Greater Cambridge Partnership

CAMBOURNE TO CAMBRIDGE

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WSP

62-64 Hills Road
Cambridge
CB2 1LA

Phone: +44 1223 558 050

WSP.com

CONTENTS

TABLES

FIGURES

1 INTRODUCTION AND SUMMARY

1.1 INTRODUCTION

1.1.1.1 The Cambourne to Cambridge (C2C) Scheme will include a 13.6km long mainly dedicated busway connecting Cambourne in the west with Cambridge in the east. A service road and maintenance track, to be used as an active travel path, will run alongside the segregated sections of busway. The C2C Scheme will use hybrid vehicles (and in due course, electric vehicles), providing a service of around 10 buses per hour each way. The Scotland Farm travel hub (a park and ride facility) will be situated along the route, just north of the A428, approximately 5km west of Cambridge. Further details about the Scheme proposal are set out in Chapter 3 of the ES[1].

1.1.1.2 This Technical Report sets out the assessment of likely significant effects on the water environment as result of the C2C Scheme. This report is intended to be read alongside its two technical appendices:

- Appendix TR13.1: Flood Risk Assessment
- Appendix TR13.2: Water Framework Directive Screening and Scoping Assessment

1.2 CONSULTATION

1.2.1.1 **Table TR13-1-**1 details the scoping opinion responses received and provides updated comments in relation to this Technical Report.

Table TR13-1-1 – Summary of Scoping Opinion Responses

Scoping Opinion Response	Comment
The Environment Agency advise that the Bin Brook is identified as a Water Framework Directive ("WFD") waterbody. The Environment Agency advise that a proposed new bridge structure over Bin Brook could increase shading and potential damage and deterioration of aquatic habitats. The Environment Agency recommends that the Water Framework Direction information is used to assess the impact on its current WFD status alongside biodiversity impacts as part of the Environmental Assessment.	A WFD Screening and scoping assessment has been undertaken (refer to Appendix TR13.2).
The Environment Agency highlight that while the proposed C2C Scheme does not include areas within a groundwater Source Protection Zone, it does include areas designated to have 'high', 'medium – high' and 'medium' groundwater vulnerability associated with underlying Principal and Secondary Aquifers. The proposed C2C Scheme route is	The surface water drainage strategy has been designed in accordance with the SUDS Manual and SUDS Indices approach has been undertaken to demonstrate sufficient pollution control measures are in place.

[1] Environmental statement (Document reference: C2C-10-00-Environmental statement (Volume 1)).

Scoping Opinion Response	Comment
therefore vulnerable to pollution since contaminants from the development may enter and pollute underlying aquifers and in turn impact surface water bodies. Due consideration should be given to the impacts that the C2C Scheme may have upon controlled waters receptors during both construction and operational phases.	
The Environment Agency highlight that a number of water dependent protected nature conservation sites have been identified as failing condition due to elevated nutrient levels and nutrient neutrality is consequently required to enable development to proceed without causing further damage to these sites. The ES needs to take account of any strategic solutions for nutrient neutrality or Diffuse Water Pollution Plans, which may be being developed or implemented to mitigate and address the impacts of elevated nutrient levels.	The C2C scheme has very low traffic rates, with hybrid vehicles assumed (and electric vehicles likely) and as such will not have a significant impact on the local air and water quality as a result of the scheme. Natural England's neutrality requirements are in relation to schemes including overnight accommodation and as such not deemed to be relevant to the C2C scheme. The surface water drainage system has been designed in accordance with best practice and incorporate SUDS which will help to treat and disperse any pollutants from the surface water drainage system. The water dependant conservation sites (assumed to be the SSSIs) are not hydraulically connected to the surface water receptors within the study area.
The Secretary of State notes that the Environment Agency set out that due consideration should be given to the impacts that the C2C Scheme may have upon controlled waters receptors during both construction and operational phases.	This has been included in scope of the assessment. It should be noted that the project will commit to use of all necessary best practice measures to minimise this risk such that a significant effect will not occur.
The Environment Agency highlight that where applicable the risks associated with piling/ground improvement and infiltration drainage should be included within this scheme. Piling, other ground improvement methods and infiltration drainage could have an adverse impact on the groundwater quality within the aquifers beneath the scheme site or provide preferential pathways for contaminant migration to the aquifers during construction and after the completion of the development.	Piling works are expected to be limited. If at detailed design it is deemed to be required a piling works risk assessment will undertaken.
The Environment Agency support the use of sustainable drainage systems (SuDS) for surface water management where they do not present a risk to controlled waters. Infiltration SuDS need to meet the criteria in our Groundwater Protection Position Statements G1 and G9 to G13, however, and must not be constructed in contaminated ground where they could cause the	The surface water drainage strategy has been designed in accordance with the SUDS Manual and SUDS Indices approach has been undertaken to demonstrate sufficient pollution control measures are in place.

Scoping Opinion Response	Comment
remobilisation of contaminants into controlled waters receptors. We would expect any SuDS to have mitigation measures in place to allow for treatment of and reduction in contaminant levels in the surface water run-off. SuDS should be constructed in line with good practice and guidance documents which include the SuDS Manual (CIRIA C753).	
Advice from the Lead Local Flood Authority (LLFA) should be sought for comments on other aspects of the surface water drainage scheme.	Consultation with the LLFA has been during the design process.
Aquifer dewatering is also not mentioned and should also be addressed if it is likely to be required. Early discussion of requirements is recommended for all potential groundwater abstraction permissions for dewatering. Due consideration should be given to the potential impacts of any aquifer dewatering of excavations during the construction phase of the development. There are requirements to identify at-risk water users and features, to assess the impact of dewatering upon these, and to determine any monitoring and/or compensation measures that might be required for their protection. The implications of dewatering in proximity to contaminated sites should also be considered. Please note that since 1 January 2018 most cases of new dewatering operations above 20 cubic metres a day will require a water abstraction licence from the Environment Agency prior to the commencement of dewatering activities. If applicable, these issues should be considered within the scope of a hydrogeological impact assessment.	Aquifer dewatering is not required as part of the Proposed Scheme.
We agree that a Flood Risk Assessment should accompany the scheme to assess the impact of the scheme on the flood zones associated with the Bin Brook. You will need to ensure climate change is assessed as part of this following the advice at Flood risk assessments: climate change allowances - GOV.UK.	The most up to date climate change allowances have been used in the assessment as detailed in the Flood Risk Assessment (refer to Appendix TR13.1: Flood Risk Assessment).

1.2.3.1 Consultation with the Environment Agency has been undertaken via email correspondence in regard to the design soffit level for the Bin Brook crossing and the results of the hydraulic modelling to support Appendix TR13.1: Flood Risk Assessment. The design soffit level for the Bin Brook crossing was agreed to be set at the 1% Annual Exceedance Probability (AEP) with 19% climate change plus a 300mm freeboard. A technical memo was produced which summarised the hydraulic modelling and the results indicating a slight increase in peak flood level. The memo also outlined the approach to deal with the slight increase in flood levels located just upstream of the new structure on Bin Brook; this approach involves seeking agreement with the local landowner. This is summarised in more detail in Section 5 of Appendix TR13.1: Flood Risk Assessment.

1.2.3.2 Consultation with the Environment Agency has also been undertaken in regard to the Stage 1 and 2 WFD assessment. An online meeting was held in January 2023 to discuss the methodology, results and mitigation of the Stage 1 and 2 WFD assessment. The Environment Agency confirmed that they agree with the findings of the WFDa Stage 1 and 2 report and that this should be submitted as part of the planning submission with the Stage 3 assessment included within the subsequent Flood Risk Activities Permit (FRAP) application as part of the detailed design stage.

1.3 ASSESSMENT METHODOLOGY

1.3.1.1 The methodology adopted for the assessment of impacts of the C2C Scheme on the water environment is based on the principles set out in the methodology outlined within LA 113 – Road drainage and the water environment **(National Highways, 2020)**. The assessment of potential effects as a result of the C2C Scheme has considered both construction and operation activities and characteristics of the C2C Scheme.

1.3.1.2 As presented in the **C2C ES Scoping Opinion** the following topics have been assessed for both the construction and operation phases of C2C:

- The chemical and hydromorphological status of surface water features such as watercourses and ponds. This has been assessed in the standalone **Appendix TR13.2: Water Framework Directive Screening and Scoping Assessment**. This will also be supported by a full Water Framework Directive (WFD) Assessment during the detailed design stage.
- Flood risk to the C2C Scheme and elsewhere as a result of the C2C Scheme. This has been assessed in the standalone **Appendix TR13.1: Flood Risk Assessment**.

1.3.2 METHOD OF BASELINE COLLECTION

1.3.2.1 The baseline data used to inform this Technical Report, as well as the related Flood Risk Assessment and WFD Screening and Scoping Assessment were sourced from the data sources listed below, as well as by site walkovers of the C2C route conducted in July 2021 and January 2022. The data sources include:

- Environment Agency's online Flood Map for Planning (Environment Agency, 2023)
- Environment Agency's online Long Term Flood Risk Map (Environment Agency, 2023)
- Environment Agency's groundwater data available on MAGIC online mapping (Department for Environment, Food and Rural Affairs, 2023)
- Environment Agency's Catchment Data Explorer (Environment Agency, 2022)
- British Geological Survey (BGS) Geology of Britain viewer (British Geological Survey, 2023)
- Cranfield University's Soilscapes (Cranfield Soil and Agrifood Institute , 2023)

1.3.3 FLOOD RISK ASSESSMENT

1.3.3.1 Full details of the assessment methodology is outlined in the standalone **Appendix TR13.1: Flood Risk Assessment.** The Flood Risk Assessment was supported by a 1D-2D hydraulic model incorporating the local channel and other structures using Flood Modeller Pro and the 2D model aspects of the area surrounding the Bin Brook proposed crossing with TUFLOW. The Flood Risk Assessment considered the impact of climate change on the C2C Scheme in relation to the Bin Brook Crossing.

1.3.4 WATER FRAMEWORK DIRECTIVE ASSESSMENT

1.3.4.1 The assessment methodology adopted by the assessment is based on the most suitable guidance provided by the Planning Inspectorate Advice Note 18: The Water Framework Directive **(The Planning Inspectorate, 2017)**. The guidance outlines a three-stage process for WFD assessment: screening, scoping, and impact assessment. The WFD assessment comprises Stage 1 – Screening and Stage 2 – Scoping only. The Environmnent Agency have agreed that a Stage 3: Impact Assessment will accompany the FRAP application during the detailed design stage. The assessment methodology (and any necessary mitigation) has been agreed upon with the Environment Agency as the competent authority for the implementation of the WFD through consultation. More detail regarding the assessment methodlogy is outlined in the standalone **Appendix TR13.2: Water Framework Directive Screening and Scoping Assessment.**

1.4 FUTURE BASELINE

1.4.1.1 The most likely change in the baseline conditions, as outlined in **Chapter 5: The environment along the route** of the ES, in the future would be associated with an increase in peak river flows and peak rainfall intensity associated with the potential effects of climate change. The Environment Agency provide guidance **(Environment Agency, 2022)** on a range of potential climate change allowances dependant on the relevant river basin district and climate change probability.

1.4.1.2 The C2C Scheme is mainly located within the Cam and Ely Ouse Catchment. In this region it is predicted that by 2115 peak river flows could increase by 19%, the higher central allowance which is used for essential infrastructure schemes such as the C2C Scheme. This may increase the frequency of flood risk to identified receptors and increase the extent of Flood Zones 2 and 3, resulting in a greater area of the C2C Scheme being at risk of fluvial flooding.

1.4.1.3 The peak rainfall intensity may also increase as a result of climate change, which could potentially increase the risk of surface water flooding to the C2C Scheme. The Environment Agency provides guidance **(Environment Agency, 2022)** on the central and upper end allowances on a catchment basis. The total potential change anticipated is a 35% increase in the 3.33% AEP rainfall event and a 40% increase in the 1% AEP rainfall events. These are to be used to inform the drainage design for the assessment of surface water risk to the C2C scheme and third parties, including the crossings of the small watercourses (i.e. those with a catchment smaller than 5km2).

1.4.1.4 Increases in peak rivers flows and peak rainfall intensity have been taken into account in the assessment of flood risk as discussed within the Appendix TR13.1: Flood Risk Assessment. Technical Report 3: Climate Resilience also outlines the climate change considerations associated with the water environment.

1.5 STUDY AREA

1.5.1.1 The Study Area encompasses surface water features up to 1km from the Order Limits. Based on professional judgement using knowledge and experience of similar schemes and current knowledge of the area this distance is considered appropriate for the assessment of direct effects (i.e. associated with overland migration of pollutants directly to surface features, pollutants conveyed in drainage systems, and works within a river channel).

1.5.1.2 Surface water features that have hydraulic connectivity with the C2C Scheme have also been assessed. These include watercourses and other water environment receptors that are located downstream of the C2C Scheme, and that could be affected by pollutants conveyed by watercourses.

1.5.1.3 The Study Area encompasses groundwater features and groundwater abstractions up to 1km from the Order Limits. This distance is appropriate for the assessment of surface borne pollutants migrating to groundwater features as there are unlikely to be any significant impacts beyond this distance due to underlying geology and the majority of the underlying soils being slowly permeable, rich loamy and clayey.

1.5.1.4 The Study Area for the assessment of flood risk has been defined by the extent by which flood risk may be influenced and the extent of the relevant Flood Zones. This is driven by the need to consider the impact of the C2C Scheme upon people and property elsewhere, regardless of their location.

2 BASELINE ENVIRONMENT

2.1 EXISTING SURFACE WATER FEATURES

2.1.1.1 The watercourses and water environment receptors located within the Study Area are summarised in **Table TR13-2-**1 and the watercourses listed are shown in Plate TR13-2-1 below. The importance of the water environment receptors is assessed on a scale of Low, Medium, High and Very High. The importance has been assessed using the guidance in Table 3.70 in LA 113 – Road drainage and the water environment **(National Highways, 2020)**. The significance of identified effects has been assessed based on the magnitude of change due to the C2C Scheme and the importance of the affected receptor.

Table TR13-2-1 – Water Environment Receptor Summary

Receptor	Location and Description	Importance
Bin Brook	The Bin Brook flows in a broadly west to east direction, starting approximately 750m east of Hardwick. Bin Brook flows beneath Gough Way and the footpath to the south of Herschel Road within the Study Area. The Bin Brook discharges into the River Cam approximately 3.4km downstream. The Bin Brook is classified as a main river. The C2C Scheme crosses the Bin Brook with a proposed bridge, just south of Herschel Road towards the eastern end of the scheme. There are approximately 15 tributaries of the Bin Brook flowing predominantly in a north to south direction. These are mainly land drains flowing along the borders of agricultural fields. There are two tributaries that flow through the Order Limits, one to the west of Long Road and one to the east of Long Road. Classified as having 'Moderate' ecological value, being heavily modified and having a failing chemical value under WFD.	Medium
River Cam	The River Cam flows from south to north and is located approximately 1km to the east of the C2C Scheme. It is also classified as a main river. Classified as having 'Moderate' ecological value, being heavily modified and having a failing chemical value under WFD.	Medium
Callow Brook	The Callow Brook flows from south to north, starting just south of the A428 in the village of Hardwick. The watercourse is culverted under the A428 and St Neots Road and flows adjacent to Scotland Road. The Callow Brook is classified as an ordinary watercourse. Located in a catchment with 'moderate' ecological status and having a failing chemical value under WFD.	Medium
Land drains and unnamed watercourses	There are a number of unnamed tributaries and land drains located throughout the Study Area. They are all classified as ordinary watercourses.	Low

Receptor	Location and Description	Importance
West Cambridge Canal	West Cambridge Canal is located to the south of Charles Babbage Road. It is largely an aesthetic feature with the flows controlled by a penstock. The canal also interacts with Cambridge University's surface water drainage system.	Low
Floodplain of the Bin Brook and River Cam	The majority of the C2C Scheme is located in the low-risk Flood Zone 1. However, the C2C Scheme does include areas located in the high-risk Flood Zone 3 associated with the Bin Brook.	Medium
Groundwater resources	Small areas of principle aquifers. Ely Ouse Woburn Sands WFD groundwater body identified as being in poor chemical condition and good quantity condition.	Low
Flood Risk Receptors	Surrounding rural agricultural land	Low
	Surrounding semi urban land, including residential properties.	High
	The C2C Scheme (classified as essential infrastructure in accordance with NPPF, as it would provide an important transport link that should remain operational in times of flooding)	High

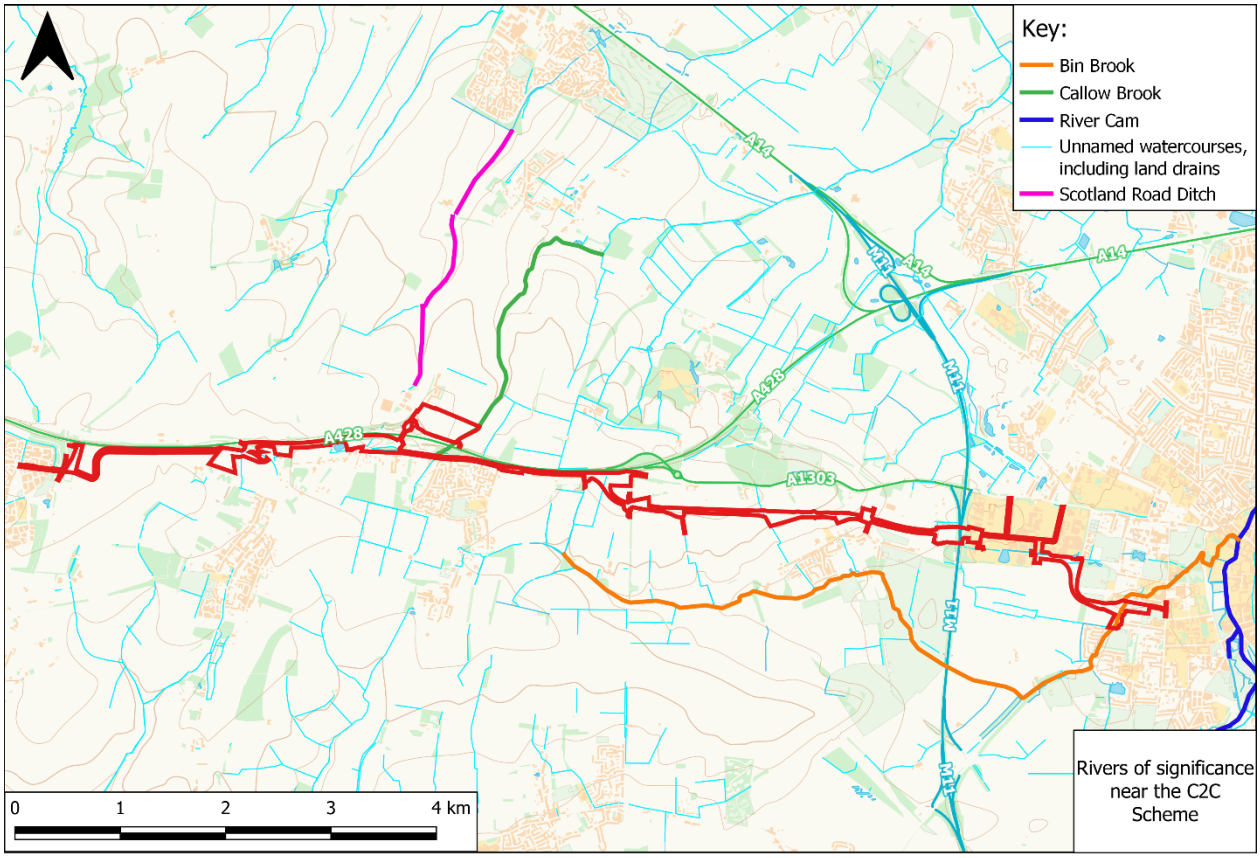

Plate TR13-2-1 – Watercourses located in Study Area

2.2 GEOLOGY AND HYDROGEOLOGY

2.2.1.1 A review of the British Geological Survey (BGS) 1:50,000 data indicates that the western most point of the C2C Scheme is primarily underlain by unproductive strata with small areas of principal aquifers. The C2C Scheme is located within the Cam and Ely Ouse Woburn Sands WFD groundwater body. The groundwater body is identified as being in poor chemical condition and good quantity condition. The poor chemical condition is attributed to diffuse pollution, mainly from agriculture.

2.2.1.2 A review of BGS 1:50,000 superficial deposit data indicates that superficial deposits across the C2C Scheme are predominantly classified as a Secondary (Undifferentiated) aquifer.

2.3 FLOOD RISK

2.3.1.1 A review of the Environment Agency's Flood Map for Planning (Rivers and Sea) indicates that the majority of the C2C Scheme is located in the low-risk Flood Zone 1. However, parts of the C2C Scheme along Bin Brook are located in the high-risk Flood Zone 3. The fluvial flood risk is associated with the Bin Brook.

2.3.1.2 A review of the Environment Agency's Flood Risk from Surface Water Map indicates that the majority of the C2C Scheme is assessed to be at low risk of surface water flooding. Several sections of the C2C Scheme are assessed to be at a high and medium risk of surface water flooding. These areas are located along Callow Brook, east of Cambridge Road and near the C2C Scheme's crossing of Bin Brook. The C2C Scheme predominantly runs along a ridgeline, limiting the possibility of surface water occurring in large volumes that would cause risk to the site. More detailed information regarding the local flood risk is in **Appendix TR13.1: Flood Risk Assessment.**

2.4 WATER FRAMEWORK DIRECTIVE

2.4.1.1 Bin Brook is directly monitored against the objectives of the WFD and is located within the Bin Brook surface water body (GB105033042680) WFD catchment. Review of the Environment Agency's Catchment Data Explorer indicates that the ecological quality is assessed as 'Moderate' and the chemical quality is assessed as 'Fail'. The catchment has been assessed as having a hydromorphological designation of 'heavily modified'.

2.4.1.2 The section of Callow Brook located within the Order Limits is not monitored directly against the objectives of the WFD but is located within the Old West River surface water body (GB205033043375) WFD catchment. Approximately 2.3km downstream of the C2C Scheme, Callow Brook is monitored directly against the objectives of the WFD. Review of the Environment Agency's Catchment Data Explorer indicates that the ecological quality is assessed as 'Moderate' and the chemical quality is assessed as 'Fail'. The catchment has been assessed as having a hydromorphological designation of heavily modified'.

3 ASSUMPTIONS AND EMBEDDED MITIGATION

3.1.1.1 This assessment is based on the design at Design Freeze 4 of the proposed surface water drainage system and watercourse crossings. It is likely that the design will change during the detailed design stage, although it is anticipated that the changes are not likely to be significant. Additional mitigation measures such as riparian planting may be identified as a result of the detailed Water Framework Directive Assessment, this would be undertaken at the detailed design stage of the C2C Scheme. Where these changes are outside of the assessment parameters detailed in the Flood Risk Assessment, additional assessment may be required.

3.1.2 CONSTRUCTION

3.1.2.1 A Code of Construction Practice2 (CoCP) has been produced and accompanies the Transport and Works Act Order application. It sets out the mitigation measures which will be used to limit potentially adverse environmental impacts during construction, such as sedimentation, pollution risks, works within watercourses and flood risk during construction. The CoCP also sets out how construction activities would be undertaken in accordance with appropriate good practice guidance, such as CIRIA's C532: Control of water pollution from construction sites **(CIRIA, 2001)** and Guidance for Pollution Prevention (GPP) including GPP1: A General Guide to Preventing Pollution **(Natural Resources Wales, Northern Ireland Environment Agency and Scottish Environment Protection Agency, 2021)** and GPP5: Works and maintenance in or near water **(Natural Resources Wales, Northern Ireland Environment Agency and Scottish Environment Protection Agency, 2018)**.

3.1.3 DESIGN AND OPERATION

3.1.3.1 Bin Brook Crossing

3.1.3.2 The Bin Brook crossing consists of a clear span bridge structure to accommodate the busway as part of the HQPT. This will bridge the watercourse just upstream of Herschel Road. This work will also include the removal of an existing farm access / footbridge at the same location. The details of the modelled bridge design are summarised in **Table TR13-3-**1 below. The standalone Flood Risk Assessment also details the sensitivity testing undertaken in **Appendix TR13.1: Flood Risk Assessment.**

Table TR13-3-1 – Proposed Bin Brook Structure

Structure Type	Span Length (m)	Required minimum soffit height (mAOD)
Clear span Bridge	10	9.67mAOD (defined as a 300mm freeboard above the peak water level for the 1% AEP event with a 19% climate change allowance)

[2] Code of Construction Practice (Document reference: C2C-26-00-Code of Construction Practice).

Structure Type	Span Length (m)	Required minimum soffit height (mAOD)
Bridge embankments	N/A	Maximum height of 9.67mAOD

3.1.3.3 Ordinary Watercourse Crossings

3.1.3.4 The C2C Scheme will include nine ordinary watercourses crossings. To ensure that these crossings do not lead to an increase in flood risk, the design of the scheme ensures that the 0.1% AEP flows can be conveyed (these flows are greater than the 1%+40% AEP flows in pipes through the scheme. The pipes have been sized based upon the following conservative principles:

- The pipes will be laid flat and not at a gradient;
- No allowances for headwater impacts;
- The 0.1% AEP peak flows have been used to size the crossings. As the 0.1% AEP peak flows are greater than the 1% AEP + 40% CC peak flows, therefore, the crossings are sufficiently sized to convey the flows, without the need for additional freeboard and
- It has assumed that the C2C Scheme will have a lifetime beyond 2100, and as the areas draining to each of the crossings is less than 5km^2 the upper end peak rainfall climate change allowance of 40% has been used.

3.1.3.5 Surface Water Drainage Strategy

3.1.3.6 A detailed description of the detailed surface drainage strategy is provided in **Annex TR13.1.4: Surface Water Drainage Strategy** of the **Appendix TR13.1: Flood Risk Assessment**. The strategy includes the following measures and assumptions:

- Surface water runoff will be conveyed within a network of swales, filter strips before discharging into detention basins/ponds;
- Where there is not sufficient space for swales and detention basins it is proposed to discharge to underground geocellular attenuation systems;
- No infiltration features are included within the drainage strategy and all attenuation features will be lined;
- The drainage strategy has been designed to accommodate the 3.33% AEP design flow, with a 100mm freeboard allowance;
- In the 1% AEP + 40% climate change design event some short-term flooding is expected, this will be managed by providing additional storage through oversized detention basins and ponds.
- The surface water drainage strategy includes filter strips, swales, detention basins and attenuation ponds. The Simple Index Approach (SIA) has been applied to the treatment train and provides sufficient mitigation.

4 ASSESSMENT OF IMPACTS AND EVALUATION OF EFFECTS

4.1 FLOOD RISK ASSESSMENT

4.1.1.1 A summary of the assessment and conclusions from the **Appendix TR13.1: Flood Risk Assessment** is provided below.

4.1.1.2 Hydraulic modelling of the Bin Brook crossing has indicated its minimal impact on the flood risk, showing minimal change in predicted flood extents for the 1% AEP event with 19% climate change allowance and showing increases of between 10 to 50mm in peak flood depth over an existing flood depth of approximately 900mm. The potential increase in risk is located within the proposed permanent land take for the C2C Scheme and within the Limits of Land to be Acquired or Used as set out in the Order, i.e., there is no change in risk to third parties. As the C2C Scheme in the area will be raised above the peak flood level it is considered that the scheme will be safe from flooding for its design life.

4.1.1.3 The small watercourse crossings have been sized using the 0.1% AEP peak flows, which is greater than the 1%AEP +40%CC peak flows, ensuring that the crossings are sufficiently sized for the lifetime of the C2C Scheme.

4.1.1.4 An increase in impermeable surfaces will not lead to an increase in surface water flood risk, with the implementation of the surface water strategy.

4.2 WATER FRAMEWORK DIRECTIVE SCREENING AND SCOPING ASSESSMENT

4.2.1.1 The assessment has concluded that two surface water bodies have the potential to be affected by the Proposed Scheme: the Bin Brook surface water body (GB105033042680) and the Old West River surface water body (GB205033043375). Among the WFD quality elements, it is considered that there are potential risks to both Ecological and Chemical Quality Elements.

4.2.1.2 A consultation meeting between WSP and the Environment Agency Technical Specialists was held in January 2023 to agree on the conclusions of **Appendix TR13.2: Water Framework Directive Screening and Scoping Assessment**. It was agreed with the Environment Agency that a Stage 3 detailed assessment would be required for the C2C Scheme prior to the commencement of works. The Stage 3 assessment will demonstrate that all potential impacts identified could be sufficiently mitigated by the C2C Scheme to demonstrate WFD compliance. The Environment Agency recommended that the Stage 3 assessment could be submitted as part of the FRAP application.

4.2.1.3 An assessment based on the current design / information and professional judgment is provided in Table TR13.2-3-7 of **Appendix TR13.2: Water Framework Directive Screening and Scoping Assessment**. According to this assessment, the mitigation measures are not expected to be impacted by the Proposed Scheme and, therefore, are not anticipated to be prevented from achieving "good ecological status" through those measures.

5 SUMMARY OF LIKELY SIGNIFICANT EFFECTS

5.1.1.1 The WFD screening and scoping assessment (**Appendix TR13.2: Water Framework Directive Screening and Scoping Assessment**) considered the potential impacts of the C2C Scheme on nine water bodies. The assessment concluded that two surface water bodies have the potential to be affected by the C2C Scheme; the Bin Brook surface water body (GB105033042680) and the Old West River surface water body (GB205033043375). Among the WFD quality elements, it is considered that there are potential risks to both Ecological and Chemical Quality Elements. However, the potential for impacts is dependent upon detailed design and construction methods. Considering this, it has been agreed with the Environment Agency that it is highly likely that these risks can be designed out or suitably mitigated during the detailed design phase. Therefore, further assessment and mitigation will be provided as part of a Stage 3: Impact Assessment to demonstrate WFD Compliance as part of the Flood Risk Activity Permit (FRAP) application.

5.1.1.2 The Bin Brook surface water body (GB105033042680) and the Old West River surface water body (GB205033043375) are Heavily Modified Water Bodies (HMWB). Information provided by the Environment Agency was used to assess if the Proposed Scheme had the potential to prevent the implementation of any HMWB mitigation measures and attainment of Good Ecological Potential. The results of this assessment indicate that the Proposed Scheme does not prevent the implementation of any HMWB mitigation measures and achievement of Good Ecological Potential. This will also be reviewed as part of the Stage 3 assessment during detailed design.

Table TR13-5-1 summarises the assessment of potential effects on the water environment receptors during the construction of the Proposed Scheme.

Table TR13-5-1 – Assessment of potential effects on water environment receptors during construction

Receptor	Importance	Potential Effects
Bin Brook and floodplain	Medium	Temporary increased sedimentation within Bin Brook could be caused by surface water runoff containing elevated levels of suspended particles that may result from land clearance, excavation, wheel washings, areas of bare earth, construction materials such as aggregate and stockpiles of topsoil substances associated with temporary works. Runoff with high sediment loads may potentially have direct adverse impacts on Bin Brook through increasing turbidity (thus reducing light penetration and reducing plant growth). The effects of increased sedimentation in construction runoff would reduce shortly after completion of the works when exposed areas of earth are resurfaced, reseeded or replanted. Increased pollution risks from spillage of fuels or other harmful substances associated with temporary works may migrate to Bin Brook. Hydrocarbons form a film on the surface of the water body and deplete oxygen levels. A common source of pollution is from leaks and spillages of hydrocarbons from mechanical plant or storage vessels. For the most part, it is only when large quantities of hazardous substances are spilled, or the spillage is directly into the river, that a significant risk of acute toxicity would arise.

Receptor	Importance	Potential Effects
		The mitigation measures detailed in the CoCP and further consultation with the Environment Agency during the development of the FRAP application would reduce the risk of increased sedimentation and potential effects to the Bin Brook. The sensitivity of Bin Brook is Medium and the magnitude of impact is Minor Adverse associated with the construction of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Slight effect (not significant) on Bin Brook.
River Cam and floodplain	Medium	As the River Cam is located approximately 1km to the east of the Proposed Scheme, the impacts associated with the construction of the Proposed Scheme are not likely. The sensitivity of the River Cam is Medium and the magnitude of impact is Negligible associated with the construction of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral effect (not significant) on the River Cam.
Callow Brook	Medium	Temporary increased sedimentation within Callow Brook could be caused by surface water runoff containing elevated levels of suspended particles that may result from land clearance, excavation, wheel washings, areas of bare earth, construction materials such as aggregate and stockpiles of topsoil substances associated with temporary works. Runoff with high sediment loads may potentially have direct adverse impacts on Callow Brook through increasing turbidity (thus reducing light penetration and reducing plant growth). The effects of increased sedimentation in construction runoff would reduce shortly after completion of the works when exposed areas of earth are resurfaced, reseeded or replanted. Increased pollution risks from spillage of fuels or other harmful substances associated with temporary works may migrate to Callow Brook. Hydrocarbons form a film on the surface of the water body and deplete oxygen levels. A common source of pollution is from leaks and spillages of hydrocarbons from mechanical plant or storage vessels. For the most part, it is only when large quantities of hazardous substances are spilled, or the spillage is directly into the river, that a significant risk of acute toxicity would arise. The mitigation measures detailed in the CoCP would reduce the risk of increased sedimentation and potential effects to Callow Brook. The sensitivity of Callow Brook is Medium and the magnitude of impact is Minor Adverse associated with the construction of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Slight effect (not significant) on Callow Brook.
Land drains and unnamed watercourses	Low	Temporary increased sedimentation within land drains and unnamed watercourses could be caused by surface water runoff containing elevated levels of suspended particles that may result from land clearance, excavation, wheel washings, areas of bare

Receptor	Importance	Potential Effects
		earth, construction materials such as aggregate and stockpiles of topsoil substances associated with temporary works. Runoff with high sediment loads may potentially have direct adverse impacts on land drains and unnamed watercourses through increasing turbidity (thus reducing light penetration and reducing plant growth). The effects of increased sedimentation in construction runoff would reduce shortly after completion of the works when exposed areas of earth are resurfaced, reseeded or replanted. Increased pollution risks from spillage of fuels or other harmful substances associated with temporary works may migrate to land drains and unnamed watercourses. Hydrocarbons form a film on the surface of the water body and deplete oxygen levels. A common source of pollution is from leaks and spillages of hydrocarbons from mechanical plant or storage vessels. For the most part, it is only when large quantities of hazardous substances are spilled, or the spillage is directly into the river, that a significant risk of acute toxicity would arise. The mitigation measures detailed in the CoCP would reduce the risk of increased sedimentation and potential effects to the land drains and unnamed watercourses. The sensitivity of the land drains and unnamed watercourses is Low and the magnitude of impact is Minor Adverse associated with the construction of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral to Slight effect (not significant) on the land drains and unnamed watercourses.
West Cambridge Canal	Low	Temporary increased sedimentation within the West Cambridge Canal could be caused by surface water runoff containing elevated levels of suspended particles that may result from land clearance, excavation, wheel washings, areas of bare earth, construction materials such as aggregate and stockpiles of topsoil substances associated with temporary works. The effects of increased sedimentation in construction runoff would reduce shortly after completion of the works when exposed areas of earth are resurfaced, reseeded or replanted. Increased pollution risks from spillage of fuels or other harmful substances associated with temporary works may migrate to the West Cambridge Canal. A common source of pollution is from leaks and spillages of hydrocarbons from mechanical plant or storage vessels. For the most part, it is only when large quantities of hazardous substances are spilled, or the spillage is directly into the watercourse, that a significant risk of acute toxicity would arise. The mitigation measures detailed in the CoCP would reduce the risk of increased sedimentation and potential effects to the West Cambridge Canal. The sensitivity of the West Cambridge Canal is Low and the magnitude of impact is Minor Adverse associated with the construction of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral to Slight effect (not significant) on the West Cambridge Canal.

Receptor	Importance	Potential Effects
Groundwater resources	Low	Increased pollution risks from spillage of fuels or other harmful substances associated with temporary works may migrate to the groundwater resources. A common source of pollution is from leaks and spillages of hydrocarbons from mechanical plant or storage vessels. For the most part, it is only when large quantities of hazardous substances are spilled, that a significant risk of acute toxicity would arise. The mitigation measures detailed in the CoCP would reduce the risk of increased sedimentation and potential effects to the land drains and unnamed watercourses. The sensitivity of the groundwater resources is Low and the magnitude of impact is Minor Adverse associated with the construction of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral to Slight effect (not significant) on groundwater resources.
Flood Risk Receptors	Low / High	The Flood Risk Assessment (**Appendix TR13.1: Flood Risk Assessment**) concludes that based upon the measures in the CoCP it is considered that the construction stage will not have a significant impact on flood risk to the surrounding area or the scheme itself. The sensitivity of the flood risk receptors is Low to High and the magnitude of impact is Negligible associated with the construction of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral to Slight effect (not significant) on the flood risk receptors.

5.1.1.3 **Table TR13-5-**2 summarises the assessment of potential effects on the water environment receptors during the operation of the Proposed Scheme.

Table TR13-5-2 – Assessment of potential effects on water environment receptors during operation

Receptor	Importance	Potential Effects
Bin Brook and floodplain	Medium	The surface water drainage strategy includes an outfall which discharges into Bin Brook. The surface water drainage strategy is provided in **Annex TR13.1.4** of **Appendix TR13.1: Flood Risk Assessment** and details the Simple Index Assessment undertaken for the outfalls. The operation of the Proposed Scheme could pose a risk to the deterioration of the WFD status including changes to the hydromorphological, physico-chemical and ecological quality of Bin Brook. **Appendix TR13.2: Water Framework Directive Screening and Scoping Assessment** concluded that it has been agreed with the Environment Agency that it is highly likely that these risks can be designed out or suitably mitigated during the detailed design phase.

Receptor	Importance	Potential Effects
		The sensitivity of Bin Brook is Medium and the magnitude of impact is Minor Adverse associated with the operation of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Slight effect (not significant) on Bin Brook.
River Cam and floodplain	Medium	As the River Cam is located approximately 1km to the east of the Proposed Scheme, the impacts associated with the operation of the Proposed Scheme are not likely. The sensitivity of the River Cam is Medium and the magnitude of impact is Negligible associated with the operation of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral effect (not significant) on the River Cam.
Callow Brook	Medium	The surface water drainage strategy includes an outfall which discharges into Callow Brook. The surface water drainage strategy is provided in **Annex TR13.1.4** of **Appendix TR13.1: Flood Risk Assessment** and details the Simple Index Assessment undertaken for the outfalls. The sensitivity of Callow Brook is Medium and the magnitude of impact is Negligible associated with the operation of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral effect (not significant) on Callow Brook.
Land drains and unnamed watercourses	Low	The surface water drainage strategy includes outfalls which discharges into the land drains and unnamed watercourses. The surface water drainage strategy is provided in **Annex TR13.1.4** of **Appendix TR13.1: Flood Risk Assessment** and details the Simple Index Assessment undertaken for the outfalls. There are a number of new watercourse crossings along the land drains and unnamed watercourses. The Flood Risk Assessment (**Appendix TR13.1: Flood Risk Assessment**) details the size and flows of the new crossings. The sensitivity of the land drains and unnamed watercourses is Low and the magnitude of impact is Negligible associated with the operation of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral effect (not significant) on the land drains and unnamed watercourses.
West Cambridge Canal	Low	The C2C Scheme will result in a new crossing over the West Cambridge Canal, located to the south of Charles Babbage Road. This crossing has not been assessed within the Flood Risk Assessment as it will be designed during the detailed design phase by Cambridge University, due to the complex interactions with the University's surface water drainage systems. As the canal is now largely an aesthetic feature with the flows controlled by a penstock beneath a footbridge upstream of the stream crossing, limiting the flows largely to a baseflow limit, it is considered that a new crossing can robustly be designed during the detailed design phase without increasing the risk of flooding to the scheme or third parties.

Receptor	Importance	Potential Effects
		The sensitivity of the West Cambridge Canal is Low and the magnitude of impact is Negligible associated with the operation of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral effect (not significant) on the West Cambridge Canal.
Groundwater resources	Low	No infiltration features are included within the surface water drainage strategy and all attenuation features will be lined as detailed in **Annex TR13.1.4** of **Appendix TR13.1: Flood Risk Assessment**. The sensitivity of the groundwater resources is Low and the magnitude of impact is Negligible associated with the operation of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral effect (not significant) on groundwater resources.
Flood Risk Receptors	Low / High	The Flood Risk Assessment (**Appendix TR13.1: Flood Risk Assessment**) concludes the following: Hydraulic modelling of the Bin Brook crossing indicates that the introduction to the Bin Brook crossing will have a minimal impact on the flood risk. The small watercourse crossings have been sized using the 0.1% AEP peak flows, which is greater than the 1%AEP +40%CC peak flows, ensuring that the crossings are sufficiently sized for the lifetime of the C2C Scheme. An increase in impermeable surfaces will not lead to an increase in surface water flood risk, with the implementation of the surface water strategy. The sensitivity of the flood risk receptors is Low to High and the magnitude of impact is Negligible associated with the operation of the Proposed Scheme. Therefore, there is likely to be a direct, temporary, cumulative, short term Neutral to Slight effect (not significant) on the flood risk receptors.

5.1.1.4 As detailed in the standalone **Appendix TR13.1: Flood Risk Assessment** and the **Appendix TR13.2: Water Framework Directive Screening and Scoping Assessment** the C2C Scheme will not have a significant effect on the water environment.

6 REFERENCES

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62-64 Hills Road
Cambridge
CB2 1LA

wsp.com