercourse passes beneath the B4082 before its confluence with the River Sowe. Due to difficult terrain the hydromorphological condition of Smite Brook could not be assessed before the B4082 culvert and up to its confluence with the River Sowe.

5.1.12. During the site walkover there were instances of bank erosion and instabilities as well as heavy vegetation and fallen trees in the watercourse. Figure 5-6 shows the sediment input Smite Brook receives from Birchley Beck and Coombe Pool, this, coupled with the densely vegetated environment upstream of the A46 culvert creates a large amount of suspended sediment within the watercourse. Smite Brook then discharges into the River Sowe. The riverbed material along Smite Brook could not be determined due to the very silty watercourse likely caused by recent storm events identified in the desk study.

Figure 5-5 Photograph locations of Figure 5-6 and Figure 5-7

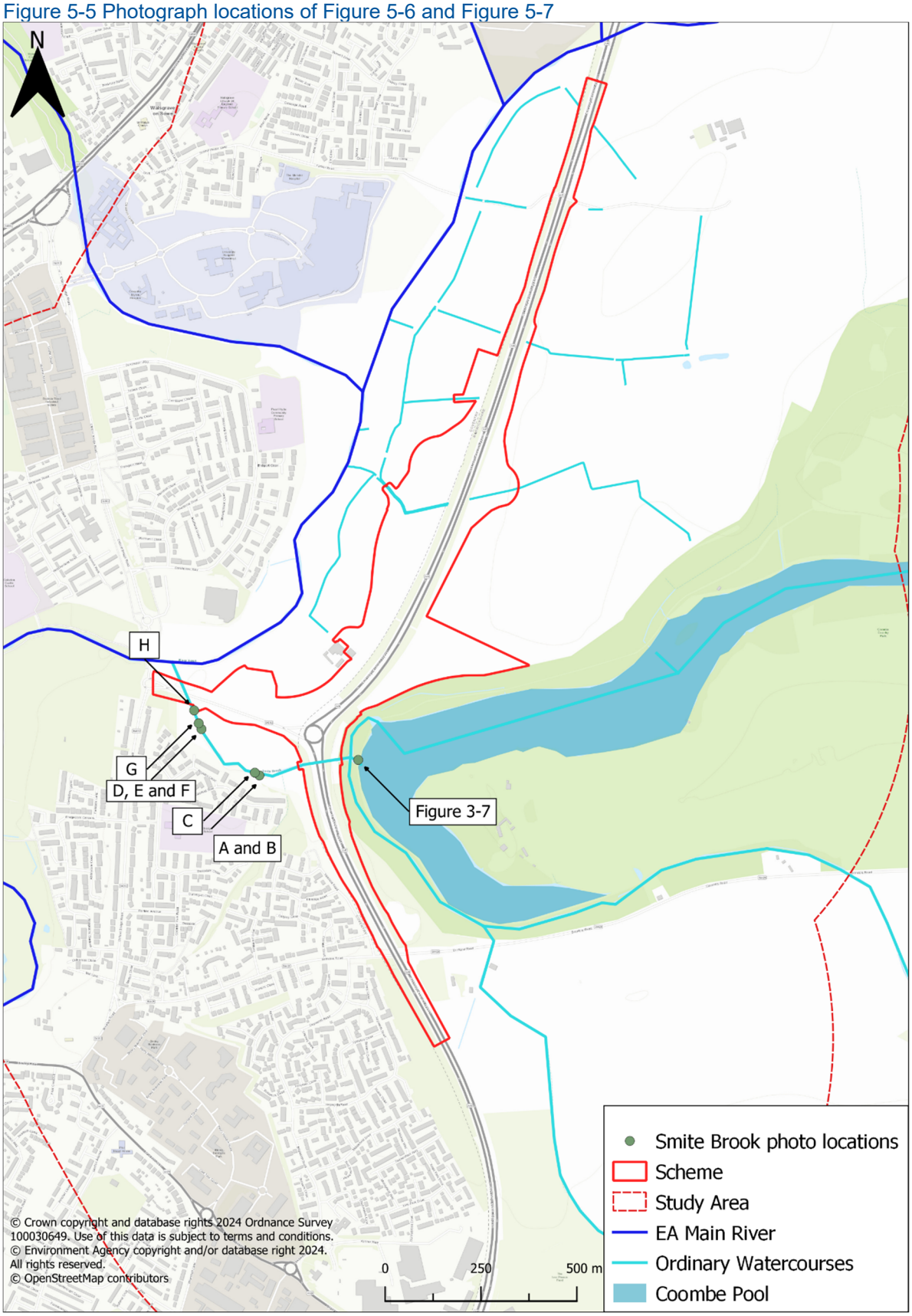


Figure 5-6 Upstream of A46 culvert

Figure 5-7 Photographs along Smite Brook

Withy Brook

5.1.13. Withy Brook spans 2.2km within the study area. The hydromorphological assessment of Withy Brook was taken at one point highlighted in Figure 5-8. Due to landowner access constraints and difficult terrain, the hydromorphological assessment of the water body could only be taken at one location (national grid reference SP 38733 80700) before the confluence with the River Sowe. Figure 5-8 shows the photograph location of Withy Brook taken during the walkover.

5.1.14. Withy Brook is approximately 3m wide for its full length. Withy Brook flows through areas of pastureland where the watercourse is heavily vegetated with both in-channel and on the bank (Figure 5-9).

5.1.15. During the site walkover there were instances of heavy vegetation on the embankments overhanging the channel and fallen trees in the watercourse. The bank profile and bed substrate were unable to be determined due to the limited access to the watercourse and the heavy vegetation. Withy Brook receives discharge from a field drain 300m west of the Scheme.

Figure 5-8 Photograph location of Figure 5-9

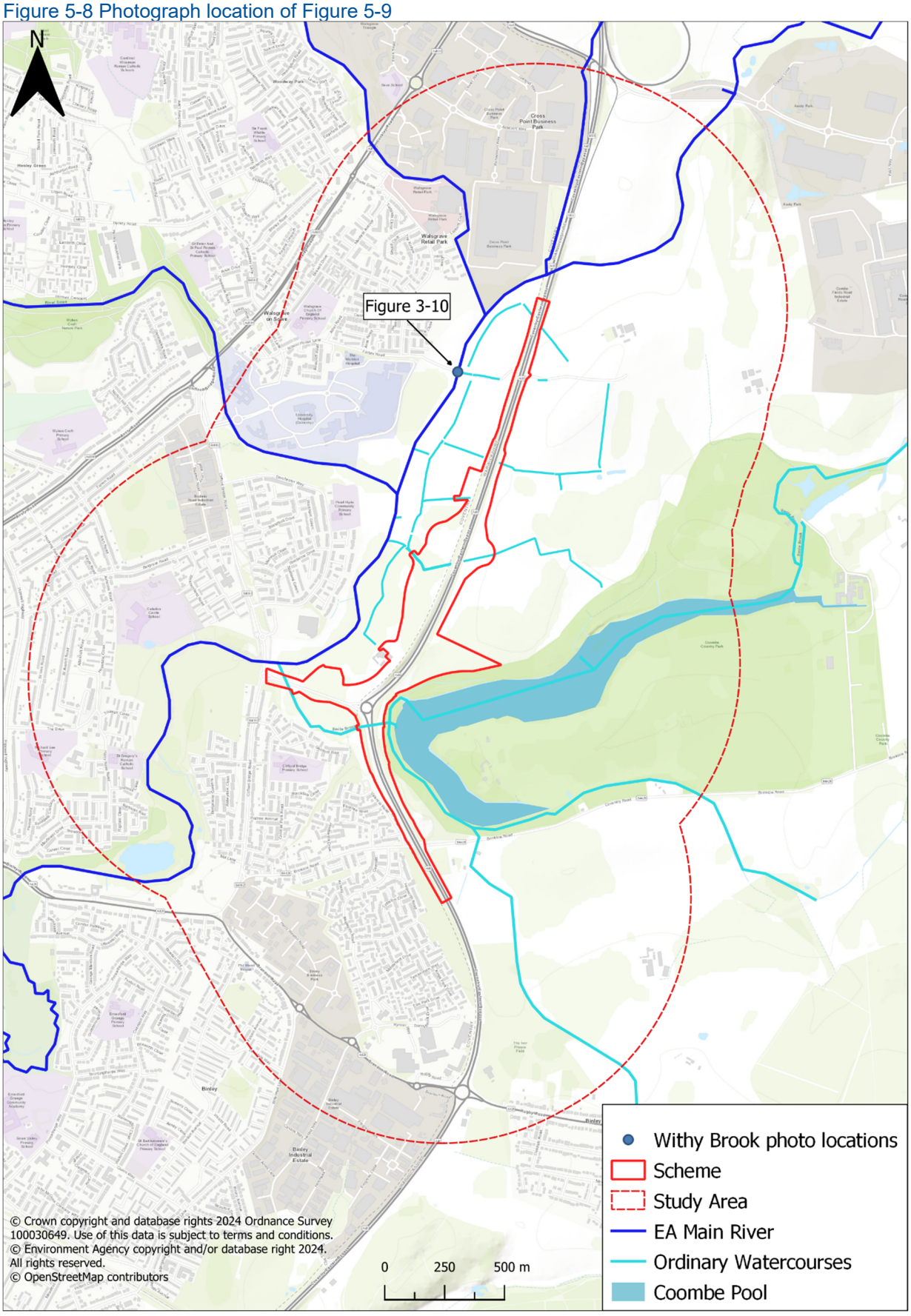


Figure 5-9 Looking downstream of High Bridge gauge on Withy Brook

Birchley Beck and unnamed tributary

5.1.16. Birchley Beck and an unnamed tributary originate south of Coombe Pool and flow northwest before they confluence with Smite Brook. Figure 5-10 shows the photograph locations taken on the Birchley Beck during the walkover.

5.1.17. Birchley Beck is culverted beneath the B4027 (Figure 5-11, photo A), and overtops steps in the bed. It is assumed these are made up of vegetation however the origin is unknown and could be further investigated during low flow conditions. (Figure 5-11, photos B and C). It is then culverted beneath a dilapidated footbridge (Figure 5-11, photo D).

5.1.18. Birchley Beck meets Smite Brook downstream of the Coombe Pool. Sluice gates (Figure 5-11) supply flows along Birchley Beck and Smite Brook and are managed by Warwickshire County Council. The watercourse at points is heavily vegetated with instances of falling trees and exposed roots, indicating channel incision. There were no J shaped trees, however leaning trees were observed. The riverbed is made up of a patchy silt layer.

5.1.19. Birchley Beck flows west through a series of culverts (Figure 5-11, photos E and F) before its confluence with the unnamed tributary, south of Coombe Pool. The unnamed tributary originates southeast of the Scheme and flows northwest. It is culverted beneath Brinklow Road before its confluence with Birchley Beck.

5.1.20. There was minimal variation in channel dimensions either side of each structure along Birchley Beck. There was no evidence of a depressed invert or prevention of sediment transport.

Figure 5-10 Photograph locations of Figure 5-11

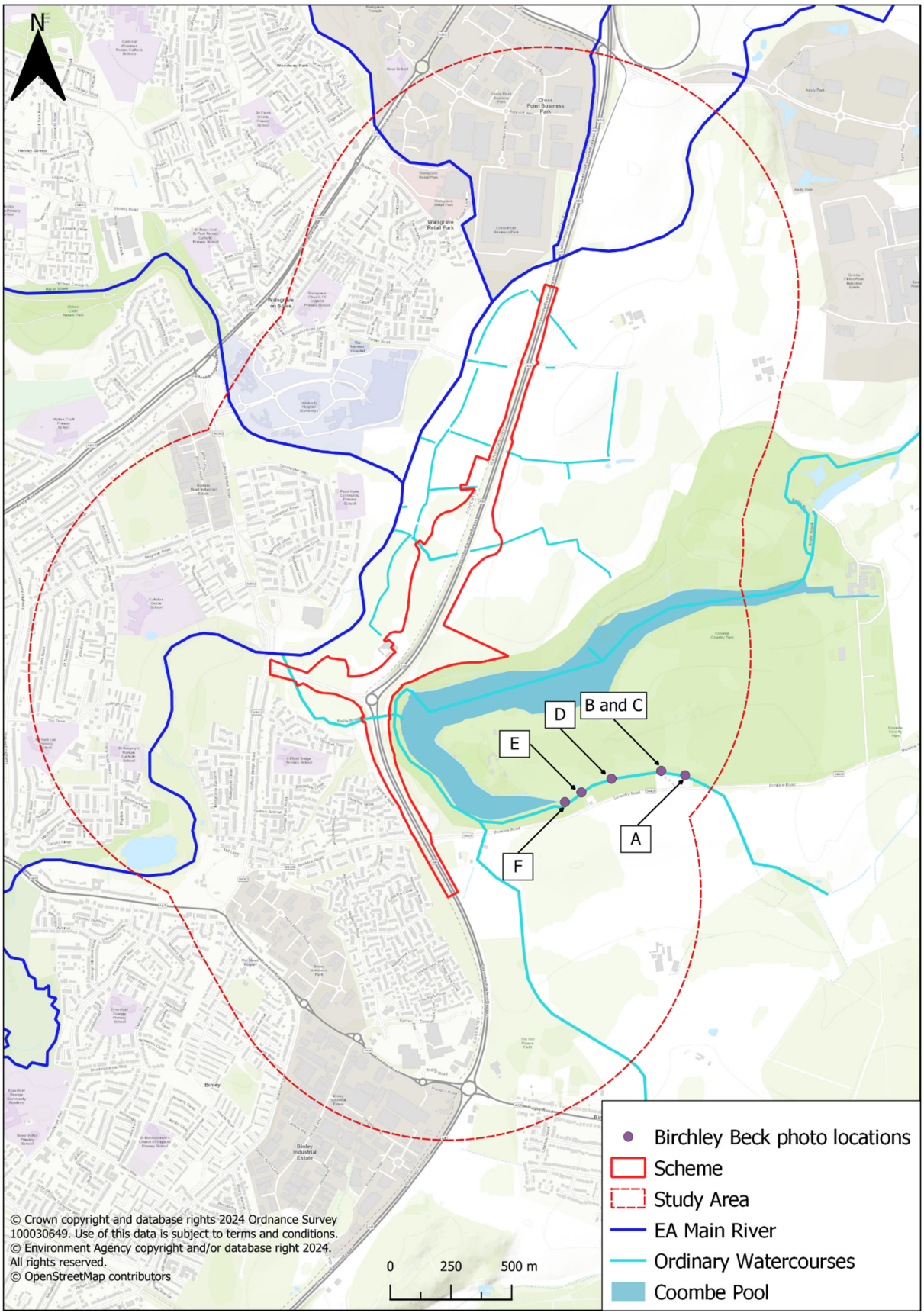


Figure 5-11 Photographs along Birchley Beck

5.2. Summary of potential destabilising phenomena

5.2.1. The desk study and baseline walkover assessed whether there were instances of potential destabilising phenomena (PDP) for Coombe Pool, the River Sowe, Smite Brook, Withy Brook and Birchley Beck and its tributaries.

Coombe Pool

5.2.2. Coombe Pool is fed by Smite Brook, outside of the study area. The morphology of Coombe Pool is defined by the work of Capability Brown and is surrounded by an open park to the east used for grazing and forests and vegetation surrounding the banks. There was no identifiable instances of bank erosion or instabilities from the walkover and desk study and no instances of sedimentation or changes in sediment supply. Coombe Pool is heavily modified providing connectivity with Smite Brook to the west via spillways and sluice gates. There was evidence of Canada Geese grazing the parks during site walkovers which has the potential to consume vegetation which are vital for fish populations and protecting the land from erosion. There were no indications of PDP during the baseline desk study and walkover.

River Sowe

5.2.3. The River Sowe and its wider tributaries across the catchment are surrounded by arable farmland to the east and urban areas to the west. There were areas of PDP where incision and undercutting of the bank was apparent during the site walkover. There was no evidence of changes to sediment supply during the desk study or site walkover. ES Chapter 8 (Biodiversity) (**TR010066/APP/6.1**) identified fish including brown trout *Salmo trutta*, bullhead *Cottus gobio* and European eel *Anguilla anguilla* in the River Sowe. PDP pressures upon hydromorphological processes are in the form of channel modification and bio geomorphology.

Smite Brook

5.2.4. Smite Brook originates northeast of the study area, flowing southwest through Coombe Pool, beneath the A46 and B4082 before its confluence with the River Sowe. During the desk study and site walkover there were instances of bank modification through incision and erosion as well as impacts from naturally formed steps due to overhanging and fallen vegetation. PDP identified by the site walkover and desk study indicated bank erosion and channel modification by overhanging vegetation and natural channel modification from fallen trees as the main risks to hydromorphological processes, for Smite Brook.

Withy Brook

5.2.5. Withy Brook originates north of the study area flowing through arable farmland before its confluence with the River Sowe. The desk study and site walkover identified the Withy Brook as having heavily vegetated banks and in-channel vegetation throughout the watercourse. This is identified as the most prominent PDP to the hydromorphological processes for the Withy Brook.

Birchley Beck and its unnamed tributary

5.2.6. Birchley Beck originates southeast of the study area flowing northwest to the study area. The two rivers are surrounding by arable farmland and pass through a series of culverts before their confluence. The PDP of Birchley Beck and its unnamed tributary identified in the desk study and site walkover including indications of bank erosion and heavy vegetation in-channel and on the banks. This would influence the hydromorphological process of the rivers through sediment trapping from fallen trees and in-channel vegetation.

6. Impacts of the Scheme

6.1.1. The activities associated with the Scheme, during construction and operation, have the potential to impact on the hydromorphology of local. The Scheme design proposes the installation of a temporary culvert along an ephemeral field drain which feeds into the River Sowe and two new outfalls, discharging runoff from catchment 5 to a tributary of the River Sowe (identified as watercourse 2) and from catchment 6 to a new ditch which connects to a tributary of the River Sowe (identified as watercourse 1). The Scheme also has the potential to increase total volume of road runoff due to the increase in hardstanding.

6.2. Summary of PDP from the Scheme

6.2.1. PDP were identified along Coombe Pool, Withy Brook and Birchley Beck and its tributary; however, the Scheme will not have an impact upon the identified PDP for these receptors. This is due to the water bodies not being at risk of changes to sediment supply, hydrology, channel and floodplain modification and bio geomorphology. New activities such as the temporary culvert on watercourse 2 and the two new outfalls to tributaries of the River Sowe have the potential to increase sediment supply and negatively impact the hydrology of the River and its tributaries. The PDP of the River Sowe (Figure 6-1) and Smite Brook (Figure 6-2) have been summarised below.

Figure 6-1 PDP along the River Sowe and its tributaries

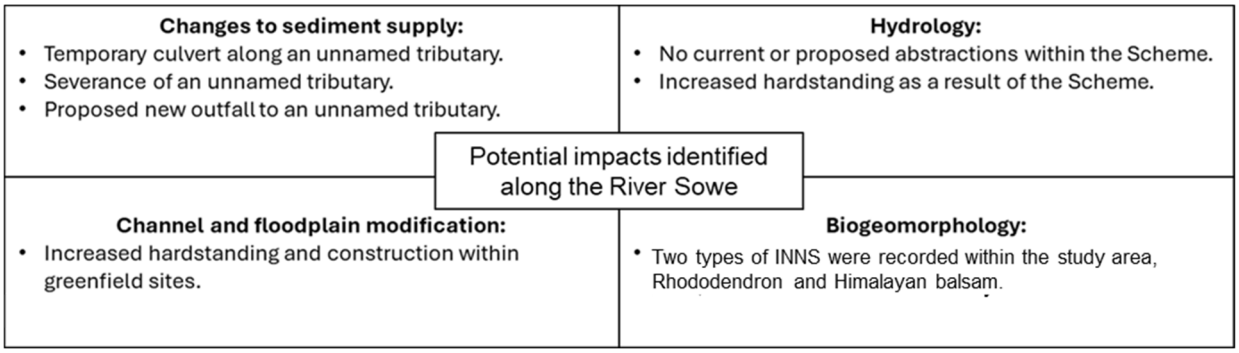
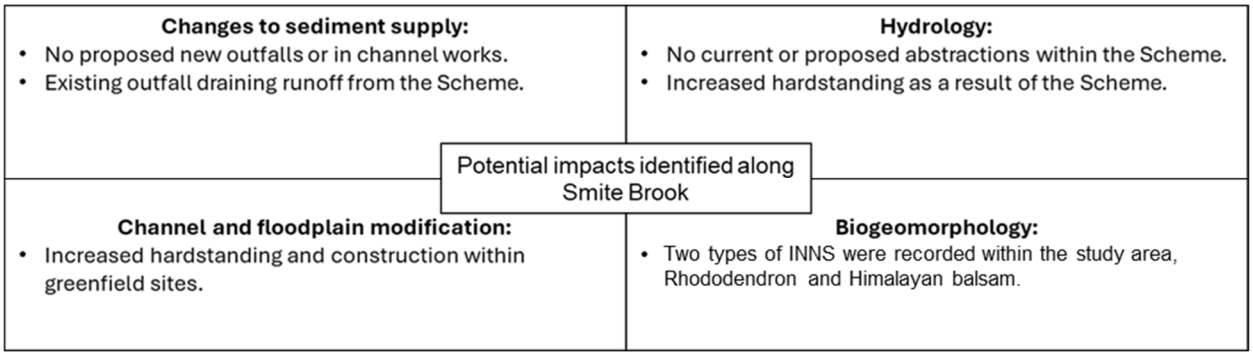


Figure 6-2 PDP along Smite Brook



Existing outfalls

6.2.2. The Scheme proposes the use of five existing outfalls discharging runoff from across the Scheme to Smite Brook and watercourse 1. There are no structural changes proposed to the existing outfalls. The locations of these and the catchments they drain can be found ES Appendix 13.3 (Water Quality Assessment) (**TR010066/APP/6.3**).

6.2.3. An assessment of pollution impacts from routine runoff to surface waters was undertaken using HEWRAT. This assessment establishes potential impacts of pollutants (including fine sediment) in routine highway runoff for the Scheme upon surrounding water bodies and the requirement for mitigation measures to adequately reduce the risk.

6.2.4. The outfalls within drainage catchment areas 1-4 set out in ES Appendix 13.3: (Water Quality Assessment) (**TR010066/APP/6.3**) all passed the HEWRAT assessment; therefore, no mitigation was required for these catchment areas.

6.2.5. The outfalls within drainage catchments area 5 and 6 set out in ES Appendix 13.3 (Water Quality Assessment) (**TR010066/APP/6.3**) initially failed step 2 (pre mitigation) due to fine sediment. Additional mitigation has been incorporated into the Scheme design (i.e. the inclusion of a ponds and ditches) as part of step 3 and this outfall passed the HEWRAT assessments for soluble pollutants and sediment bound pollutants. Due to this, no significant impacts relating to additional sediment inputs or sediment quality are anticipated as a result of the inclusion of this mitigation.

6.2.6. The accidental spillages assessment (detailed in ES Appendix 13.3 (Water Quality Assessment) (**TR010066/APP/6.3**)) indicates that the risk of serious pollution incidents is considerably less than the annual acceptable threshold of 0.5%. All catchment areas passed the accidental spillages assessment and therefore no mitigation is required. The increase from the baseline assessment is minimal.

6.2.7. There will be a minimal impact upon local hydrology via the existing outfalls and there is no expected channel change as a result of the scheme. The existing outfalls will have a minimal impact upon the identified PDP. There were no instances of existing channel instability from the outfalls. It is unlikely that the additional flow through these existing outfalls would cause a water body scale impact.

New outfalls

6.2.8. The Scheme proposes installation of two new outfalls, discharging runoff from catchment 5 to a tributary of the River Sowe (identified as watercourse 2) and

from catchment 6 to a ditch which connects to a tributary of the River Sowe (identified as watercourse 1).

6.2.9. The construction of the proposed outfalls would ensure that the outfall structure is set back from the channel bank and bed to minimise the impact on flow and sediment conveyance. Outfall design should comply with the guidance set out in CIRIA's Culvert, Screen, and Outfall Manual (Benn et al., 2019). Subject to a scour assessment, scour protection would be included into the design if necessary to minimise the risk of bed and bank erosion. The extent of the scour protection will be minimised as far as practicable to reduce the impact on natural processes. This will be confirmed at detail design stage. This is not anticipated to have a significant water body scale impact to any hydromorphology receptors.

Temporary culvert

6.2.10. A temporary culvert (which will be in place during construction only) has been proposed on an unnamed ephemeral tributary (an ordinary watercourse) of the River Sowe (identified as watercourse 2). In order to install the temporary culvert within watercourse 2, works will be required within the watercourse. The temporary culvert has the potential to affect the hydromorphological features of the watercourse. This can cause channel instabilities and incision of the watercourse as well as causing sedimentation upstream of the culvert. Increased flow throttling at the point of the culvert has the potential to increase the erosion of the channel bed and bank.

6.2.11. The temporary culvert would be designed to minimise impacts on hydromorphology receptors and ensure there is no loss of habitat or biodiversity. To minimise hydromorphological impacts upon the watercourse, the culvert design, and associated watercourse diversion where it ties into the existing watercourse, would maintain existing flow and as far as practical sediment conveyance. Best practice construction measures, including undertaking the works when there is no flow in the ephemeral watercourse, alternatively should this not be possible then in-river sediment controls should be used during the construction of the temporary culvert. The works should be undertaken during no to low flow periods to minimise sediment transport. The development of the construction programme at detailed design will minimise the length of time which this culvert is required, ideally it will be in place only during the summer months, when no, to low flows are expected in the ephemeral watercourse.

Road works in proximity to watercourses

6.2.12. The Scheme proposes the permanent severance and partial infilling of a 150m section of an ordinary watercourse (identified as watercourse 1), west of the Scheme which discharges to the River Sowe. The severing and partial infilling of

watercourse 1 will take place at the head of the ditch, which has no upstream connection and only takes field and highway runoff. The downstream connection will remain, and a new outfall will be constructed along watercourse. The Scheme also proposes the severance, partial infilling and realignment of 125m of an ordinary watercourse east of the Scheme (identified as watercourse 3). At the point of severance and partial infilling the watercourse currently connects to filter drains that run parallel to the existing A46. The proposed drainage will follow the same approach and the severed watercourse 3 will be redirected and connect to filter drains around the edge of the Scheme. This will then feed into the Scheme drainage. The proposed severance of and realignment of watercourse 3 and partial infilling of watercourse 1 are required due to the increase in Scheme footprint caused by the extension of the B4082 northbound and the proposed dumbbell roundabout system.

6.2.13. During construction, the proposed extension of the B4082 and the dumbbell roundabout will require partial infilling of watercourse 1 and 3, and redirection of watercourse 3, connecting it to pre-earthworks drainage (PED). This would then discharge to watercourse 1. Construction over and within this drainage channel has the potential to increase sedimentation and contamination of downstream receptors such as the River Sowe. Watercourses 1 and 3 are an ephemeral field drainage channels and therefore is expected to have a minimal impact on morphology and quality of flow to the River Sowe. Construction works will follow the Guidance for Pollution Prevention (GPP) 5 guidelines (NetRegs, 2018).

6.2.14. During operation of the Scheme, minor changes to the overland flow route associated with watercourses 1 and 3 will occur. This has the potential to alter the channel bank and riparian zone downstream of the area proposed for partial infilling. However, as both watercourses 1 and 3 are ephemeral field drainage channels, and overland flow being managed through the realignment of watercourse 3 into the existing drainage network and proposed drainage, impacts upon morphology and quality of flow to the River Sowe will be negligible.

6.2.15. The Scheme also proposes the realignment of the A46 which will cause the modification of parts of the A46 southbound embankment to the east of the Scheme. SuDS would be implemented as part of the temporary works drainage strategy during construction. This would capture sediment runoff and mitigate the hydromorphological impacts to the watercourse. This measure in line with GPP 5 should ensure sediment from the realignment of the A46 southbound embankment is not discharged directly to nearby watercourses.

7. Conclusion

7.1.1. The A46 Walsgrave Junction is located approximately 5km to the east of Coventry city centre. The study area contains areas of hydromorphological importance which has the potential to be impacted as a result of the Scheme.

7.1.2. This assessment considers the potential impact of the Scheme to the following watercourses identified in the study area; Coombe Pool, River Sowe, Withy Brook, Smite Brook and Birchley Beck and its unnamed tributary.

7.1.3. Following the desk study and walkover survey Coombe Pool, Withy Brook and Birchley Beck and its unnamed tributary are not considered to be at risk from the Scheme. This is due to there being no pathways for runoff to these water bodies as runoff will be discharged to the River Sowe and Smite Brook.

7.1.4. The impact assessment has considered the potential impacts to hydromorphological features which are primarily due to the increased surface water runoff and sediment runoff which has the potential to cause channel instability along the River Sowe and Smite Brook.

7.1.5. The assessment concluded that subject to mitigation identified there are no significant water body scale impacts anticipated to hydromorphological receptors. The Scheme design proposes the implementation of attenuation basins, a pond, a temporary culvert and a new outfall discharging to Smite Brook and two watercourses. In addition to this, the Scheme aims to modify the A46 southbound embankment to shallow the bend of the A46.

7.1.6. It is acknowledged that there are a range of existing PDP’s that are influencing the water bodies such as hydrology, changes to sediment supply, biogeomorphology and channel and floodplain modification.

7.1.7. However, with the mitigation measures in place the Scheme is not anticipated to lead to hydromorphological change. Due to this, it is considered a detailed assessment is not required.

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