Greater Cambridge Partnership

ES SCOPING REPORT

Cambourne to Cambridge Scheme

70086660-WSP-EAC-XX-RP-LE-00001
7TH FEBRUARY 2022

CONFIDENTIAL

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1 INTRODUCTION

1.1 PURPOSE OF THIS ES SCOPING REPORT

1.1.1. This document is the Environmental Statement (ES) Scoping Report for the Cambourne to Cambridge (C2C) Scheme. It is prepared in support of a request made under rule 8(1) of the Transport and Works Act (Applications and Objections Procedure) (England and Wales) Rules 2006 (the Application Rules) and regulation 5(6) of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (EIA Regulations 2017) for the Secretary of State (SoS) to give an opinion (a Scoping Opinion) as to the information to be provided in the ES for the C2C Scheme. This report is based on the requirements of rule 8(2) of the Application Rules and regulation 5(8) of the EIA Regulations 2017.

1.1.2. The report identifies and describes the key environmental and other information needed to inform the opinion of the Secretary of State. In doing this the following is presented:

- Plans and drawings to show the extent of the land affected by the proposals;
- A brief description of the nature and purpose of the proposed works;
- A brief description of the possible effects on the environment of the proposed C2C Scheme;
- The assessment methodology that will be used to produce each technical chapter;
- The environmental surveys and studies required to evaluate the baseline conditions, and
- Any environmental matters that are considered not likely to create potentially significant environmental effects. Such matters are proposed to be 'scoped out' (i.e. not considered further) in the ES for the C2C Scheme.

1.2 GOVERNANCE

1.2.1. The Greater Cambridge Partnership (GCP) is the local delivery body (representing the Cambridgeshire County Council (CCC), the South Cambridgeshire District Council (SCDC), the Cambridge City Council (City Council) and the University of Cambridge) for a City Deal with central Government, bringing powers and investment to Cambridge and Greater Cambridgeshire, worth up to £500 million over 15 years.

1.2.2. Greater Cambridge Partnership is responsible for delivering the Cambourne to Cambridge (C2C) project under a Memorandum of Understanding (MoU) with CCC. The Applicant for the purposes of an Order under the Transport and Works Act 1992 is CCC, but in all respects the functions and duties of the Applicant have been and will be delivered by GCP.

1.2.3. Through investment in transport and infrastructure, the Applicant will bring forward schemes to connect people to places of employment and allow communities to grow sustainably in the coming years, by creating better and greener transport networks, reducing congestion and making better use of limited road space by prioritising sustainable transport.

1.3 BACKGROUND

1.3.1. GCP is proposing to construct the infrastructure required to enable a high-quality public transport service to operate between Cambourne and Cambridge – this scheme is known as the Cambourne to Cambridge Better Public Transport project (referred to throughout as the 'C2C Scheme', which is taken to include a dedicated new busway and a shared use path for the majority of the alignment).

A detailed description of the C2C Scheme is provided in Section 2, but in summary the C2C Scheme is made up of three core elements:

- A new, largely segregated, roadway for bus use, with public transport priority measures between Cambourne and Cambridge where the route joins the existing road network, that avoids general traffic congestion;
- A new travel hub at Scotland Farm; and
- A shared use path (for non-motorised users and emergency and maintenance vehicle access).

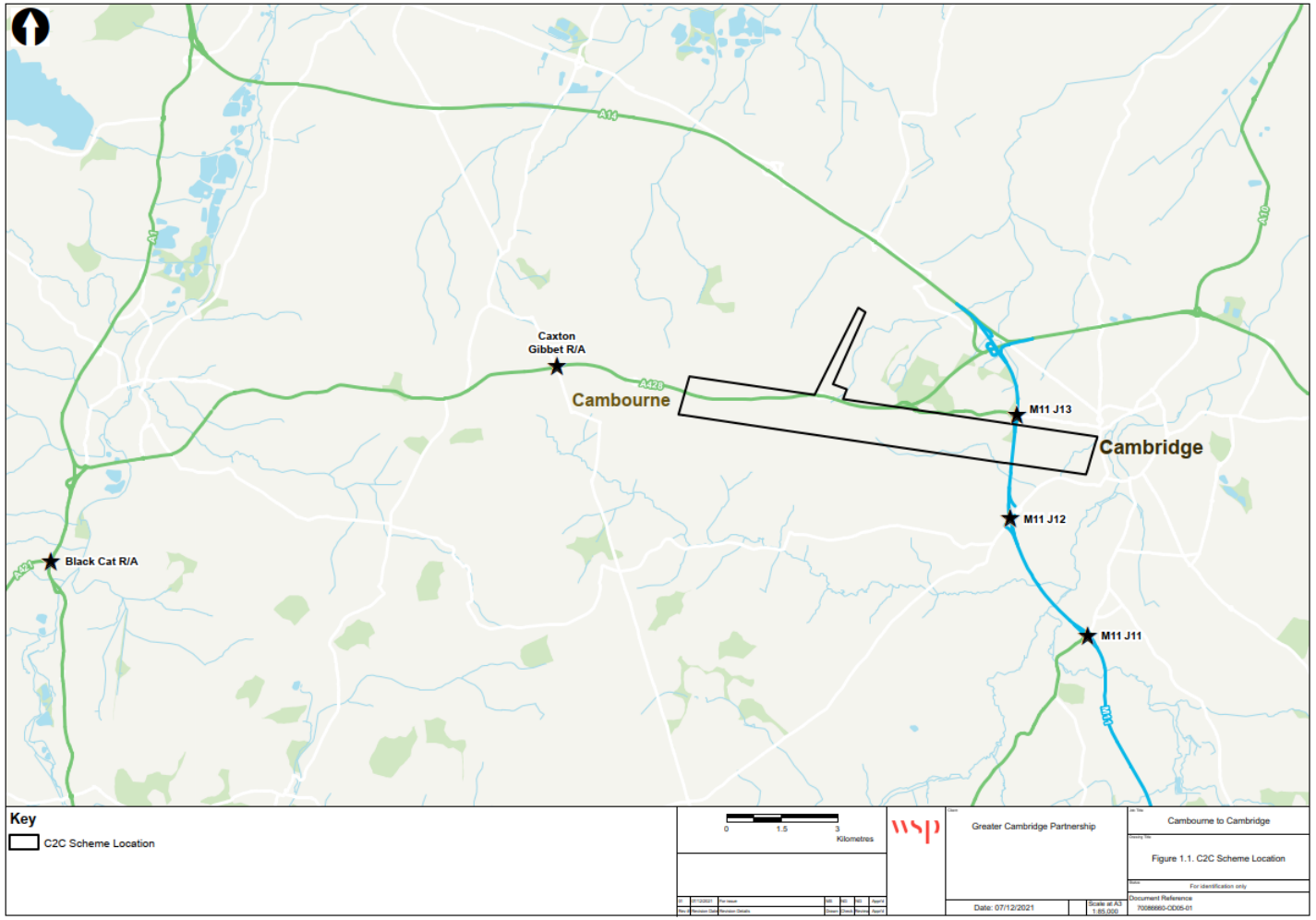
1.3.2. The busway will include both dedicated sections where the busway traffic is segregated from the existing road network; and on road busway sections - where the busway would use existing roads,– possibly in dedicated lanes or merged with other traffic. Busway stops will be provided at agreed locations.

1.3.3. The shared use path would include facilities for pedestrians, cyclists and horse riders and would run parallel to the busway within the TWAO limits. The shared use path would also be used for some emergency access, at times there is the need for a safe refuge to be available for passengers, and for access for maintenance vehicles. The design of this path along the route will be configured according to demand, safety and stakeholder consultation. For on road sections the existing facilities used by cyclists and pedestrians will be improved.

1.3.4. Facilities to maintain access across the busway by footpaths and bridleways (Public Right of Way (PROW)), as well as other access tracks will be included.

1.3.5. Figure 1-1 shows the location and route of the C2C Scheme in the context of Cambridge and its surroundings. A more detailed explanation of the route is within Section 2.3.

Figure 1-1 - Proposed C2C Scheme Alignment



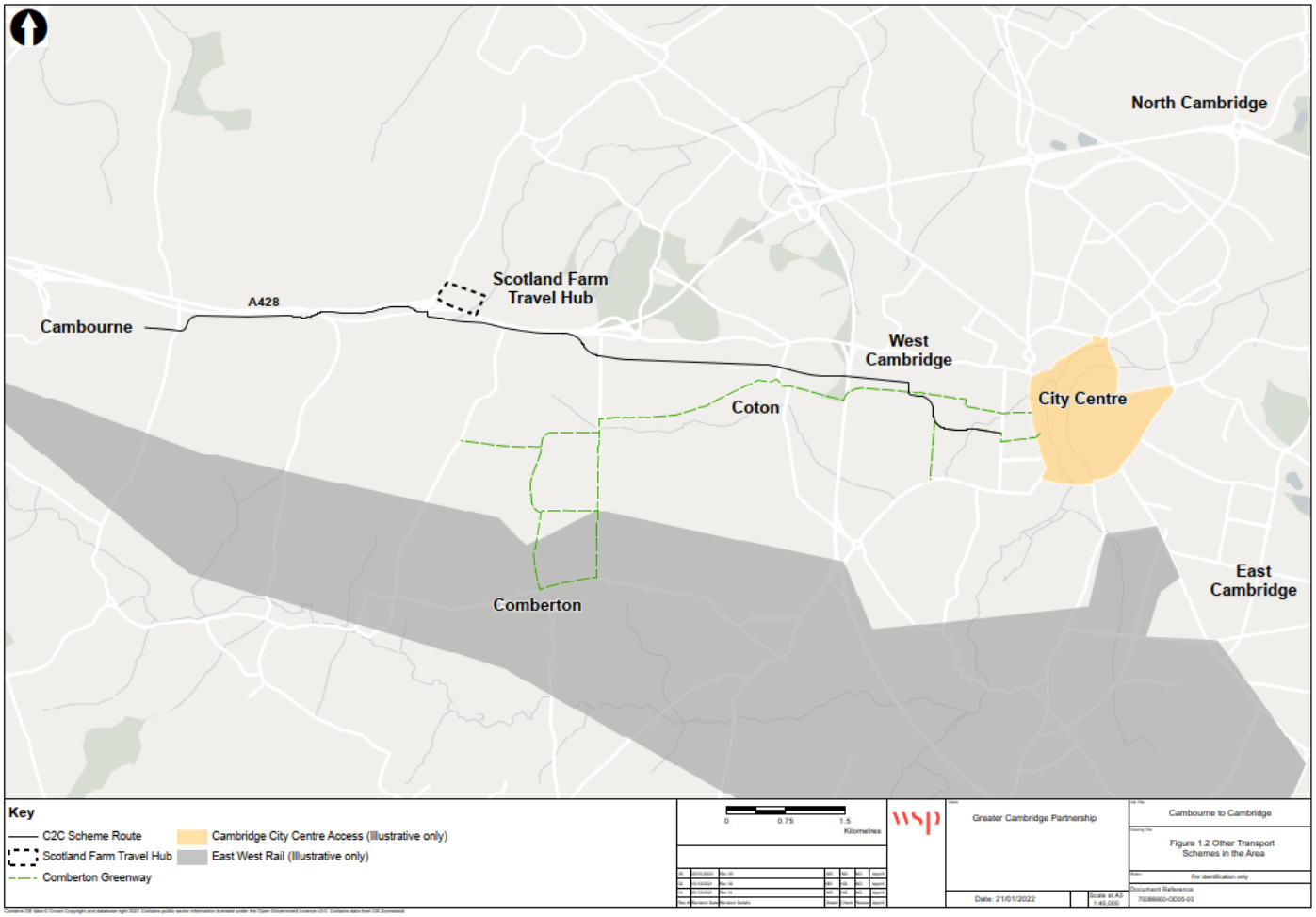
1.4 OTHER TRANSPORT SCHEMES IN THE AREA

1.4.1. There are a number of transport schemes in the area between Cambourne and Cambridge at various stage of development (not all are committed but are in the process of being developed). These include:

- East West Rail;
- A428 Black Cat to Caxton Gibbet;
- Cambridge City Centre Access; and
- Comberton Greenway.

1.4.2. A map showing the location of these schemes in relation to C2C is given in Figure 1-2. These schemes will be assessed as part of the cumulative impact assessment where scheme details are sufficiently advanced.

Figure 1-2 - Other transport schemes in the area



1.5 PREFERRED SCHEME OPTIONEERING

1.5.1. The development of the C2C Scheme has been underway since 2015. After initial route optioneering and consultation, from 2017 to 2019 it was split into two parts for the purposes of further route optioneering and consultation:

- The first part of the overall route corridor was from Madingley Mulch Roundabout on the A1303/A428 to Grange Road in Cambridge – hereafter termed the 'eastern section'.
- The second part of the overall route corridor was from Cambourne to Madingley Mulch Roundabout – hereafter termed the 'western section'.

1.5.2. For the eastern section of the route corridor, a short-list of four options were appraised against each other, using the following methodology:

- Multi Criteria Assessment aligned to scheme objectives based on DfT's WebTAG guidance[1] (including environmental appraisal of the options under consideration that took specific account of air quality, climate change, noise, landscape and townscape, heritage, biodiversity and water resources);
- Value for Money appraisal using transport modelling outputs and scheme costs;
- Assessment of associated Wider Economic Impacts relating to Gross Value Added (GVA) benefits and land value uplift; and
- Reflecting public consultation feedback.

1.5.3. Following a review of locations which revisited earlier appraisal, two different site location options were considered for the Travel Hub for the most recent consultation and Outline Business Case. The options for each Travel Hub site were assessed as part of each option in the eastern section shortlist (i.e. each route option was assessed twice, once for each different Travel Hub option).

1.5.4. For the western section of the route corridor a short-list of six options were appraised against each other, using the same methodology applied to eastern section options.

1.5.5. For each western section option, the recommended option for the completed eastern section option appraisal was included in the appraisal[2].

1.5.6. The optioneering of the key component parts resulted in a single recommended route option and a single preferred Travel Hub location being identified, which, taken together all comprised the initial design of the C2C Scheme. The preferred option was a largely off-road route from Cambourne to

[1] Department for Transport (2021). Transport Analysis Guidance (TAG) Unit 3, Environmental Impact Appraisal. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/999917/tag-unit-A3.pdf [Accessed 01 December 2021].

[2] Greater Cambridge Partnership (GCP). 2020. Cambourne to Cambridge – Better Public Transport Project: Outline Business Case/ Available at: https://www.greatercambridge.org.uk/transport/transport-projects/cambourne-to-cambridge/cambourne-to-cambridge-outline-business-case [Accessed 01 December 2021].

Grange Road with a Scotland Farm Travel Hub. This optioneering process and conclusion are presented in the Outline Business Case (OBC)[2].

1.5.7. The initial design for the C2C Scheme presented in the OBC was revisited in 2021 and slight amendments to the route made to take into consideration matters raised by stakeholders, environmental factors, engineering design and constructability. The Travel Hub site was not changed. It is this route and Travel Hub that forms the C2C Scheme covered in this Scoping Report. The C2C Scheme is described in Section 2 and shown within Figure 1-1.

1.6 TRANSPORT AND WORKS ACT 1992 REQUIREMENTS

1.6.1. The Applicant will be applying to the Secretary of State (SoS) for an order under the Transport and Works Act [3]. 1992 accompanied by a request for a Planning Direction under Section 90(2A) of the Town and Country Planning Act 1990 for the C2C Scheme. If authorised, the Transport Works and Act Order (TWAO) and deemed planning permission would together provide the powers required for the construction, maintenance and operation of the C2C Scheme.

1.6.2. The procedural requirements for TWAO applications are set out in the Application Rules, which provide that an application for a TWAO shall (unless the Secretary has made a direction under rule 7(3)), be accompanied by a statement of environmental information. This Rule is applicable if the project for which consent is sought is of a type mentioned in Annex I of the EIA Directive[4], or of a type mentioned in Annex II of the EIA Directive unless, in the case of an Annex II project, the SoS has issued a negative screening opinion under rule 7(13). The request for a Planning Direction to be made under the Town and Country Planning Act 1990 (as amended, Section 90(2A) is subject to the provisions of the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (as amended)). Since the substantive provisions of the process of environmental impact assessment (EIA) required under both procedures are the same, the generic term "EIA Requirements" is used in this ES.

1.6.3. The C2C Scheme does not fall within the types of development listed in Annex I of the EIA Directive or Schedule 1 of the EIA Regulations 2017. However, Annex II of the EIA Directive and Schedule 2 of the EIA Regulations 2017 are relevant to the C2C Scheme as they covers transport infrastructure projects that could have a significant environmental impact. Therefore, it is appropriate that the C2C Scheme is considered to be EIA development.

1.6.4. The Applicant has determined not to apply for a screening opinion as it considers that the C2C Scheme constitutes a project of a type mentioned in Annex II of the Directive and Schedule 2 of the EIA Regulations with potentially significant environmental effects. Therefore, the Applicant intends to

[3]Transport and Works Act (Applications and Objections Procedure) (England and Wales) Rules 2006 (the "Application Rules").

[4] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment, amended by Directive 2014/52/EU.

submit an Environmental Statement (ES) with the proposed Transport and Works Act application and request for a Planning Direction and is therefore requesting under rule 8 of the Application Rules that the SoS gives a Scoping Opinion in relation to the C2C Scheme.

1.7 ENVIRONMENTAL IMPACT ASSESSMENT

1.7.1. The purpose of the Environmental Impact Assessment (EIA) process is to ensure that information on the likely significant environmental effects of certain projects is taken into account by a decision-maker before determining whether or not to grant development consent. The environmental information to be taken into account is that provided by the applicant, statutory consultees and other stakeholders, including members of the public. As the C2C scheme is a project for which the EIA process is to be undertaken, the ES will be prepared by competent experts and provide specified information to enable the Secretary of State and all stakeholders to understand the likely significant environmental effects of the proposed scheme. The Secretary of State cannot grant the TWAO or the deemed permission until the consultation, publicity and notifications required by the EIA Requirements have been undertaken. The Secretary of State must examine the environmental information (including the Environmental Statement and the consultations), reach a reasoned conclusion on the significant effects of the proposed scheme on the environment, integrate that conclusion into the decision as to whether a TWAO is to be granted and deemed permission granted and, if so, consider whether it is appropriate to impose monitoring measures.

2 SCHEME DESCRIPTION

2.1 PROJECT NEED

2.1.1. To meet the growing economy in the project area the role of the C2C Scheme as defined in the OBC[2] is as follows:

2.1.2. "To connect existing and new communities along the A428/A1303 to places of employment, study and key services to enable the sustainable growth for Greater Cambridge. We will deliver this through improved, faster and more reliable High Quality Public Transport (HQPT) services, together with high quality cycling and walking facilities serving a new Travel Hub site to the west of Cambridge."

2.1.3. The Cambridgeshire and Peterborough Independent Economic Review[5] found evidence that, across the regional economy, growth is higher than official figures suggest. Examination of employment growth in individual companies suggests firms are increasing employment at a rate greater than that captured by the Office of National Statistics (ONS) data; similarly, turnover growth is strong. There are, however: "major doubts as to how well the area is set up to cope with future growth, particularly where the strain is already evident."

2.1.4. Based on this evidence, and in line with existing policy and strategies, the key underlying drivers for the need for change along the A428/A1303 route and for investment in the C2C Scheme can be summarised as follows:

- The A428 is a nationally important route and forms part of the nationally strategically important Oxford-Milton Keynes-Cambridge arc - highlighted by the National Infrastructure Commission as a priority for growth.
- Large population growth will require the delivery of significant additional housing, much of which is planned to be located to the West of Cambridge along the A428/A1303 route.
- Employment is growing rapidly within Greater Cambridge[6], including in destinations on the edge of the city such as West Cambridge and the Biomedical Campus to the South, with a need to provide effective transport connections from existing and future settlements.

[5] The Cambridgeshire and Peterborough Independent Economic Review (CPIER). Available at: https://www.cpier.org.uk/final-report/ [Accessed November 2021]

[6] The Greater Cambridge area covers the footprint of the Cambridge city and South Cambridgeshire district councils – as defined in the City Deal agreement. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/321722/Greater_Cambridge_City_Deal_Document.pdf [Accessed November 2021]

- The demand generated by the growth in housing and employment will generate ever greater levels of demand for travel in and around Greater Cambridge and will thereby exacerbate current congestion issues.
- Car ownership in Greater Cambridge is high, with 85% of households having access to a car compared to the national average of 74%[5].
- The existing rail network does not serve movements along the A428/A1303 route.
- The existing A428/A1303 is inadequate for walking and cycling as a mode of transport into Cambridge.
- Congestion on the route means that current public transport services are unable to offer an attractive alternative to private car.
- Without intervention, those living and working in the new developments could become locked into a cycle of car dependency and low use of other modes exacerbating capacity issues along the route.

2.2 C2C SCHEME LOCTION AND SURROUNDING AREA

2.2.1. As shown in Figure 1-2, the C2C Scheme lies to the west of Cambridge, running for approximately 13.6km between the town of Cambourne and Cambridge City Centre along the A428/A1303 corridor, terminating on Grange Road in the western outskirts of Cambridge. The C2C Scheme will service existing and growing settlements and development areas along the route, including:

- Cambourne (including proposed new residential development at Cambourne West);
- Future residential development at Bourn Airfield;
- Highfields Caldecote;
- Hardwick;
- Madingley;
- Coton, and
- Cambridge (including the University's growing research and development site at West Cambridge).

2.2.2. The C2C Scheme includes a little over 2km of route on existing roads (in Cambourne, West Cambridge, and in Cambridge) and approximately 11.5km on a new alignment for the segregated carriageway. Of the 11.5km of new alignment about half is proposed to be on land used for agricultural purposes (largely arable and one orchard) and the other half is on land that is occupied by grassland, orchard, woodland or scrub.

2.2.3. The C2C Scheme would cross four PRoWs, which would remain open in the long term, but may require temporary closure or diversions during construction.

2.2.4. The route for C2C Scheme is located in the Green Belt between Hardwick and Cambridge for a length of approximately 6km. The Scotland Farm Travel Hub is also located in the Green Belt.

2.3 C2C SCHEME ROUTE – DETAILED DESCRIPTION

2.3.1. The route is described in further detail below.

2.3.2. The route includes both a shared use path (for Non-Motorised Users (NMU) users and for emergency and maintenance vehicle access) and the HQPT infrastructure (road, HQPT stops, traffic control etc).

2.3.3. From west to east, the route alignment starts in Cambourne, running on the existing street network starting on Sterling Way before turning onto a new section of segregated route which crosses the Broadway and then into Bourn Airfield.

2.3.4. The route then passes along the northern edge of the Bourn Airfield. This section of Bourn Airfield has been delineated for the route in a Planning Statement[7] which provides additional detail on the allocation within the adopted South Cambridgeshire Local Plan (2018) for a mixed use, residential lead development for 3,500 dwellings. The mixed-use village at Bourn Airfield will be capped at 500 dwellings until the C2C Scheme is delivered[8].

2.3.5. The parameter plans within this application, include a safeguarded corridor for the C2C route consistent with the SPD.

2.3.6. The route leaves the eastern end of Bourn Airfield, crossing the existing St Neots Road west of the Childerley Gate roundabout on St Neots Road.

2.3.7. From this point the route continues east as a segregated route on greenfield land on the southern side of the A428 until it re-joins the highway network at the Scotland Road dumb bell junction on south side of the A428. The route then uses the existing highway network to access the proposed Scotland Farm Travel Hub (part of the C2C Scheme), located to the east of Scotland Road, just north of the A428.

2.3.8. On leaving the Travel Hub the busway follows passes along the highway, joining St Neots Road from the southern part of the roundabout on the Scotland Farm/A428 Junction. This is a change from the previously planned route that passed on a segregated path north of St Neots Road. The revised route protects the tree belt to the benefit of existing residents along this section who will continue to be screened from views of the A428. East of Hardwick the route passes south and cuts just below the Cambridge Water Company's land at Madingley Mulch Roundabout (the junction between the A1303 and the A428). The Cambridge Water Company site is commonly referred to as the Waterworks site but is shown as Comberton Plantation on the OS basemap. This site has a buried reservoir and distribution mains which the route would avoid through a further revision to the preferred route

2.3.9. From the Waterworks site the route continues through agricultural fields to the south of the A1303, Madingley Road. The route then passes north of Coton, crosses Cambridge Road at a new

[7] https://www.scambs.gov.uk/media/18063/bourn-airfield-new-village-supplementary-planning-document-2019.pdf

[8] Bourn Airfield draft committee report FINAL accessible format template.pdf (moderngov.co.uk)

signalised junction (part of the C2C Scheme) before continuing across Coton Orchard to cross the M11 on a new bridge proposed to be constructed as part of the C2C Scheme. The M11 crossing would be just south of Junction 13 on the M11.

2.3.10. After crossing the M11 the route enters the West Cambridge site and runs alongside Charles Babbage Road before turning south and exiting the West Cambridge site into an arable field. This area of open land between the city boundary and the M11 is commonly referred to as the West Fields.

2.3.11. The route curves southwards alongside the Cambridge University Athletics Sportsground to join the track running east / west that is commonly referred to as the Rifle Range track or road. Once the route intersects this track it turns eastwards along the track over the Bin Brook and passes the Cambridge University Rugby Ground to merge with Grange Road, where the C2C Scheme ends.

2.3.12. At this point the users of the route (including the NMU users) merge with other users on Grange Road and is the point at which the segregated and shared use paths terminate.

2.4 SCHEME OPERATING SYSTEM

2.4.1. The Applicant's objective is to deliver a scheme that provides a modern, guided HQPT service. The Applicant is currently pursuing technological guidance systems, with an idea of moving away from a physical guidance system for C2C. This is being considered for a number of reasons including the restrictions of a physical guidance system impacting future proofing in relation to other schemes.

2.4.2. The Applicant undertook a market sounding exercise in October 2018 to determine market interest and the availability of technological guidance solutions for deployment on the Cambridgeshire Rapid Transit schemes. Six guidance technology options have been investigated:

- Kerb;
- Optical;
- Trolley;
- Slot/rail;
- Magnetic; and
- Wire/cable.

2.4.3. The exercise concluded that both kerb guidance and optical guidance achieve most or all of the guidance requirements for the C2C Scheme and should both be developed/investigated further.

2.4.4. To robustly account for either scenario, the EIA will assess both kerb and optical guidance systems. The EIA will take a 'Rochdale Envelope' approach to the assessment of these options as discussed further in Section 4.4.

2.4.5. The physical infrastructure required for each system would differ but the overall C2C Scheme footprint would be broadly similar – and each could operate on the route alignment described in Section 2.3. The key differences between the two systems on the design of the C2C Scheme is discussed further at in Section 2.5.

2.4.6. Irrespective of which operating system is employed, the C2C Scheme will include the following facilities:

- A suitable segregated carriageway for the buses where they are not operating on existing roads.

- Busway stops at Cambourne, east Bourn Airfield, west Bourn Airfield, Hardwick, Coton (possibly), West Cambridge.
- Travel Hub with capacity for around 2,000 cars at the Scotland Farm site north of the A428 with bus pick up/drop off point, coach parking, waiting room and welfare facilities, possibly solar panel power generation, connections to shared use paths, secure cycle parking, recharging points for electric powered vehicles.
- Signalised junctions with priority for the buses where the route crosses existing roads.
- Shared use path for the full length of the C2C Scheme within the route corridor.
- Pedestrian and cyclist access to the Scotland Farm Park and Ride site from Dry Drayton.
- Appropriate environmental mitigation and landscaping to deliver biodiversity net gain along the route.

2.5 SCHEME DESIGN DESCRIPTION

2.5.1. This section outlines the two design options available for the C2C Scheme. It is based on an optical guidance system, as this is currently the preferred option. The optical guidance system has a slightly larger footprint than the kerb-based guidance but there is no marked difference between the land take requirements of the guidance systems (see Figure 4-2).

OPTICAL GUIDANCE DESIGN

2.5.2. Optical guidance systems are typically deployed on a single standard asphalt road surfacing of about 7.3m width that would permit bi-direction movement of the vehicles. Higher specification pavement construction would be required, compared to a standard carriageway, to avoid channelisation of the surface as the vehicles follow the same path as they follow the optical line. The design parameters for optical guidance would be expected to be closely aligned to commonly understood road construction guidance and regulations e.g. Department for Transport DRMB[9].

2.5.3. On the guided section the driver only controls the acceleration and braking. Optical guidance systems use the following technology to steer the vehicle although the driver can intervene in the case of emergency:

- A camera at the front of the vehicle constantly records a defined area, scanning bands of paint on the ground representing a reference path.
- An onboard computer which combines signals obtained from a camera with the dynamic parameters of the vehicle to generate commands. Parameters include:
- Vehicle speed.
- Yaw rate (turning angle around the vehicle's axis).
- Steering wheel angle (to detect deviations).

[9] Department for Transport (DRMB). Available at: Standards For Highways | Design Manual for Roads and Bridges (DMRB) [Accessed 02 December 2021].

- Commands are transmitted to the guidance motor on the steering column to correct any deviation of the vehicle from the reference path.

2.5.4. Benefits of the technology include:

- It allows for precise positioning at boarding platforms, helping those with limited mobility as access can be perfectly aligned.
- Vehicles can follow a fixed path around corners.
- Technology can be retrofitted to any vehicle.
- Smooth transition between continuous guidance and no guidance modes.
- Limited fixed infrastructure required.

2.5.5. The carriageway would be drained through a positive drainage system design in accordance with standard design principles and would be sustainable drainage system (SuDS) compliant.

KERB GUIDED DESIGN

2.5.6. A kerb guided design would involve the construction of robust kerbs (generally concrete) at prescribed widths to accommodate the guidance mechanism installed on the vehicles on both sides of the carriageway. There is a separate carriageway for each direction of travel, so there would be two carriageways along the route. The width of the two carriageways would normally be around 6.3m in total, less than a conventional two-lane carriageway.

2.5.7. A kerb guided vehicle system will require the ability for emergency vehicles to gain access to the any point on the route. This would be enabled by providing access along the shared use path, which would need to be a minimum of 4m wide to accommodate the emergency access.

2.5.8. Construction would potentially take longer than for an optical system, and require higher quantities of raw materials.

2.5.9. Kerb guided HQPT systems all have the following distinct attributes:

- Small horizontal guide wheels fixed to the steering track of vehicles.
- Horizontal wheels on bus axles make contact with the kerbs, guiding the vehicle.
- The vehicles approach a guided section at low speed, ensuring a smooth entry.
- On the HQPT route the driver only controls the acceleration and braking.
- The width of the HQPT route is determined by the width of the vehicle and the additional guidewheels.

2.5.10. Benefits of the technology include:

- The guideway allows for high speed operation (over 85 km/h on the existing CGB) despite narrow corridor.
- A narrow guideway takes up less space than a conventional multi-vehicle road (3.2/6.3m as opposed to 3.5/7.3m).
- Allows for precise positioning at boarding platforms, helping those with limited mobility as access can be perfectly aligned.
- Technology can be retrofitted to any vehicle.

TRAVEL HUB DESIGN

2.5.11. The Scotland Farm Travel Hub would be designed to segregate the movement of the HQPT vehicles from cars using the parking areas. Current estimate is that there will be up to 2000 car parking spaces, and there may be some coach parking for visiting coaches to Cambridge.

2.5.12. The potential for solar photo-voltaic panels to be installed over some of the car parking area will be investigated. The solar panels, if proposed are likely to be a maximum of five metres in height above the ground level of the Travel Hub.

2.5.13. There would be a waiting area and shelter for passengers to purchase tickets, to provide information on the services and the Travel Hub operations, and to provide welfare facilities for the Travel Hub users. The drop off/pick up points would have real time displays to indicate waiting times between services. Lighting would use LEDs that minimise light spillage and the potential impact on sensitive receptors (particularly residents immediately adjacent to the north of the Travel Hub on Scotland Road).

2.5.14. A shared use path to connect the Travel Hub site with Dry Drayton will be developed.

SHARED USE PATH

2.5.15. The C2C Scheme includes a shared use path along the full length of the route. Along the majority of the route the shared use path would provide a new facility, although along some stretches of the route the shared use path would upgrade existing paths. Where possible, the shared use path would be segregated from other road users where it is installed.

2.5.16. There are a number of guidance documents setting out how NMU facilities should be designed. The Applicant intends that the shared use path be a multi-user facility that will provide for different user groups, such as pedestrians, cyclists and, where appropriate, equestrians. The shared use path will, for majority of the route, segregate cyclists and pedestrians. The precise arrangements will be determined as the C2C Scheme develops.

2.5.17. If an optical guided solution is adopted the shared use path will be a minimum of approximately 3m wide. If a kerb guided solution is adopted then the shared use path will be approximately 4m wide at all points and will also serve as the emergency access route along the busway.

2.5.18. A Non-Motorised User Working Group has been set up by the Applicant to review and contribute advice and input to the design of the shared use path.

ENVIRONMENTAL DESIGN

2.5.19. The environmental design will be driven by the outcome from the EIA process. This will identify where particular environmental pressures may be experienced and where mitigation is proposed to be included in the C2C Scheme design. At the Scoping stage the key elements to the environmental design are anticipated to include:

- Biodiversity: The identification of measures required to ensure compliance with relevant legalisation and policy and mitigate likely significant adverse environmental effects on biodiversity resulting from the construction and operation of the C2C Scheme. The Applicant is seeking to achieve a 20% Biodiversity Net Gain (BNG) for the C2C Scheme. This gain will be achieved by identifying areas for suitable new habitat of high quality to be created along the route and designed to fit into the landscape setting.

- Heritage: The first stage in planning of the mitigation will be intrusive surveys (trial trenching), to build on the geophysical and walkover surveys. Designs to preserve or protect heritage assets will be documented in the environmental design.
- Landscape: The route alignment from the M11 to the Waterworks site crosses an open area of Green Belt. The design of the C2C Scheme will work with the natural landscape setting and contouring whilst considering all potential mitigation.
- Noise: Where necessary, acoustic screening will be included in the design to minimise noise from the C2C Scheme; for example using earth bunding or acoustic barriers.
- Lighting: All lighting will be designed to minimise both vertical and horizontal light spill. Lighting will only be installed in areas of high use, i.e. junctions with highways, and on the Travel Hub. The shared use path will have solar studs or similar lighting to provide an indication of the path layout in the darker areas of the countryside.
- Greenhouse Gases: Embedded carbon will be reduced as far as reasonably practicable within the final C2C Scheme design. Photo-voltaic panels may also be used to provide a renewable energy source for the operation of the Travel Hub. Opportunities for further refinement during detailed design will be highlighted in the environmental design.
- Climate Change: The design will take into account predicted future climate where the elements of the design cannot be easily modified or upgraded. The overall resilience to climate change will be reflected within the ES.
- Water Environment: The C2C Scheme will include a SuDS drainage design to ensure acceptable levels of discharge from the C2C Scheme, and to treat surface runoff to remove suspended solids, metals and hydrocarbons from discharged water.

3 CONSULTATION

3.1 CONSULTATION TO DATE

3.1.1. Since the Cambourne to Cambridge project's inception in 2015, community and stakeholder engagement has taken place using differing methodologies and producing a number of outcomes. The feedback from the wide consultation has informed and shaped the C2C Scheme design and optioneering process, which has led to the option outlined in this report.

3.1.2. Public and stakeholder involvement has taken place at every key stage in the optioneering process. It has allowed transparency in the development of the emerging major transport scheme and it has given key stakeholders and communities the opportunity to raise any concerns and provide direct feedback on the proposals. The direct community involvement has provided an understanding of transport users' needs and the impact that a high-quality public transport scheme could have on their travel behaviour.

3.1.3. Consultations that have taken place include, but are not restricted to, engagement with the following Stakeholders:

- Addenbrooke's Hospital;
- American Cemetery and Memorial;
- British Horse Society;
- Cambridge Campaign for Future Transport;
- City Council;
- Cambridge Past, Present, and Future;
- Cambridge walking groups;
- Cambridgeshire County Council;
- Cambridgeshire Local Access Forum;
- Cambridgeshire & Peterborough Combined Authority;
- Cambridgeshire City Council Passenger Transport;
- Camcycle;
- Campaign to Protect Rural England;
- Camsight;
- Coton Busway Action Group;
- Coton Primary School;
- Countryside Properties;
- Environment Agency;
- GCP City Access Team;
- Highways England (now National Highways);
- Historic England;
- Local Liaison Forum (LLF);
- Local landowners;
- Madingley Mulch Limited;
- National Trust;
- Natural Cambridgeshire;
- Natural England;
- Parish Councils;
- Ramblers Association;
- Residents Associations;
- Royal Society for the Protection of Birds;
- Save the West Fields;
- Smarter Cambridge Transport;
- South Cambridge District Council;
- South West Fields;
- Sport England;
- Stagecoach;
- Sustrans;
- The Gardens Trust;
- Tower Transit Operations;
- Town, Parish and District Councils;
- University of Cambridge, its Colleges and other institutions; and

- Wildlife Trust

Table 3-1 summarises when consultation has taken place, along with the outcomes and their impact on the C2C Scheme development.

Table 3-1 – Consultation to date

Consultation	Outcome/Impact on C2C Scheme Development

2015 Public Consultation	• The majority of respondents agreed that better bus services are needed.
	• The most preferred options included:
	  • an on-road bus lane in bound from Madingley Mulch roundabout into the city centre;
	  • a bus priority route from Madingley Mulch to Bourn Airfield along the old A428.
	• A bus-only route between Cambourne and Bourn Airfield received majority support
	• Alternative options and modifications were taken for further assessment.

2016 Local Liaison Forum (LLF) established	• Continuous engagement with LLF throughout C2C Scheme history. • New route option suggested and taken forward for further appraisal work. • Scoring of options in appraisal was a joint operation. • Numerous technical discussions with the LLF's own technical group since 2016 • Recently meetings held November 2018, February, April, May 2019, January and June 2020
December 2016 Stakeholder Workshop Consultations	• Local Stakeholder Workshop – 8th December 2016. • Cambourne Workshop – 14th March 2017. • Local Planning Authority Workshops – January 2017-May 2017. • The start of a formal dialogue between LLF and residents / stakeholders.
July – August 2017 Busway User Research	• Speed, reliability of journey and frequency of service are key service elements which motivate people to use the service. This has assisted in informing the specification of the proposed C2C Scheme. • When informed of the potential new bus service between Cambourne and Cambridge, around a third of respondents indicated a fair- to strong likelihood of using it.
August 2017 Stakeholder Workshop Consultations	• Utilising feedback from the workshop, the Park & Ride locations were narrowed down. This led to further evaluation and two sites were taken forward: The Waterworks and Scotland Farm. These were presented for public consideration in the 2017-18 consultation.
December 2017-January 2018 Public Consultation & Focus Groups	• Bi-directional bus lanes and an optimised on-road option to include both inbound and out bound bus priority were taken forward for further consideration. • The bus lane was removed from the on-road option and cycle provisions were included and formed part of the 'do minimum' option.
March 2018 – Stakeholder Workshops	• No preference was shown for a preferred on-road or off-road solution from the options presented.

Consultation	Outcome/Impact on C2C Scheme Development
	• There was a preference for a separate cycle and pedestrian walkway on the on-road option so the pedestrian bridge was taken forward in the 'Low Cost' options. • The consultees suggested that the proposed bus lane from High Cross junction be removed from the on-road option. As such this has been proposed to be included in a 'Low Cost' option.
February 2019 - March 2019 Phase 2 Consultation events in St Neots, Cambourne, Dry Drayton, Hardwick and Caldecote	• For the Phase 2 options of the route, just under half of respondents (48%) indicated 'Option 1: off-road' would be their preferred choice for the link between Madingley Mulch roundabout and Bourn Airfield. • For the choice of Travel Hub site, the majority of respondents (63%) preferred 'Option A – Scotland Farm'
May 2019 Non-Motorised Users (NMU) and Landscape, Heritage and Ecology (LHE) Working groups established	• The working groups have influenced the design, highlighting the need to review alignments around Coton and the layout of shared use routes that are being taken forward as the C2C Scheme develops and heads towards full Environmental Impact Assessment
July 2019 – C2C Environment and landscape: Community drop - ins	• Concerns were mainly raised around the areas of Coton and St Neots Road. Residents were able to view potential alternative alignments that had been developed to minimise the impact from the public transport route adjacent to properties with regard to vegetation loss. • Comments received from the events are being taken forward as the design is developed leading towards the Environmental Impact Assessment.
Summer 2021	• Follow-up sessions to Cambourne Town Council, Dry Drayton, Coton, Hardwick, Bourne, Highfields Caldecote Parish Councils, with meetings offered to Madingley and Comberton Parish Councils. Also meeting with West Area Community Forum. All attendees appraised of scheme progress and plans for EIA/TWAO.

Full details of consultation carried out between October 2015 and September 2019 is presented in the Statement of Community Involvement prepared by Mott MacDonald to accompany the OBC.

3.2 FUTURE CONSULTATION

3.2.1. Ongoing consultation with relevant environmental statutory bodies (as listed in Schedules 5 and 6 of the TWA Rules) will continue.

3.2.2. As part of the route crosses the M11 engagement with National Highways has commenced and will continue to ensure the design meets the agencies requirements.

3.2.3. Further public consultation will take place in May 2022, including face to face community events where possible, depending on the emerging COVID-19 public consultation policy from central

government[10]. Virtual events may supplement or replace these if necessary[11]. If a public event takes place it is likely these will be at the following locations:

- Cambourne;
- Hardwick;
- Coton; and
- Newnham.

3.2.4. At each event the C2C Scheme alignment will be presented, including information on proposed mitigation measures based on feedback from consultation undertaken during the optioneering process (between 2017 and the end of 2019). Communities will be given an opportunity to comment on the current C2C Scheme alignment and their comments will be taken into consideration in developing the final preliminary design of the C2C Scheme. Stakeholders will also be able to review documents on-line and in local libraries and submit comments via the GCP website or in written form.

3.2.5. Further engagement with directly impacted landowners, and with residents in close proximity to the C2C Scheme alignment, will continue through the EIA process.

3.2.6. During the design and EIA process ongoing engagement will continue with groups representing the various communities along the route including the following:

- Bourn Parish Council;
- Cambourne Town Council;
- Comberton Parish Council;
- Coton Parish Council;
- Dry Drayton Parish Council;
- Hardwick Parish Council;
- Highfields Caldecote Parish Council;
- Madingley Parish Council; and
- North Newnham Residents Association.

[10]The Town and Country Planning (Development Management Procedure, Listed Buildings and Environmental Impact Assessment) (England) (Coronavirus) (Amendment) Regulations 2020 will be applied to all consultation until these regulations are annulled or superceded.

[11] Parliament UK (2020). Planning update: Written statement – HLWS231. Virtual working and planning – Responding to Covid – 19 Restrictions. Available online at: https://www.parliament.uk/business/publications/written-questions-answers-statements/written-statement/Lords/2020-05-13/HLWS231/ Accessed: November 2021

3.3 WORKING GROUPS

3.3.1. In addition to the project specific engagement with stakeholders two working groups have been established to help to establish a consistent and robust approach for C2C and other GCP schemes:

- the NMU Working Group; and
- the Landscape, Heritage and Ecology Working Group.

3.3.2. Membership of these working groups includes statutory regulators as well as relevant organisations representing cycling, equestrian, walking, conservation, heritage and landscape interests. These two working groups meet about every month and have been instrumental in reviewing and commenting on emerging designs of GCP transport schemes. The outputs from these working groups will continue to inform the ongoing C2C Scheme development.

4 ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

4.1 THE SCOPING PROCESS

4.1.1. The purpose of scoping is to establish the coverage of the EIA and the information reported in the ES in terms of topics, as well as more specific aspects within included topics. As explained in Section **1.1**, EIA is a process to determine the likely significant effects of a development, the findings of which are presented by the applicant in an ES. It goes on to includes consultation, publication, notification and steps by the Secretary of State. This is required by the EIA Requirements and Section 13 B of the Transport and Works Act 1992. The entirety of the process of EIA must ensure that the likely significant environmental effects of a proposed development are identified. Close working between the environment and design team will seek to identify these effects early so that measures to mitigate them can be embedded as a fundamental part of the design, or the mandated construction and operational practices. To ensure that the information provided in the ES is as comprehensive as required, the scoping process supports the Applicant in requesting a scoping opinion from the SoS. A scoping opinion provides guidance to the Applicant as to the level of detail required for the assessment of those environmental topics in respect of which there may be likely significant effects. Scoping is undertaken in order to focus the various aspects of the EIA on those environmental impacts likely to result in significant effects.

4.1.2. On the basis of the scoping opinion, the EIA will be undertaken, and its findings reported in the ES. There is no standard format for an ES, although Rule 11 and Schedule 1 of the Application Rules and Regulation 18 (3) and Schedule 4 of the EIA Regulations 2017 specify information that must be provided as a minimum in the ES. This is set out in below.

Figure 4-1. Schedule 4 – Regulation 18(3) – EIA Regulations 2017

1. A description of the development, including in particular:
- **a)** a description of the location of the development;
- **b)** a description of the physical characteristics of the whole development, including, where
- **c)** relevant, requisite demolition works, and the land-use requirements during the
- **d)** construction and operational phases;
- **e)** a description of the main characteristics of the operational phase of the development (in
- **f)** particular any production process), for instance, energy demand and energy used, nature
- **g)** and quantity of the materials and natural resources (including water, land, soil and
- **h)** biodiversity) used;
- **i)** an estimate, by type and quantity, of expected residues and emissions (such as water, air,
- **j)** soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities and types
- **k)** of waste produced during the construction and operation phases.

2. A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.

3. A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge.

4. A description of the factors specified in regulation 4(2) likely to be significantly affected by the development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape.

5. A description of the likely significant effects of the development on the environment resulting from, inter alia:
   - **a)** the construction and existence of the development, including, where relevant, demolition works;
   - **b)** the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources;
   - **c)** the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste;
   - **d)** the risks to human health, cultural heritage or the environment (for example due to accidents or disasters);
   - **e)** the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;
   - **f)** the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change;
   - **g)** the technologies and the substances used.

   The description of the likely significant effects on the factors specified in regulation 4(2) should cover the direct effects and any indirect, secondary, cumulative, transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development. This description should take into account the environmental protection objectives established at Union or Member State level which are relevant to the project, including in particular those established under Council Directive 92/43/EEC(a) and Directive 2009/147/EC(b).

6. A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved.

7. A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases.

8. A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to EU legislation such as Directive 2012/18/EU(c) of the European Parliament and of the Council or Council Directive 2009/71/Euratom(d) or UK environmental assessments may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should

Include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies.

9. A non-technical summary of the information provided under paragraphs 1 to 8.

10. A reference list detailing the sources used for the descriptions and assessments included in the environmental statement.

4.1.3. Any environmental matters proposed to be 'scoped out', i.e. not addressed by the EIA and included in the ES for further assessment, are included in Section 18.1 of this Scoping Report with justification for this decision included within the relevant technical chapter. However, if the design of the C2C Scheme changes substantially during the EIA process, then a review of all environmental matters will be undertaken. Based on professional judgment and following consultation with the relevant statutory organisations/bodies, if required, matters previously excluded could be 'scoped back' into the EIA and ES.

4.1.4. The ES will be based on the Scoping Opinion provided by the Secretary of State for Transport and will include a statement outlining the relevant expertise or qualifications of the competent experts that have prepared it.

4.2 SPATIAL SCOPE

4.2.1. The spatial (geographic) scope of the EIA and ES will vary for each topic, but will be sufficient to include potential significant effects on the environmental receptors identified. For the purpose of the EIA, the spatial scope will comprise the following areas:

- Area within the C2C Scheme Order limits of deviation – this is expected to cover the footprint of the busway, Travel Hub and any additional permanent land take that may be required by the C2C Scheme, including land required for mitigating permanent adverse effects
- Areas required temporarily to allow for construction of the C2C Scheme, including access. These are referred to as land to be acquired or used (LLAU); and
- Areas beyond the C2C Scheme Order limits where environmental impacts could occur – each individual technical chapter will identify its specific study area (Zone of Influence) for impact assessment.

4.3 TEMPORAL SCALE

4.3.1. The EIA will assess the potential for construction and operational impacts arising from the C2C Scheme. At this stage, the current programme is presented in Table 2.1.

4.3.2. The C2C Scheme is expected to operate for at least 60 years. Once built, it will be regularly repaired and maintained to ensure its operation is safe, reliable and efficient. The ES will provide further information on the maintenance requirements of the C2C Scheme. In view of the relatively long lifespan of the C2C Scheme, and the absence of a decommission plan, there is insufficient information now to allow for a meaningful assessments of likely significant effects arising from a

decommissioning phase. As such, the ES will not discuss the decommissioning of the C2C Scheme although the sustainability of materials and resource use in construction will be considered.

4.4 ROCHDALE ENVELOPE

4.4.1. As the project has key elements of the C2C Scheme design that remain open to final decisions it will be necessary for the ES to present information on two design options (as set out in Section 2.5).

4.4.2. The Planning Inspectorate have published guidance[12] on how an ES can accommodate uncertainty in the development's design. What is clear that the flexibility in the design must not be so large as to give rise to two or more different schemes and the details that are not yet finalised should be clearly identified and described in all application documents. Furthermore, the assessment of the yet to be agreed elements of the design need to be clearly described in consultation materials.

4.4.3. All environmental effects should be assessed based on reasonable assumptions or, if available, on the specific design options that have not yet been finalised. The final ES will report on the reasonable worst-case effects which can present challenges where there is considerable uncertainty over elements of the C2C Scheme.

4.4.4. In the case of the C2C Scheme the uncertainty is over the means of guidance, which as described in Section 2.5 would alter the nature of the carriageway constructed on all segregated sections of the C2C Scheme. In summary, the options would differ as set out below:

- Optical guidance: requires a standard single carriageway asphalt road surface with surface road markings (likely to be painted) enabling two-way travel within a 7.3m wide carriageway
- Kerb guidance: requires two separate carriageways with a kerb (normally concrete) that the bus is physically in contact with via wheels projecting from the side of the bus, this would enable one way traffic in each carriage within a carriageway corridor likely to be about 6.3m wide.
- The maximum difference in land take between the two options (per metre length of the route) is about 7%.
- Depending on the precise construction methods for a kerb guided solution there is a potentially longer construction period for this mode than for a standard road constructed to enable an optically guided solution.
- Larger area of hard surface associated with the optical guidance system than for the kerb guidance system.

[12] The Planning Inspectorate: Using the Rochdale Envelope, July 2018 Version 3.0. https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2013/05/Advice-note-9.-Rochdale-envelope-web.pdf Accessed: November 2021

4.4.5. All other elements of the infrastructure required for the C2C Scheme remain guidance neutral and so would be assessed based on a standard design regardless of the mode of guidance. This would apply to:

- The route alignment itself;
- The Travel Hub;
- All traffic controls and lighting at junctions;
- bus stops en-route; and
- The shared use path.

4.4.6. An assessment of the potential impacts on the different environmental topics was completed as part of this scoping phase. The results of this high-level review are presented below in Table 4-1.

Table 4-1 – Comparison of Environmental Impacts between Guidance Options

Topic	Optical Guidance		Kerb Guidance	
	Construction phase	Operational phase	Construction phase	Operational phase
Air Quality	Potentially shorter construction phase reduces impact on air quality from plant. Slightly larger footprint not significant enough to affect air quality from construction	Neutral between guidance options assuming the mode of vehicular propulsion is the same between options.	Slightly smaller footprint not significant enough to be differentiator to air quality from construction.	Neutral between guidance options assuming the mode of vehicular propulsion is the same between options.
Biodiversity	No significant difference between options based on the information available at the time of writing – but potentially quicker construction could reduce overall time of any effects on species in the area of the route. Marginally better than kerb guidance as a result.	No significant difference based on the information available at the time of writing – slightly larger footprint will have slightly worse impact on biodiversity value requiring additional habitat creation to achieve biodiversity net gain.	No significant difference between options based on the information available at the time of writing – but potentially longer construction could increase overall time of any effects on species in the area of the route (i.e. species such as the barbastelle bat *Barbastella barbastellus* may be subjected to disturbance over a longer period). Marginally worse than optical guidance as a result.	No significant difference based on the information available at the time of writing – slightly smaller footprint will have slightly lower impact on biodiversity value requiring less additional habitat creation to achieve biodiversity net gain.
Carbon	Slightly shorter construction period decreases construction plant and	Neutral between guidance assuming mode of propulsion is	Longer construction period increases construction plant and equipment	Neutral between guidance assuming mode of propulsion is

Topic	Optical Guidance		Kerb Guidance	
	Construction phase	Operational phase	Construction phase	Operational phase
	equipment carbon emissions and using lower quantities of raw materials will lead to lower embedded carbon in the road infrastructure. Where construction waste is also lower this will also lead to lower embodied carbon.	same between options.	carbon emissions, and using larger quantities of raw materials will lead to higher embedded carbon in the road infrastructure. Where construction waste is also higher this will also lead to higher embodied carbon.	same between options.
Climate Change	No significant difference. Climate change impacts on construction activities will have negligible differences for each option.	No significance difference between guidance options. Climate change impacts at operational phase will have negligible differences for each option.	No significant difference. Climate change impacts on construction activities will have negligible differences for each option.	No significant differences between guidance options. Climate change impacts at operational phase will have negligible differences for each option.
Community and Health	Slightly less impact due to potentially shorter construction phase.	Neutral between guidance on communities and health. Larger footprint results in overall slightly larger land take which may affect some socio-economic land use more than kerb guided. But marginal as increase is 1 metre wider per m length.	Slightly more impact due to potentially longer construction phase.	Neutral between guidance on communities and health.
Historic Environment	Potential for greater land take means during construction slightly higher potential impact on buried heritage assets.	Neutral between options – assume landscaping will ensure same effect on setting between options.	Potential for deeper excavation in places to ensure sufficiently robust kerb structure may increase risk of encountering buried heritage assets.	Neutral between options – assume landscaping will ensure same effect on setting between options.
Landscape and Visual	Greater potential land take - marginal increase in construction visual	Road has slightly softer visual impact locally compared to kerb guidance design. Marginal difference in impact on landscape	Slightly smaller land take - marginal reduction in construction visual impact, but over	Kerb guidance has harsher visual impact locally (along route) – mitigated if grass grows

Topic	Optical Guidance		Kerb Guidance	
	Construction phase	Operational phase	Construction phase	Operational phase
	impact, but over shorter time frame. Assume similar number of batching plants/construction compounds between designs.	character between guidance assuming appropriate landscaping in place.	potentially longer time frame. Assume similar number of batching plants/construction compounds between designs.	within/between carriageways. Marginal difference in impact on landscape character between guidance assuming appropriate landscaping in place.
Noise and Vibration	No significant difference other than shorter construction phase reducing duration of noise impacts.	No significant difference between guidance options. Nature of noise arising from the C2C Scheme likely to be more from tyre noise.	No significant difference other than longer construction phase increasing duration of noise impacts.	No significant difference between guidance options. Nature of noise arising from the C2C Scheme likely to be more from combination of noise from kerb guidance mechanism and from tyre noise.
Land use and property	Increased footprint has slightly increased land take for physical infrastructure.	No significant difference between options.	Lower footprint reduced land take for physical infrastructure.	No significant difference between options.
Major Accidents	Neutral between guidance options.	Neutral between guidance options.	Neutral between guidance options.	Neutral between guidance options
Soils and Geology	Larger land take results in increased impact on soils and geology- the effect to the construction phase will remain the same.	The effects will remain the same.	Smaller land take results in reduced impact on soils and geology. The effects are likely to remain the same.	The effects will remain the same.
Traffic and Transport	Shorter construction phase – reduced duration of impact from construction traffic.	Neutral between guidance options.	Longer construction phase – increased duration of impact from construction traffic.	Neutral between guidance options.

Topic	Optical Guidance		Kerb Guidance	
	Construction phase	Operational phase	Construction phase	Operational phase
Water resources and flood risk	Neutral impact on water resources between options.	Slightly larger area of hard surface results in larger volume of surface water runoff – less opportunity for in-carriageway SUDS.	Neutral impact on water resources between options.	Smaller surface area results in lower volume of surface water runoff during rainfall. Greater opportunity to install SUDS within carriageway.

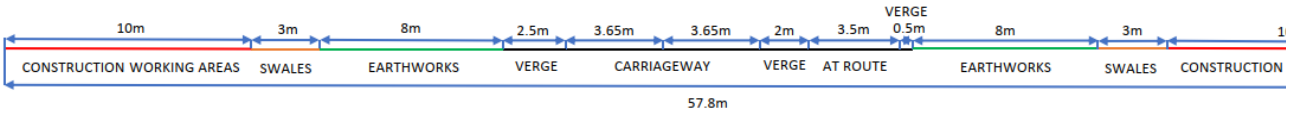
4.4.7. The following figure (Figure 4-2) shows the indicative cross section for the C2C Scheme route for both the optically guided or kerb guided option.

4.4.8. The implications on the design between the two methods of guidance are reasonably well understood and can be clearly identified in all application and consultation documentation. Therefore, a robust assessment of the environmental effects can be presented in the ES.

4.4.9. In common with other schemes of this scale, nature and anticipated level of design at the consenting stage, the Applicant will require a proportionate degree of flexibility to be built into the consent for the C2C Scheme to enable the detailed design to be developed within the parameters (limits of deviation) of the consent. This would be necessary to ensure that the C2C Scheme can respond to developments in technology, unforeseen ground conditions and to ensure that any consent granted can be practicably implemented. The ES chapters will set out the assumptions made in assessments to ensure that the likely significant environmental effects from implementation of the TWAO and deemed planning permission will be no greater than those assessed in the EIA process.

4.4.10. Figure 4-2 shows an indicative cross section of the C2C Scheme route.

Figure 4-2 – Indicative cross section of the C2C Scheme route



4.5 CUMULATIVE IMPACT ASSESSMENT

METHODOLOGY OF ASSESSMENT

4.5.1. The proposed methodology for assessing the cumulative effects is based on the Planning Inspectorate guidance[13]. Based on this, the EIA will consider the following types of cumulative effects:

- Combined effects - the combination of individual environmental topic effects from the C2C Scheme on a particular receptor; and
- Cumulative effects - effects due to interactions between the C2C Scheme and other reasonably foreseeable, nearby future developments of an appropriate scale outside the C2C Scheme boundary.

4.5.2. Cumulative effects from the C2C Scheme alongside other developments in its vicinity will be assessed according to each topic and summarised in a Cumulative Effect chapter in the ES. The proposed list of development to be addressed by the EIA will be confirmed presently and in line with the PINS methodology.

4.6 CONSTRUCTION

CONSTRUCTION STRATEGY

4.6.1. A construction strategy for the C2C Scheme will be prepared for consideration in the ES. This strategy will provide the principles (including phasing and programming) of works which will form the basis of contract specifications. The appointed contractor will be expected to adopt the contract specifications when delivering the C2C Scheme. It is currently anticipated that the delivery of the C2C Scheme will be phased over a period of approximately 24 months, to include enabling works and construction activities.

CODE OF CONSTRUCTION PRACTICE

4.6.2. The draft Code of Construction Practice (CoCP) is a document that is prepared to define the general measures required to minimise and control any potential harm on the environment and human beings arising from construction activities, the adoption of which will be assumed within the various topic assessments. The draft CoCP sets out general contractor obligations with respect to the impact of construction activities on local residents, businesses, the general public and the surroundings in the vicinity of the works. It applies to the construction phase and is in addition to statutory regulations and other contractual requirements.

[13] The Planning Inspectorate (2015). Cumulative Effects Assessment. Advice note seventeen: Cumulative effects assessment relevant to nationally significant infrastructure projects. Available online at: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2015/12/Advice-note-17V4.pdf Accessed: November 2021

4.6.3. The appointed contractor will be required to use the CoCP to inform their more detailed Construction Environmental Management Plan (CEMP) that will reflect specific control and management measures that reflect the detailed design and methods proposed to construct it, and will contain more site-specific information to demonstrate how the requirements of the CoCP will be complied with.

4.6.4. It is anticipated that if a TWAO is granted for the C2C Scheme, the provision of an agreed CEMP will be one of the conditions attached to the deemed planning permission. A draft CoCP will be submitted as part of the ES.

4.6.5. The draft CoCP will include an outline of the appropriate mitigation requirements that have been identified during the EIA process or used by the EIA as the basis for determining likely significant effects. Where additional detail is required, on the basis of more refined construction information, these will be approved under a condition to the deemed planning permission that will be sought in parallel to the TWAO.

THE ENVIRONMENTAL STATEMENT

4.6.6. A proposed structure for the main volume of the ES is set out below. This structure seeks to convey information to a general audience and will draw on the specialist information provided by each topic's assessment. Detailed information pertaining to each of the assessments will also be available on a topic-by-topic basis. Supporting appendices be provided, including, *inter alia*, a register of mitigation.

Figure 4-3 - Proposed structure for the main volume of the ES

1 C2C and the environment
- 1.1 C2C and environmental impact
- 1.2 The EIA and consent application
- 1.3 Assessing impacts and effects
- 1.5 Finding information in the ES

2 The EIA process
- 2.1 Legal requirements
- 2.2 EIA scoping
- 2.3 Assessment techniques
- 2.4 Defining significance
- 2.5 Spatial context
- 2.6 Temporal context
- 2.7 Environmental issues
- 2.8 Assessment concepts
- 2.9 Mitigation strategy

3 Scheme description
- 3.1 The route and its features
- 3.2 Design proposals
- 3.3 Land use change
- 3.4 Construction strategy
- 3.5 Materials and waste
- 3.6 Sustainable design
- 3.7 Climate change and the future environment

4 Evolution of the scheme
- 4.1 The story so far
- 4.2 Strategic issues and transport modes
- 4.3 Alternative routes
- 4.4 Park and ride locations
- 4.5 Design concepts
- 4.6 Operating alternatives
- 4.7 Consultation

5 The environment along the route
- 5.1 Land uses
- 5.2 Communities and homes
- 5.3 Environmental quality
- 5.4 Soils and geology
- 5.5 The water environment
- 5.6 Nature
- 5.7 Landscape and history
- 5.8 Future change

6 General impacts of the scheme
- 6.1 Causes of change
- 6.2 Landtake
- 6.3 New features
- 6.4 Emissions: land, air and water
- 6.5 Changes in traffic
- 6.6 Construction activities
- 6.7 Major accidents and disasters
- 6.8 Impact interaction

7 Mitigation through design and practice
- 7.1 Concepts
- 7.2 Landscape design
- 7.3 Construction practices
- 7.4 Delivering on commitments
- 7.5 Mitigation by topic

8 Effects on people and communities
- 8.1 Noise and vibration
- 8.2 Air quality
- 8.3 Visual effects
- 8.4 Movement: transit and access
- 8.5 Homes, jobs and amenity
- 8.6 Health and wellbeing

9 Effects on the natural environment
- 9.1 Biodiversity
- 9.2 Land and soil
- 9.3 Water and flooding

10 Effects on the cultural environment
- 10.1 Landscape
- 10.2 Built heritage
- 10.3 Archaeology

11 Effects on global resources
- 11.1 Carbon emissions
- 11.2 Material use
- 11.3 Waste

12 Cumulative effects
- 12.1 Other developments
- 12.2 East West Rail
- 12.3 Bourn Airfield
- 12.4 ..... Etc

13 Taking the scheme forward
- 13.1 Seeking consent through a TWA
- 13.2 Decision making
- 13.3 Giving feedback on the ES
- 13.4 Finding other information

5 AIR QUALITY

5.1 INTRODUCTION

5.1.1. This chapter presents the proposed scope and approach to identifying and assessing the likely significant impacts on air quality resulting from the construction and operation of the C2C Scheme. The approach reflects the measures that have been identified and embedded within the C2C Scheme design to date, as well as reasonable assumptions about the methods used for construction. Where additional measures are required to mitigate likely significant environmental effects, these will be identified following the assessment of air quality and an assessment of the residual relevant air quality objectives and limit values (Table 5-1) effects undertaken.

5.2 LEGISLATION AND STANDARDS

5.2.1. The following legislation and standards are relevant to the air quality assessment of the C2C Scheme:

- The Air Quality Standards Regulations 2010 (as amended);
- Environment Act 1995 (as amended);
- Air Quality (England) Regulations 2000 (as amended);
- The Clean Air Strategy 2019;
- Environment Act 2021;
- National Planning Policy Framework 2019;
- National Planning Practice Guidance;
- Cambridge City Council Local Plan 2018;
- South Cambridgeshire Local Plan 2018; and
- Greater Cambridge Sustainable Design and Construction Supplementary Planning Document, 2020.

5.2.2. The relevant air quality standards relevant to the assessment are summarised in Table 5-1.

Table 5-1 - Relevant air quality objectives and limit values

Pollutant	Averaging period	Air Quality objectives and limit values		Attainment date
		Concentration	Allowance	
Nitrogen Dioxide (NO_2)	1-hour	200 µg/m^3	18 per calendar year[14]	31 December 2005[15] 1 January 2010[16]
	Annual	40 µg/m^3	-	31 December 2005[17] 1 January 2010[18]
Particulates (PM_{10})	24-hour	50 µg/m^3	35 per calendar year[19]	31 December 2004[20] 1 January 2005[21]
	Annual	40 µg/m^3	-	31 December 2004[22] 1 January 2005[2324]
Particulates ($PM_{2.5}$)	Annual	20 µg/m^3	-	TBC[25]

[14] Can be expressed as the 99.79th percentile of 1 hour means.

[15] Air Quality (England) Regulations 2000 as amended.

[16] EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe and The Air Quality Standards Regulations 2010. Derogations (time extensions) have been agreed by the EU for meeting the NO_2 limit values in some zones/agglomerations.

[17] Air Quality (England) Regulations 2000 as amended.

[18] EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe and The Air Quality Standards Regulations 2010. Derogations (time extensions) have been agreed by the EU for meeting the NO_2 limit values in some zones/agglomerations.

[19] Can be expressed as the 90.41st percentile of 24 hour means.

[20] Air Quality (England) Regulations 2000 as amended.

[21] EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe and The Air Quality Standards Regulations 2010. Derogations (time extensions) have been agreed by the EU for meeting the NO_2 limit values in some zones/agglomerations.

[22] Air Quality (England) Regulations 2000 as amended.

[23] EU Directive 2008/50/EEC on ambient air quality and cleaner air for Europe and The Air Quality Standards Regulations 2010. Derogations (time extensions) have been agreed by the EU for meeting the NO_2 limit values in some zones/agglomerations.

[24] In March 2011, the Commission agreed the UK's revised application for a time extension for meeting the daily PM_{10} limit value, granting a "temporary and conditional exemption" for the Greater London urban area.

[25] The Environmental Act 2021 – 4 (9) A draft of a statutory instrument (or drafts of statutory instruments) containing regulations setting (b) the $PM_{2.5}$ air quality target, must be laid before Parliament on or before 31 October 2022.

5.3 STUDY AREA

5.3.1. During the construction phase, the C2C Scheme will introduce new, but temporary, emission sources to nearby sensitive receptors in the form of:

- Potentially dust-generating activities, such as earth moving and construction works; and,
- Increased construction traffic on the local road network.

5.3.2. The spatial scope for the assessment of construction phase impacts will be confined to the area within 350m of the C2C Scheme alignment and will consider potential air quality effects during the entire construction phase. This is in accordance with the Institute of Air Quality Management's (IAQM's) publication 'Guidance on assessment of dust from demolition and construction'[26].

5.3.3. The study area for the assessment of construction and operational phase traffic impacts will be based on criteria provided in the Design Manual for Roads and Bridges (DMRB) LA 105 Air Quality[27] for determining an 'affected road network'. These criteria are as follows:

- A change in annual average daily traffic (AADT) ≥ 1,000; or
- A change in heavy duty vehicle (HDV)[28] AADT ≥ 200; or
- A change of speed band[29]; or
- A change of carriageway alignment by more than 5m.

5.3.4. However, the predicted changes in construction phase traffic flows would need to be triggered for a two year period for them to lead to likely significant effects and therefore if changes occur for a period less than this, dispersion modelling will not be undertaken and the effects of emissions from construction phase traffic on local air quality will be assessed qualitatively.

5.3.5. The DMRB LA 105 Air Quality guidance also advises that contributions from vehicle emissions are generally imperceptible above background concentrations farther than 200m from the road source. Therefore, only sensitive receptors which are located within 200m of affected roads will be considered within the assessment. The study area for the cumulative assessment would include the same area determined for the C2C Scheme and any other areas where the affected roads criteria are exceeded.

[26] Institute of Air Quality Management (Version 1.1 Updated June 2016). Guidance on the Assessment of Dust from Demolition and Construction

[27] Design Manual for Road and Bridges (2019). LA 105 Air Quality. Available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20105%20Air%20quality-web.pdf. [Accessed November 2021].

[28] HDVs include goods vehicles with a gross weight greater than 3.5 tonnes and buses and coaches.

[29] Unadjusted traffic model speeds will be used to define the speed bands for individual links within the traffic model for the purpose of defining study area.

5.3.6. The traffic data that will be generated for the C2C Scheme will be based on the output from a regional traffic model (CSRM). The use of a regional traffic model is considered to be best practice for determining changes in traffic across a wide area as a result of a scheme such as this and this model is being used to inform other aspects of the C2C Scheme appraisal such as the economic benefits.

5.3.7. Applying the DMRB LA 105 Air Quality affected road criteria to determine the study area for the air quality assessment is considered to be appropriate because the application of alternative criteria could result in the assessment of changes to traffic flows, which are not as a result of the C2C Scheme, but as a consequence of 'model noise'.

5.4 ASSESSMENT METHODOLOGY

SURVEYS

5.4.1. A six-month air quality survey commenced in July 2019 to monitor concentrations of NO_2 at 21 locations along the proposed route and nearby roads. The survey locations were agreed with the local environmental health officer. The survey was completed in January 2020 and so the results are not affected by the COVID-19 lockdown introduced in late March 2020.

5.4.2. The survey included triplicate diffusion tubes co-located with the existing automatic monitor at Girton to determine a local bias adjustment factor. We will use this data, bias adjusted and annualised in accordance with the methodology outlined with Department for Environment, Food and Rural Affairs (Defra) Local Air Quality Management Technical Guidance TG16[30] to help determine existing baseline conditions.

ASSESSMENT APPROACH

Construction dust

5.4.3. Construction activities can result in temporary effects from dust. 'Dust' is a generic term which usually refers to particulate matter in the size range 1-75 microns in diameter; the most common impacts from dust emissions are soiling and increased ambient PM_{10} concentrations. Dust can be transported either by wind or re-suspension by vehicles. It can also arise from wind erosion of material stockpiles and earth moving activities.

5.4.4. The usefulness of numerical criteria to determine effects from construction dust is limited, as the perception of loss of amenity or nuisance is affected by a wide range of factors such as character of the locality and sensitivity of receptors. As a result, assessment methodologies that are based on a qualitative approach are advocated. The EIA will assess construction dust effects in accordance with

[30] Department for Environment Food and Rural Affairs (Defra). Local Air Quality Management Technical Guidance (TG16). Available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-April-21-v1.pdf [Accessed 02 December 2021].

the IAQM 'Guidance on assessment of dust from demolition and construction'[31], this is because the construction phase has the potential to cause dust effects at:

- A 'human receptor' within:
  - 350m of the boundary of the site; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).
- An 'ecological receptor' within:
  - 50m of the boundary of the site; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

Operational phase

5.4.5. The following scenarios will be considered in the operational phase assessment:

- 2019 Base Year (Traffic flows from the base year will be used to inform the air quality model verification process);
- 2024 Opening Year Do-Minimum - this scenario would include committed developments in the area but would not include the C2C Scheme;
- Opening Year Do-Something - this scenario would include committed developments in the area and would include the C2C Scheme;
- 2024 Opening Year Do-Something - this scenario would include committed developments in the area and would include the C2C Scheme and Scheme dependant development; and,
- 2024 Opening year Do-Something cumulative - this scenario would include committed developments in the area and would include the C2C Scheme, other GCP schemes including CSETS and CSWTH, and Scheme dependant development.

5.4.6. Details of the individual developments and transport schemes that are included in each of these scenarios will be provided as part of the ES submission.

5.4.7. Future emissions across the UK are predicted to improve over time as newer, less polluting vehicles enter the national fleet and older, more polluting vehicles are removed from the roads. This means later years will see improvements in air quality and that the assessment of effects on air quality in the opening year will provide a conservative approach.

5.4.8. Assessment of air quality effects for the opening year of the C2C Scheme will be worst case as the traffic model developed by CCC, which will inform the assessment, has been developed assuming

[31] Institute of Air Quality Management (Version 1.1 Updated June 2016). Guidance on the Assessment of Dust from Demolition and Construction.

future traffic growth up to 2026, which is two years after the proposed opening year of 2024. Consequently, the traffic flows used for the opening year will be higher than will occur in reality.

5.4.9. Assessment of operational phase air quality effects will be undertaken using the advanced dispersion model ADMS-Roads and supplemented by the following tools listed below. This is consistent with the approach required with Defra's Local Air Quality Management Technical Guidance (LAQM TG16) and CCCs "Air Quality in Cambridge - Developers Guide".

- The latest version of the Emission Factor Toolkit;
- The latest version of Defra's Local Air Quality Management NOx to NO_2 conversion; and
- The latest version of Defra's background pollutant maps.

Receptors

5.4.10. The key sensitive receptors that will be included in the air quality assessment are those human health or ecological receptors located within 200 metres of the C2C Scheme or roads that are described as 'affected' in accordance with the DMRB LA 105 Air Quality criteria outlined earlier, and are likely to include:

- Sensitive human health receptors, which are representative of the likely worst-case impacts from the C2C Scheme;
- Ecological designations of importance when considering air quality effects including Sites of Special Scientific Importance (SSSIs), Local Nature Reserves (LNR), Local Wildlife Sites (LWS), Nature Improvement Areas (NIA), Ancient Woodlands and veteran trees.

Assumptions and Limitations

5.4.11. Dispersion modelling has associated with it an inherent level of uncertainty, primarily as a result of:

- Uncertainties associated with traffic data;
- Uncertainties with emissions data;
- Uncertainties with recorded meteorological data; and
- Simplifications made in the model algorithms or post processing of the data that represent atmospheric dispersion or chemical reactions.

5.4.12. To address these uncertainties, the base year model outputs will be verified against monitoring data in accordance with Defra's Local Air Quality Management Technical Guidance 2016 (TG16).

SIGNIFICANCE CRITERIA

5.4.13. The assessment of significance will be undertaken in accordance with the EPUK and IAQM guidance[32]. This is to ensure that the descriptions of effects presented within the ES Chapter are clear, consistent and in accordance with specific air quality guidance. Table 5-2 provides effect descriptors for changes in NO_2, PM_{10} and $PM_{2.5}$ concentrations as a result of the C2C Scheme.

5.4.14. The magnitude of any concentration change identified will be considered in relation to the air quality assessment level (AQAL), which may be an air quality objective, EU limit[33] or target value or an environment agency environmental assessment level (EAL). For this Scheme, the relevant AQAL have been presented in Table 5-2.

5.4.15. EPUK recognises that professional judgement is required in the interpretation of air quality assessment significance is intended as a tool to help interpret the results to the air quality assessment and would therefore be employed in conjunction with professional judgement.

Table 5-2 – Description of effects for individual receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Minor	Moderate
76%-94% of AQAL	Negligible	Minor	Moderate	Moderate
95%-102% of AQAL	Minor	Moderate	Moderate	Substantial
103%-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

[32] Environmental Protection UK and Institute of Air Quality Management (Version 1.2 Updated January 2017). Land Use Planning & Development Control: Planning for Air Quality.

[33] The UK formally left the EU on 31st January 2020 and new air quality legislation for the UK will be brought forward in due course. The Air Quality (Miscellaneous Amendment and Revocation of Retained Direct EU Legislation) (EU Exit) Regulations 2018 (SI 2018/1407) (see Regulation 5) makes changes to retained direct EU legislation relating to air quality, to ensure that it continues to operate effectively.

Notes: [a] AQAL = Air Quality Assessment Level i.e. 40µg/m³ for annual mean NO_2 and PM_{10} and 25µg/m³ for annual mean $PM_{2.5}$. The table is only designed to be used with annual mean concentrations
[b] Percentage pollutant concentrations are intended to be rounded to whole numbers. For example, the '<1%' category in this table includes all changes from 0.5% to 1.4% (equivalent to an annual mean NO_2 or PM_{10} absolute concentration change of between 0.2µg/m³ and 0.6µg/m³). Changes of 0% (i.e. less than 0.5%) are described as negligible.

5.4.16. The EPUK and IAQM criteria in the table above should be used to describe impacts at individual receptors and should be considered as a starting point to make a judgement on significance of effects, as other influences may need to be accounted for. The EPUK and IAQM Planning and Air Quality guidance states that the assessment of overall significance should be based on professional judgement, taking into account several factors, including:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

5.4.17. The EPUK and IAQM Planning and Air Quality guidance states that for most road transport related emissions, long-term average concentrations are the most useful for evaluating the impacts. The guidance does not include criteria for determining the significance of the effect on hourly mean NO_2 concentrations or daily mean PM_{10} concentrations. The significance of effects of hourly mean NO_2 and daily mean PM_{10} concentrations arising from the operational phase have therefore been determined qualitatively using professional judgement and the principles described above.

5.4.18. The following terms have been used to define the significance of the effects identified and apply to both beneficial and adverse effects:

- Major effect: where the Proposed Development could be expected to have a substantial improvement or deterioration on receptors sensitive to changes in local air quality;
- Moderate effect: where the Proposed Development could be expected to have a noticeable improvement or deterioration on receptors sensitive to changes in local air quality;
- Minor effect: where the Proposed Development could be expected to result in a perceptible improvement or deterioration on receptors sensitive to changes in local air quality; and
- Negligible: where no discernible improvement or deterioration is expected as a result of the Proposed Development on receptors sensitive to local air quality, including instances where no change is confirmed.

5.4.19. Effects that are classified as moderate or above are considered to be **significant**. Effects classified as minor or negligible are considered to be **not significant**.

5.5 BASELINE

5.5.1. Cambridge City Council declared an Air Quality Management Area (AQMA) in 2005 for exceedances of the annual mean objective for nitrogen dioxide (NO_2). The AQMA is located in the centre of Cambridge bounded by the inner ring road. The C2C Scheme proposals end at Grange Road, which is also the western boundary of the AQMA.

5.5.2. SCDC declared an AQMA in 2008 for exceeding the annual mean objectives for NO_2 and the daily objectives for particulate matter (PM_{10}). The AQMA is located along the A14 and M11 north of Cambridge, at a distance of approximately 0.9km from the C2C Scheme alignment.

5.5.3. Baseline pollutant concentrations of NO_2 and particulate matter will be obtained from existing data sources and collection of site-specific monitoring data. The data sources include:

- All relevant local authority Local Air Quality Management (LAQM) Review and Assessment documents (including monitoring data);
- Defra's UK Air Quality Information Resource (AIR) website; and
- A C2C Scheme specific NO_2 monitoring survey which was undertaken in 2019 along the C2C Scheme alignment and in the wider study area.

5.6 POTENTIAL IMPACTS

CONSTRUCTION

5.6.1. Potential effects during the construction phase could include:

- On-site dust emissions arising from construction activities and vehicle movements;
- Emissions associated with on-site plant and vehicles used in the construction of the C2C Scheme; and
- Emissions associated with construction traffic on the local road network.

5.6.2. Air quality effects associated with construction dust emissions could result in loss of amenity and/or nuisance caused by, for example, soiling of buildings and washing, and reduced visibility.

5.6.3. Construction work requires the use of a range of site plant, such as excavators, piling rigs, cranes and on-site generators. All construction plant have an energy demand, and some may result in direct emissions to air from exhaust.

5.6.4. Given the local and temporary nature of site plant, plant emissions are considered to have a negligible impact on local air quality and consequently will not be assessed within the EIA.

5.6.5. Construction phase traffic flows could affect air quality at the selected human health receptors and ecologically designated sites within 200 metres of the routes, which they use to travel to and from the site. Where changes in HDV is greater than 200 movements per day, for a period of two years or more, as per the requirements set out within DMRB LA 105 Air Quality, the effect on local air quality will be assessed.

OPERATION

5.6.6. Potential effects on air quality during the operational phase will include:

- Changes in emissions associated with changes in traffic flows (including composition and speed) on the local road network; and
- Changes in road layout which may bring road traffic emission sources closer to, or farther away from, sensitive receptors.

5.6.7. The pollutants that will be considered in the assessment of operational phase air quality effects are:

- Nitrogen oxides (NOx), including nitrogen dioxide (NO_2);
- Particulate matter (PM_{10}) defined as those less than 10 microns in diameter; and
- Particulate matter ($PM_{2.5}$) defined as those less than 2.5 microns in diameter.

5.6.8. No assessment is considered necessary for emissions of any pollutants other than those identified above, as no significant emission sources of these pollutants will be introduced or affected by the

C2C Scheme, and because their total concentrations are expected to be well below air quality objectives within the study area.

5.7 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

5.7.1. The following impacts on air quality will be considered in the ES:

- Impacts associated with construction dust; and
- Changes in air quality resulting from changes in traffic flows (during construction and operational phases).

SCOPED OUT

5.7.2. The following impacts on air quality will not be considered in the ES:

- Impacts associated with non-traffic related emissions during operation will not be considered in the ES; and
- Changes in air quality associated with construction plant emissions.

6 BIODIVERSITY

6.1 INTRODUCTION

6.1.1. This chapter presents the proposed scope and approach to identifying and assessing likely significant impacts and effects on biodiversity resulting from the construction and operation of the C2C Scheme and identifying the requirement for any protected species licences. Where additional measures are required to mitigate likely significant environmental effects, these will be identified following the assessment of effects and a residual assessment undertaken. The C2C Scheme seeks to deliver BNG. It is proposed to identify and describe this provision in an Appendix to the ES though the BNG will not be assessed as part of the C2C Scheme for EIA purposes.

6.1.2. Ecology surveys to inform this scheme have been undertaken over a number of years, and in some cases the survey data is now out of date. Some surveys will be undertaken in 2022 in order to update historic survey data. The reports and survey information that have been reviewed to inform this EIA Scoping Report form part of ongoing ecological surveys, scoping exercises and stakeholder consultation that should continue into 2022. The assessment methodology, baseline, potential impact and proposed scope sections of this chapter may therefore be subject to change.

6.1.3. As the C2C Scheme alignment has changed since the previous surveys were carried out, any references to scheme or survey areas in Section 6.5 regarding baseline (i.e. the 'Site', 'Survey Area', 'Proposed Scheme' etc) are used as per the definitions in the associated report (as listed in section 6.4) based on the alignment as it was at the time

6.2 LEGISLATION AND POLICY

NATIONAL LEGISLATION AND POLICY

6.2.1. The key legislation relating to ecology and the environment is the Conservation of Habitats and Species Regulations 2017 (as amended), and the Wildlife and Countryside Act (WCA) (1981), (as amended) and, from November 2021, the Environment Act 2021. Together, these form the framework for species and habitat protection in England. Badgers are protected under the Protection of Badgers Act 1992. All hedgerows are protected by the Hedgerow Regulations 1997.

6.2.2. Identified within the National Planning Policy Framework[34] (NPPF), the UK Government has committed to promoting sustainable development by ensuring that biological diversity is conserved and enhanced as an integral part of any development. It clearly states that a development should

[34] Ministry of Housing, Communities and Local Government (2021). National Planning Policy Framework. Available at: National Planning Policy Framework (publishing.service.gov.uk) [Accessed November 2021].

seek to minimise impacts on biodiversity, provide net gains in biodiversity and establish coherent ecological networks that are more resilient to current and future pressures.

6.2.3. Section 15, paragraph 180 states that: "When determining planning applications, local planning authorities should apply the following principles: a) if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused; b) development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest; c) development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists; and d) development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around developments should be integrated as part of their design, especially where this can secure measurable net gains for biodiversity or enhance public access to nature where this is appropriate".

6.2.4. Under the Natural Environment and Rural Communities (NERC) Act 2006, all public bodies are required to have regard to biodiversity conservation when carrying out their function. Under this act a list of habitats and species that are of principal importance for the conservation of biodiversity in England are published under Section 41 (S41). These include those former UK Biodiversity Action Plan (UK BAP) priority habitats and species that occur in England.

6.2.5. The Cambridgeshire and Peterborough Biodiversity Group provide BAPs[35], now known as UK Priority Habitats and Species, for the habitats and species within Cambridgeshire. The Cambridgeshire and Peterborough Biodiversity Group lists the following UK Priority Habitats found in Cambridgeshire and Peterborough:

- Rivers;
- Ponds;
- Eutrophic standing waters;
- Arable field margins;
- Hedgerows;
- Traditional orchards;

[35]Cambridgeshire and Peterborough Biodiversity Group (2019). Priority Species and Habitats. Available at: http://www.cpbiodiversity.org.uk/biodiversity-action-plans [Accessed November 2021]

- Wood-pasture and parkland;
- Wet woodland;
- Lowland mixed deciduous woodland;
- Lowland dry acid grassland;
- Lowland calcareous grassland;
- Lowland meadows;
- Coastal and floodplain grazing marsh;
- Lowland fens;
- Reedbeds; and,
- Open mosaic habitats on previously developed land.

6.2.6. The Cambridgeshire and Peterborough Biodiversity Group lists 205 UK Priority Species found in Cambridgeshire and Peterborough, including the following species considered to be potentially relevant to the Site due to surveys undertaken to date: Eurasian curlew *Numenius arquata*, common linnet *Carduelis cannabina* subsp. *autochthona/cannabina*, corn bunting *Emberiza calandra* subsp. *calandra/clanceyi*, northern lapwing *Vanellus vanellus*, skylark *Alauda arvensis* subsp. *arvensis/scotica*, yellowhammer *Emberiza citrinella*, common toad *Bufo bufo* , great crested newt *Triturus cristatus*, adder *Vipera berus*, common lizard *Zootoca vivipara*, slow-worm *Anguis fragilis*, grass snake *Natrix helvetica*, barbastelle bat *Barbastella barbastellus*, brown hare *Lepus europaeus*, soprano pipistrelle *Pipistrellus pygmaeus*, noctule *Nyctalus noctula*, brown long-eared bat *Plecotus auritus*, soprano pipistrelle *Pipistrellus pygmaeus*, water vole *Arvicola terrestris*, otter *Lutra lutra*, and West European hedgehog *Erinaceus europaeus*.

LOCAL PLANS

6.2.7. A number of policies are relevant to biodiversity within the Cambridge Local Plan (2018)[36] as detailed below:

- Policy 69: Protection of sites of biodiversity and geodiversity importance.
- Policy 70: Protection of priority species and habitats.
- Policy 71: Trees.

6.2.8. The Cambridgeshire Green Infrastructure Strategy[37] has been produced to assist in shaping and coordinating the delivery of green infrastructure in the county. The first of the four main strategies relates to biodiversity: “Reversing the decline in biodiversity. The objective of this strategy is to

[36] UK Government (2018) Cambridge Local Plan. https://www.cambridge.gov.uk/media/6890/local-plan-2018.pdf [Accessed November 2021].

[37] Cambridgeshire County Council (2011). The Cambridgeshire Green Infrastructure Strategy Available at: https://www.cambridge.gov.uk/media/2557/green-infrastructure-strategy.pdf [Accessed November 2021].

conserve and enhancing biodiversity, through the protection and enhancement of habitats (terrestrial and aquatic) and wildlife sites and linkage of key habitats".

6.2.9. Furthermore, the South Cambridgeshire Local Plan[38] detailed the following policies which are relevant to biodiversity:

- Policy NH/4: Biodiversity;
- Policy NH/5: Sites of Biodiversity or Geological Importance;
- Policy NH/6: Green Infrastructure; and,
- Policy NH/7: Ancient Woodlands and Veteran Trees.

6.2.10. These policies detail that development proposals where the primary objective is to conserve or enhance biodiversity will be permitted and new developments must aim to maintain, enhance, restore or add to biodiversity.

6.2.11. Through implementation of these policies, the latest Defra biodiversity net gain metric will be applied to the C2C Scheme with the commitment to achieve net gain in biodiversity.

6.2.12. South Cambridgeshire District Council have also produced the South Cambridgeshire Biodiversity Supplementary Planning Document[39], which provides additional details on how policies will be implemented to ensure that biodiversity is adequately protected and enhanced throughout the development process. It seeks to ensure that biodiversity and appropriate landscaping are fully integrated to new developments in order to create accessible green spaces for wildlife and people, to contribute to a high quality natural and built environment, and to contribute to a better quality of life.

6.2.13. To further support these policies, Natural Cambridgeshire Local Nature Partnership (LNP)[40] has developed a toolkit which identifies how developments can contribute to the policy of achieving a net gain in biodiversity.

6.3 ECOLOGICAL ZONES OF INFLUENCE

6.3.1. The C2C Scheme was reviewed to identify the spatial scale at which ecological features could be affected as a result of the C2C Scheme and associated activities. This is defined as the Ecological Zone of Influence (EZoI). Areas within the EZoI may include:

[38] South Cambridgeshire County Council (2018). South Cambridgeshire County Council Local Plan. Available at: https://www.scambs.gov.uk/planning/local-plan-and-neighbourhood-planning/the-adopted-development-plan/south-cambridgeshire-local-plan-2018/ [Accessed November 2021].

[39] South Cambridgeshire District Council (2009). South Cambridgeshire Biodiversity Supplementary Planning Document. Available at: https://www.scambs.gov.uk/media/6675/adopted-biodiversity-spd.pdf [Accessed November 2021].

[40] Natural Cambridgeshire Local Nature Partnership (LNP) (2018). Natural Cambridgeshire Developing with Nature Toolkit. Available at: https://naturalcambridgeshire.org.uk/wp-content/uploads/2018/10/nc-developing-with-nature-toolkit.pdf [Accessed November 2021].

- Areas directly within the land take for the C2C Scheme and associated infrastructure; and
- Areas beyond the C2C Scheme boundary from which impacts described are likely.

6.3.2. The current guidance on ecological assessments[41] recommends that all ecological features that occur within an EZoI for a scheme are investigated. To achieve this, Survey Areas have been defined in Table 6-1 based on the EZoI for each ecological feature. These form the Study Area as described in DMRB guidance LA108, and indicate the area to be considered for survey. The actual areas to be covered by field surveys will be determined based a number of factors, including ongoing scoping exercises, access availability, habitat suitability and changes in the scheme. The areas covered by each feature of the desk study are hereafter individually referred to as the 'Desk Study Area'. The broad areas within which each type of field survey should be undertaken (where there is suitable habitat) are hereafter individually referred to as the 'Survey Area'. Table 6-1 below therefore details the maximum potential Desk Study Areas and Survey Areas required to inform this assessment, and these areas are subject to change.

6.3.3. Surveys should be targeted in areas of suitable habitat within the Survey Area, depending on the survey type and/or target species where appropriate, and in accordance with best practice guidance.

6.3.4. The EZoI will vary for different ecological features depending on their sensitivity to an environmental change. The geographical areas for obtaining ecological data through desk studies and field-based surveys are based on the potential impacts of the C2C Scheme on ecological features and accepted best practice survey guidance (Table 6-1).

6.3.5. The EZoIs are informed by the scheme design, desk studies and surveys and will be regularly reviewed and amended as the project evolves. The EZoI information and Survey Areas provided throughout this chapter are therefore subject to change. The EZoIs and therefore Survey Areas may also require updating following consultation with the council (and where necessary, Natural England).

6.3.6. Survey Areas and Desk Study Areas used to date have been based on C2C Scheme alignments that were understood to be correct at the time the reports were written. As minor changes to the alignment have been made, the EZoI is now slightly altered as based on the location of the current C2C Scheme boundary, therefore the Survey Area and Desk Study Areas should also be altered accordingly. Any references to the C2C Scheme alignment in describing the baseline in Section 6.5 refer to the alignment as it was at the time of the survey (as described in the associated report listed in Section 6.4). Future surveys should be based on the updated Red Line Boundary (RLB) for the C2C Scheme, and the revised potential Desk Study Areas and Survey Areas presented in Table 6-

[41] Chartered Institute of Ecology and Environmental Management (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal. Available at: Combined-EclA-guidelines-2018-compressed.pdf (cieem.net) [Accessed 01 December 2021].

1. A scope review is being undertaken to determine any significant gaps in previous surveys as a result of the C2C Scheme changes.

6.3.7. The EZoI for aquatic features and therefore Survey Area for any additional aquatic surveys should be defined once the scoping survey has been undertaken in January to February 2022.

6.3.8. The Desk Study Area and Survey Area for bats is based on the maximum potential Desk Study Area and Survey Area for bat radiotracking surveys (requirements to be confirmed following consultation) and will be refined as the project evolves.

6.3.9. A scoping exercise to determine the appropriate level of survey of any compensation areas should also be undertaken once these compensation areas have been identified

Table 6-1 – Desk study areas and survey areas based on zone of influence

Ecological Feature	Relevant Survey Guidance	Desk Study Area	Survey Area[42]
Statutory Designated sites	Design Manual for Roads and Bridges (DMRB) *LA 115 Sustainability and environment. Appraisal. Habitats regulations assessment* (HE, 2019). (formerly 44/09, DMRB 11.4.1) and CIEEM (2018)[41] *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal.*	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	N/A
International statutory designated sites for bats	Design Manual for Roads and Bridges (DMRB) *LA 115 Sustainability and environment. Appraisal. Habitats regulations assessment* (HE, 2019). (formerly 44/09, DMRB 11.4.1.)	Within and up to 30km beyond the Red Line Boundary of the C2C Scheme	N/A
Non-statutory designated sites	CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal.*	Within and up to 1km beyond the Red Line Boundary of the C2C Scheme	N/A
Protected Species / Habitat Surveys			
Badger	Harris *et al*., (1989) Surveying Badgers Design Manual for Roads and Bridges (DMRB) *LD 118 Biodiversity design* (formerly LA 118)	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Within and up to 250m beyond the Red Line Boundary of the C2C Scheme.

[42] Excluding unsuitable habitat and land separated from the Scheme by significant barriers

[43] Harris et al (1989). Surveying Badgers. The Mammal Society.

Ecological Feature	Relevant Survey Guidance	Desk Study Area	Survey Area[42]
Barn owl	Shawyer (2011) Barn Owl *Tyta alba* Survey Methodology and Techniques for use in Ecological Assessment. The Barn Owl Trust. Survey Techniques, Leaflet no. 8. Gilbert *et al.,* (1998) Bird Monitoring Methods. A Manual of techniques for Key UK Species.	Within and up to 5km beyond the Red Line Boundary of the C2C Scheme	Up to 1.5km either side of the centre line of the motorised section of the C2C Scheme (plus the land within and adjacent to the Red Line Boundary of the C2C Scheme along Scotland Road, as a non-motorised road is planned for this section).
Bats	Bat Conservation Trust (2016). Good Practice Guidelines: Bat Surveys for Professional Ecologists	TBC following survey and consultation.	TBC following survey and consultation.
Botany	National Vegetation Classification (NVC)	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Key areas of habitat within and up to 250m beyond the Red Line Boundary of the C2C Scheme
Breeding birds	Common Bird Census (1983) British Trust for Ornithology.	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Within and up to 250m beyond the Red Line Boundary of the C2C Scheme
Brown hare	Wiltshire Mammal Group (2015) Brown Hare Surveys 2015-2016 British Trust for Ornithology (1999) Developing a mammal monitoring programme for the UK	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Within and up to 250m beyond the Red Line Boundary of the C2C Scheme
Great crested newts	English Nature (2001) Great crested newt mitigation guidelines	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Within and up to 250m beyond the Red Line Boundary of the C2C Scheme
Habitats and invasive or notable plant species	UK Habitat Classification Habitat Definitions Version 1.1 (UK Habitat Classification Working Group, 2020) [44] Biodiversity Metric 3.0 Technical Supplement (Natural England, 2021)[45]	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Within the Red Line Boundary of the C2C Scheme
Hedgerows	Department for Environment Food and Rural Affairs (2007) Hedgerow Survey Handbook (2nd edition)	Within and up to 2km beyond the Red Line	Hedgerows directly impacted by the C2C Scheme

[44] Uk Habitat classification working group (2020). UK Habitat Classification Habitat Definitions Version 1.1

[45] Natural England (2011). The Biodiversity Metric 3.0. Available at: http://publications.naturalengland.org.uk/publication/6049804846366720. [Accessed December 2021].

[46] Department for Environment Food and Rural Affairs (2007). Hedgerow Survey Handbook (2nd edition)

Ecological Feature	Relevant Survey Guidance	Desk Study Area	Survey Area[42]
		Boundary of the C2C Scheme	
Invertebrates	Drake et al., (2007) Surveying terrestrial and freshwater invertebrates for conservation evaluation	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Within the Red Line Boundary of the C2C Scheme.
Reptiles	Froglife (1999) Advice Sheet 9: Reptile Survey	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Within the Red Line Boundary of the C2C Scheme
Water vole and otter	Strachen & Moorhouse (2006) Water Vole Conservation Handbook Dean, et al., (2016). The Water Vole Mitigation Handbook[47] Chanin, P. (2003). Monitoring the Otter *Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series No. 10, English Nature, Peterborough.	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Within and up to 250m beyond the Red Line Boundary of the C2C Scheme
White clawed crayfish	Peay S (2003). Monitoring the White-clawed Crayfish *Austropotamobius pallipes* . Conserving Natura 2000 Rivers Monitoring Series No. 1. English Nature, Peterborough.	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Within and up to 250m beyond the Red Line Boundary of the C2C Scheme, and 300m upstream/downstream of C2C Scheme crossing point on Bin Brook.
Wintering Birds	Bibby *et al.,* (2000) Bird Census Techniques (2nd Edition)	Within and up to 2km beyond the Red Line Boundary of the C2C Scheme	Within and up to 250m beyond the Red Line Boundary of the C2C Scheme.
Aquatic features	To be determined following the aquatic scoping survey	TBC	TBC

[47] Dean, M. Strachan, R. Gow, D. Andrews, R. Matthews, F. Chanin, P, R, F (2016). The Water Vole Mitigation Handbook

[48] Peay S (2003). Monitoring the White-clawed Crayfish *Austropotamobius pallipes*.

6.4 ASSESSMENT METHODOLOGY

SURVEYS

6.4.1. The following reports of surveys undertaken to date have been reviewed to inform this ES Scoping Report:

- Badger Survey Report[49];
- Barn Owl Survey and Mitigation Considerations[50];
- Barn Owl Survey Report[51];
- Botany Survey Report[52];
- Breeding Bird Survey Report[53];
- Brown Hare Survey Report[54];
- C2C Bat Activity Survey Summary[55];
- Cambourne to Cambridge Better Public Transport: Phase 1 Habitat Survey, Hedgerow and Invertebrate Assessment[56];
- Cambourne to Cambridge Better Public Transport: Stage 1 Bat Inspection Survey 2021[57];
- Cambourne to Cambridge Better Public Transport: Breeding Bird Survey 2021[58];
- Cambourne to Cambridge Better Public Transport: Great Crested Newt eDNA Survey, 2021 Update[59];
- Cambourne to Cambridge Better Public Transport: Phase 1 Habitat Survey Appendix 5: Hedgerow Assessment 2021[60];
- Cambourne to Cambridge Better Public Transport: Phase 1 Habitat Survey Appendix 4: Invertebrate Habitat Assessment 2021[61];

[49] Cambridge Ecology (2018). Badger Survey Report.

[50] Wildlife Conservation Partnership (2020). Barn Owl Survey and Mitigation Considerations Cambourne to Cambridge (C2C) and Cambridge South East Transport (CSET) Phase 2 (The Greater Cambridgeshire Partnership).

[51] Cambridge Ecology (2019). Barn Owl Survey Report.

[52] Cambridge ecology (2018). Botany Survey Report.

[53] Cambridge Ecology (2018). Breeding Bird Survey Report.

[54] Cambridge Ecology (2019). Brown Hare Survey Report.

[55] Thomson Environmental Consultants (2021). C2C Bat Activity Survey Summary.

[56] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: Phase 1 Habitat Survey, Hedgerow and Invertebrate Assessment.

[57] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: Stage 1 Bat Inspection Survey 2021.

[58] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: Breeding Bird Survey 2021.

[59] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: Great Crested Newt eDNA Survey, 2021 Update.

[60] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: Phase 1 Habitat Survey Appendix 5: Hedgerow Assessment 2021.

[61] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: Phase 1 Habitat Survey Appendix 4: Invertebrate Habitat Assessment 2021.

- Cambourne to Cambridge Better Public Transport: Phase 2 Vegetation (NVC) Survey of Semi-natural Woodland, Un-improved Grassland and Arable Field Margins 2021[62];
- Cambourne to Cambridge Better Public Transport: Reptile Survey 2021[63]
- Cambourne to Cambridge Better Public Transport: Stage 2 Bat Activity 2021[64];
- Cambourne to Cambridge Better Public Transport: Water Vole and Eurasian Otter Presence Absence Survey 2021[65];
- Cambourne to Cambridge Better Public Transport: White-clawed Crayfish Presence Absence Survey 2021[66];
- eDNA Great Crested Newt Report[67];
- Great Crested Newt Survey Report[68];
- Invertebrate Survey Report[69];
- Phase 1 Habitat Survey Report[70];
- Protected Species Constraints Survey Report[71];
- Reptile Survey Report[72];
- Stage 1 Bat Inspection Survey Report[73];
- Stage 2 Bat Activity Survey Report 2020 final[74];
- Water Vole Survey Report[75]; and
- Winter Bird Survey Report[76].

6.4.2. The following documents relevant to biodiversity and the natural environment have also been reviewed to inform this EIA Scoping Report.

[62] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: Phase 2 Vegetation (NVC) Survey of Semi-natural Woodland, Un-improved Grassland and Arable Field Margins 2021.

[63] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: Reptile Survey 2021.

[64] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: Stage 2 Bat Activity 2021.

[65] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: Water Vole and Eurasian Otter Presence Absence Survey 2021.

[66] Cambridge Ecology (2021). Cambourne to Cambridge Better Public Transport: White-clawed Crayfish Presence Absence Survey 2021.

[67] Cambridge Ecology (2018). eDNA Great Crested Newt Report and associated updated report.

[68] Cambridge Ecology (2018). Great Crested Newt Survey Report.

[69] Cambridge Ecology (2018). Invertebrate Survey Report.

[70] Cambridge Ecology (2018). Phase 1 Habitat Survey Report.

[71] Cambridge Ecology (2017). Protected Species Constraints Survey Report.

[72] Cambridge Ecology (2018). Reptile Survey Report.

[73] Cambridge Ecology (2019). Stage 1 Bat Inspection Survey Report.

[74] Cambridge Ecology (2020). Stage 2 Bat Activity Survey Report 2020 final.

[75] Cambridge Ecology (2018). Water Vole Survey Report.

[76] Cambridge Ecology (2019). Winter Bird Survey Report.

- C2C – OBC 2020 – Risk Register Appendix P[77];
- C2C- Jan 2020 - App 1 - Strategic Case[78];
- C2C-OBC-2020-Environmental-Appraisal-Report-Appendix-I[79];
- C2C-OBC-2020-Options-Appraisal-Report-Part-1-Appendix-A[80];
- C2C-OBC-2020-Options-Appraisal-Report-Part-2-Appendix-B[81];
- C2C-OBC-2020-Options-Appraisal-Report-Part-3-Appendix-C[82];
- Draft EIA Scoping Report[83]; and
- Technical Note[84]

6.4.3. The 2017-2019 ecological surveys were previously discussed with the CCC's Ecology Officer, including a meeting in February 2020, to ensure they covered the required survey areas, and to review their validity. Further liaison with Local Authority is being undertaken to review the scope and timing of existing and proposed surveys.

6.4.4. The survey strategy has been developed with reference to BS 42020:2013 Biodiversity: Code of Practice for Planning and Development[85]. This sets out optimal approaches to surveying with respect to timing, duration, spatial coverage and longevity. It considers that survey shelf life should be no more than two to three years old, unless there are exceptional reasons that demonstrate conditions have remained unchanged. The proposed strategy for ecological survey is set out below in Table 6-2.

[77] Mott MacDonald (2020). Risk Register – Outline Business Case – Appendix P.

[78] Mott MacDonald (2020). Cambourne to Cambridge Better Public Transport Project – Outline Business Case/ Strategic Case

[79] Mott MacDonald (2020). Environmental Appraisal Report – Outline Business Case – Appendix I

[80] Mott MacDonald (2018). Cambourne – Cambridge Better Public Transport Project – Options Appraisal Report (Part 1).

[81] Mott MacDonald (2018). Cambourne – Cambridge Better Public Transport Project – Options Appraisal Report (Part 2).

[82] Mott MacDonald (2019). Options Appraisal Report (Part 3) – Outline Business Case Appendix C.

[83] Mott Macdonald (2020). Draft EIA Scoping Report.

[84] Mott Macdonald (2020). Technical Note.

Table 6-2 – Ecological survey summary

Ecological survey	Dates of completed surveys	Survey data valid until	Planned surveys
Protected species and habitat scoping survey and biological records update			November 2021 to July 2022 (to resolve 2021 access limitations, changes due to C2C Scheme re-alignment, and to obtain recent records)
Phase 1 Habitat survey	August 2017, May – July 2021	July 2023	N/A
UK Habitat Classification survey (UKHab) plus survey for invasive or notable plant species	November 2021 (Coton Orchard only)	November 2023 (Coton Orchard only)	May to July 2022 (if required to update survey data and/or resolve previous access limitations)
Botany survey – including National Vegetation Classification (NVC)	April to September 2018, June to July 2021	July 2023	May to August 2022 (to resolve 2021 access limitations)
Hedgerow survey	April to July 2021	July 2023	November 2021 to July 2022 (to resolve 2021 access limitations)
Aquatic scoping survey	N/A	N/A	January to February 2022 (need for further aquatic surveys TBC following scoping)
Bats – Stage 1 (ground level tree assessments)	December 2018 to February 2019, March 2021	March 2023	November 2021 to February 2022 (to resolve 2021 access limitations)
Bats – Stage 1 (buildings)	March 2021	March 2023	January to August 2022 (to resolve 2021 access limitations)
Bats – Stage 2 (emergence/re-entry and static survey)	Emergence surveys: May to September 2019, May to July 2021	July 2023	May to August 2022 (if required to update survey data – including bat activity transect survey

Ecological survey	Dates of completed surveys	Survey data valid until	Planned surveys
	Static surveys: June to October 2019, April/May 2020	October 2021	data – and/or resolve previous access limitations)
Bats – activity transect surveys	May to June 2021	June 2023	N/A - Static detector surveys will be undertaken in the activity season if required.
Bats – crossing point surveys (linear features)	June to July 2021	July 2023	May to September 2022 (if required to update survey data and resolve previous access limitations)
Bats – winter hibernation survey of trees and buildings	N/A	N/A	January to March 2022
Bats – winter activity survey	N/A	N/A	November 2021 to April 2022
Bats – radiotracking survey	N/A	N/A	May to August 2022 (TBC following ongoing consultation)
Badger surveys	November 2017 to January 2018	January 2020	January to March 2022
Breeding bird survey	April to June 2018, April to June 2021	June 2023	March to June 2022 (if necessary to resolve 2021 access limitations)
Barn Owl – Stage 1 desk study update	August 2017, May 2020	May 2022	December 2021 to July 2022
Barn Owl – Stage 2 and 3	November 2018 to January 2019	January 2021	January to July 2022
Winter bird survey	November 2018 to March 2019	March 2021	January to March 2022 (to update survey data and resolve previous access limitations)
eDNA surveys for GCN	April to June 2017, 2018, 2019, 2021	June 2022	April - June 2022 (to update survey data and

Ecological survey	Dates of completed surveys	Survey data valid until	Planned surveys
			resolve 2021 access limitations)
GCN population survey	April to June 2018	June 2020	March to June 2022 (if required due to positive eDNA results)
Reptile survey	April to July 2018, April to June 2021	June 2023	April to May 2022 (to resolve 2021 access limitations)
Invertebrate survey	April to September 2018	September 2020	April to September 2022 (to resolve 2021 access limitations)
Invertebrate Habitat Assessment	June 2021	June 2023	Not required – see Section 7.5
Water vole and otter survey	April to July 2018, April to May 2021	May 2023	April – August 2022 (to undertake early- and late-season visits and resolve 2021 water vole and otter access limitations)
White-clawed crayfish survey	September 2021	September 2023	July 2022 (if required to resolve 2021 access limitations)
Brown Hare survey	December 2018 to March 2019	March 2021	Not required – see Section 7.5

ASSESSMENT APPROACH

Ecological Impact Assessment (EcIA)

6.4.5. The impact assessment on biodiversity will be undertaken in accordance with the following guidance:

- DMRB LA 108 Biodiversity[86];
- Chartered Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment in the UK[87]; and
- CIEEM Sources of Survey Methods.

6.4.6. The assessment of the potential impacts takes into account both impacts within the C2C Scheme boundary and those that could occur beyond the C2C Scheme boundary. Following the assessment of likely significant effects, consideration will be given to appropriate mitigation measures required and an assessment undertaken of the significance of effects of residual impacts. CIEEM Guidance[41] will be used to help evaluate sites, habitats and species and to assess the effects on ecological integrity to help apply the DMRB method.

6.4.7. Following the completion of further surveys and the assessment of impacts, mitigation measures to avoid or reduce any adverse effects will be identified and developed, and any residual significant effects that may need compensating for will be evaluated. If mitigation is identified for likely significant effects then the appropriateness of monitoring measures will be considered.

Habitats Regulations Assessment (HRA)

6.4.8. Eversden and Wimpole Woods Special Area of Conservation (SAC) is designated for the presence of barbastelle bats. There are also records of a barbastelle maternity colony at Madingley Woods SSSI. The SAC is located within 7km of the project and therefore a Habitat Regulations Assessment (HRA) will be required.

6.4.9. An HRA report will be produced in parallel to the EIA process in accordance with the Conservation of Habitats and Species Regulations 2017, in relation to European designated sites.

Biodiversity Net Gain (BNG)

6.4.10. Delivering biodiversity net gain is anticipated to become a legal requirement (likely in 2023) in accordance with the Environment Act 2021. A BNG assessment will be undertaken in respect of the C2C Scheme. Although the findings of the BNG assessment will be presented in an appendix to the ES, the assessment of the likely significant effects of the C2C Scheme will not include the proposed BNG.

[86] Highways England (2020). Design Manual for Roads and Bridges (DMRB) LA 108 Biodiversity. Available at: https://www.standardsforhighways.co.uk/dmrb/search/af0517ba-14d2-4a52-aa6d-1b21ba05b465 [Accessed 29 November 2021]

[87] CIEEM (2018). Guidelines For Ecological Impact Assessment in the UK and Ireland. Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-Sept-2019.pdf [Accessed 8 December 2021]

SIGNIFICANCE CRITERIA

6.4.11. The value (sensitivity) of ecological features and nature conservation resources will be assessed in accordance with Highways England DMRB LA 108 Biodiversity[86] guidance and refer to Guidelines for Ecological Impact Assessment in the UK[41].

6.4.12. The value (sensitivity) of ecological features and nature conservation resources will be assessed using the criteria outlined in Table 6-3. Following this, the characterisation of ecological impacts will be undertaken and will include consideration of the value, integrity and conservation status of the resource affected, and a characterisation of the impact, which will consider:

- Positive or negative (e.g. adverse/beneficial);
- Duration (e.g. permanent/temporary);
- Reversibility (e.g. irreversible/reversible);
- Extent/magnitude; and
- Frequency and timing.

Table 6-3 – Biodiversity resource importance

Resource	Description of Importance
International or European importance	
Designated Sites	Sites including: 1) European sites: a) Sites of Community Importance (SCIs); b) Special Protection Areas (SPAs); c) potential SPAs (pSPAs); d) Special Areas of Conservation (SACs); e) Candidate or possible SACs (cSACs or pSACs); f) Wetlands of International Importance (Ramsar sites). 2) Biogenetic Reserves, World Heritage Sites (where recognised specifically for their biodiversity value) and Biosphere Reserves. 3) Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such
Habitats	N/A
Species	Resident, or regularly occurring, populations of species which can be considered at an international or European level where: 1) the loss of these populations would adversely affect the conservation status or distribution of the species at an international or European scale; or2) the population forms a critical part of a wider population at this scale; or3) the species is at a critical phase of its life cycle at an international or European scale.
UK or National Importance	
Sites	Sites including:

Resource	Description of Importance
	1) Sites of Special Scientific Interest (SSSIs) or Areas of Special Scientific Interest (ASSIs); 2) National Nature Reserves (NNRs); 3) National Parks; 4) Marine Protected Areas (MPAs) including Marine Conservation Zones (MCZs); or 5) areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such.
Habitats	Habitats including: 1) Habitats of Principal Importance (HPI); 2) habitats included in the relevant statutory list of priority species and habitats; and 3) areas of irreplaceable habitats including: a) ancient woodland; b) ancient or veteran trees; c) blanket bog; d) limestone pavement; e) sand dunes; f) salt marsh; g) lowland fen. 4) areas of habitat which meet the definition for habitats listed above but which are not themselves designated or listed as such.
Species	Resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: 1) the loss of these populations would adversely affect the conservation status or distribution of the species at a UK or national scale; or 2) the population forms a critical part of a wider population at this scale; or 3) the species is at a critical phase of its life cycle at a UK or national scale.
Regional Importance	
Sites	Designated sites (non-statutory) including heritage coasts.
Habitats	Areas of habitats identified (including for restoration) in regional plans or strategies (where applicable).
Species	Species including: 1) resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: a) the loss of these populations would adversely affect the conservation status or distribution of the species at a regional scale; or

Resource	Description of Importance
	b) the population forms a critical part of a wider regional population; or c) the species is at a critical phase of its life cycle; 2) Species identified in regional plans or strategies.
County or equivalent authority importance	
Sites	Wildlife / nature conservation sites designated at a county (or equivalent) level including: 1) Local Wildlife Sites (LWS); 2) Local Nature Conservation Sites (LNCS); 3) Local Nature Reserves (LNRs); 4) Sites of Importance for Nature Conservation (SINCs); 5) Sites of Nature Conservation Importance (SNCIs); 6) County Wildlife Sites (CWSs);
Habitats	Areas of habitats identified in county or equivalent authority plans or strategies (where applicable).
Species	Species including: 1) resident, or regularly occurring, populations of species which can be considered at an international, European, UK or national level where: a) the loss of these populations would adversely affect the conservation status or distribution of the species at a county or unitary authority scale; or b) the population forms a critical part of a wider county or equivalent authority area population, e.g. metapopulations; or c) the species is at a critical phase of its life cycle. 2) Species identified in a county or equivalent authority area plans or strategies.
Local Importance	
Sites	Wildlife / nature conservation sites designated at a local level including: 1) Local Wildlife Sites (LWS); 2) Local Nature Conservation Sites (LNCS); 3) Local Nature Reserves (LNRs); 4) Sites of Importance for Nature Conservation (SINCs); 5) Sites of Nature Conservation Importance (SNCIs); 6) Sites of Local Nature Conservation Importance (SLNCIs); 7) City Wildlife Sites.
Habitats	Areas of habitat considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal, or genetic exchange.

Resource	Description of Importance
Species	Populations / communities of species considered to appreciably enrich the habitat resource within the local context including features of importance for migration, dispersal or genetic exchange.

Source: DMRB LA108 Biodiversity[35]

6.4.13. The definition of significance will be taken from the EcIA guidelines and DMRB guidance. The importance of the feature (identified in Table 6-3) and level of impact (identified in Table 6-4) shall be used to determine the significance of effect on the ecological features (Table 6-5).

6.4.14. CIEEM[41] defines a significant effect as one "that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general". For designated sites, impacts shall be considered significant when the C2C Scheme and associated activities affect the integrity of the site in terms of the coherence of its ecological structure and function or the impact on the site is likely to be significant in terms of its ecological objectives

6.4.15. For ecosystems, effects shall be considered significant when the C2C Scheme and associated activities result in a change in ecosystem structure and function that reduces its ability to sustain the habitat, complex of habitats and/or the population levels of species of interest.

Table 6-4 – Level of impact and typical description[36]

Level of Impact (Change)		Typical Description
Major	Adverse	1) Permanent/irreversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.
	Beneficial	1) Permanent addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource.
Moderate	Adverse	1)Temporary/ reversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact negatively affects the integrity or key characteristics of the resource.
	Beneficial	1)Temporary addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact positively affects the integrity or key characteristics of the resource.
Minor	Adverse	1) Permanent/irreversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
	Beneficial	1) Permanent addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
Negligible	Adverse	1)Temporary/ reversible damage to a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.

Level of Impact (Change)		Typical Description
	Beneficial	1)Temporary addition of, improvement to, or restoration of a biodiversity resource; and 2) the extent, magnitude, frequency, and/or timing of an impact does not affect the integrity or key characteristics of the resource.
No change		No observable impact, either positive or negative

Table 6-5 – Significance matrix[88]

Resource Importance	Level of Impact					
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
	International or European importance	Neutral	Slight	Moderate or large	Large or very large	Very large
	UK or national importance	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Regional importance	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	County or equivalent authority importance	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Local importance	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

6.5 BASELINE

6.5.1. Completed and planned surveys (see Table 7.2) as well as data collected from the following sources will be used in developing a thorough understanding of the biodiversity baseline:

- Desk based data search (information collated using Multi-Agency Geographic Information for the Countryside, Joint Nature Conservation Committee[89], Cambridgeshire and Peterborough

[88] Highways England (2020). Design Manual for Roads and Bridges (DMRB) LA 108 Biodiversity. Available at: https://www.standardsforhighways.co.uk/dmrb/search/af0517ba-14d2-4a52-aa6d-1b21ba05b465 [Accessed 29 November 2021]

[89] Joint Nature Conservation Committee (JNCC) and Department for Environment, Food and Rural Affairs (Defra) (on behalf of the Four Countries' Biodiversity Group) (2012). UK Post-2010 Biodiversity Framework. Available at: http://jncc.defra.gov.uk/pdf/UK_Post2010_Bio-Fwork.pdf [Accessed 01 December 2021].

Biodiversity Group[90] and Natural England National Character Area Profile 88 Bedfordshire and Cambridgeshire Claylands); and

- Third party data including Bourn Airfield, Volume One, Two and Three – Environmental Statement[91].

6.5.2. Access constraints prevented surveyors from surveying certain areas along the route during protected species and habitat surveys undertaken to date. Access issues are currently being addressed where possible. The acquisition of third-party survey data for sections of the C2C Scheme is also in progress.

6.5.3. An updated biological records search for the entire C2C Scheme should be undertaken in winter 2021 due to the time elapsed since biological records were last obtained[92].

DESIGNATED SITES

Statutory sites for nature conservation

6.5.4. There are three statutory designated sites[93] within 2km of the C2C Scheme, namely:

- Madingley Wood Site of Special Scientific Interest (SSSI) 0.3km to the north;
- Caldecote Meadows SSSI 1.6km to the south; and,
- Hardwick Wood SSSI 1.7km to the south.

6.5.5. The only internationally designated site for bats located within 30 kilometres of the C2C Scheme is Eversden and Wimpole Woods Special Area of Conservation (SAC), located approximately 6.5km to the south.

Non-statutory sites for nature conservation

6.5.6. Eleven non-statutory sites lie within 1.0 km of the C2C Scheme:

- Scrubland east of the M11 City Wildlife Site is within the footprint of the C2C Scheme;
- Coton Path Hedgerow County Wildlife Site is within the footprint of the C2C Scheme;
- Madingley Slip Road RSV County Wildlife Site to the north of the C2C Scheme opposite the Long Road/St Neots Road junction – separated from the C2C Scheme by the existing carriageway of A428;

[90] Cambridgeshire and Peterborough Biodiversity Group (2019). Habitat Action Plans. Available at: Priority Species and Habitats | Cambridgeshire and Peterborough Biodiversity Group (cpbiodiversity.org.uk) [Accessed 01 December 2021].

[91] Turley (2018). Third party data including Bourn Airfield, Volume One, Two and Three – Environmental Statement.

[92] Cambridge ecology (2017). Cambourne to Cambridge Better Public Transport: Protected Species Constraints Survey 2017. Final Report.

[93] Cambridge and Peterborough Environmental Records Centre (CPERC) (2017). Available at: https://www.cperc.org.uk/ [Accessed 01 December 2021].

- Bin Brook City Wildlife Site is located within 45m of the point where the C2C Scheme joins Grange Road;
- Adams Road Sanctuary City Wildlife Site is located 0.14km to the north of Adams Road;
- Trinity Meadows City Wildlife Site is located 0.23km to the east of Grange Road;
- Drain at Garret Hostel Lane City Wildlife Site is located 0.42km to the east;
- Meadow and Ditch Opposite King's College City Wildlife Site is located 0.47km to the east
- Bird Sanctuary, Conduit Head City Wildlife Site is located 0.45km to the north;
- Hedgerows East of M11 County Wildlife Site is located 0.5km to the south of the C2C Scheme; and,
- Bucket Hill Plantation Grassland County Wildlife Site is located 0.9km to the south on Bourn Airfield.

HABITATS AND FLORA

Phase 1 Habitat Survey

6.5.7. The dominant habitats across the C2C Scheme are arable fields, amenity grasslands, improved grassland, tall ruderal vegetation, poor semi-improved grassland, dense/scattered scrub and ephemeral/short perennial.

6.5.8. Habitats of conservation value present within the Site, due to their status as Cambridgeshire UK Priority Habitats and Habitats of Principal Importance (HPI) under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. Habitats of Principal Importance in England were unimproved grassland, broad-leaved lowland deciduous woodland (including plantation woodland), traditional orchards, hedgerows, wet and dry ditches and waterbodies and a brook. Seventeen rare plant species and four alien invasive species were recorded within the Site.

6.5.9. Open Mosaic Habitat, which is also a HPI, was well represented, particularly in areas associated with the dualling of the A428, including Childerley Gate, the Hardwick balancing ponds and in the complex of habitats around Madingley Reservoir.

6.5.10. Fourteen sites meeting the criteria for county or national importance were identified within the Site. A further twenty-five lower tier sites of district or parish importance were also identified. The presence of these sites must be of material consideration during the planning process.

UK Habitat Classification survey (UKHab)

6.5.11. Delivering biodiversity net gain will become a legal requirement (likely in 2023). The Biodiversity Metric 3.0[45] is used to calculate BNG, and UKHab is the habitat classification system required by this metric.

6.5.12. A UKHab survey should be undertaken in 2022 of all the scoped in areas that were not subjected to Phase 1 Habitat Survey in 2021. Consultation with the Local Authority ecologist should be undertaken to better understand the need for a 2022 UKHab survey of all habitats within the project (including areas proposed for compensatory habitat creation). Condition assessment data will also be required for all habitats within the Scheme in order to carry out the BNG assessment.

6.5.13. The UKHab survey should follow the UK Habitat Classification Habitat Definitions Version 1.1[44]) and include habitat condition assessments following the Biodiversity Metric 3.0 Technical Supplement[45].

National Vegetation Classification (NVC) survey

6.5.14. Vegetation with characteristics of the following National Vegetation Classification (NVC) communities was recorded between June and July 2021:

- W8a *Fraxinus excelsior – Acer campestre – Mercurialis perennis* woodland, *Primula vulgaris – Glechoma hederacea* sub-community
- W8d *Fraxinus excelsior – Acer campestre – Mercurialis perennis* woodland, *Hedera helix* sub-community
- MG1d *Arrhenatherum elatius* grassland, *Pastinaca sativa* sub-community
- MG1e *Arrhenatherum elatius* grassland, *Centaurea nigra* sub-community
- MG5b *Centaurea nigra – Cynosurus cristatus* grassland, *Galium verum* sub-community
- MG9 *Holcus lanatus - Deschampsia cespitosa* grassland
- MG10 *Holcus lanatus – Juncus effusus* rush pasture
- OV15a *Anagallis arvensis - Veronica persica*, *Stellaria media-Convolvulus arvensis* sub-community
- OV8 *Veronica persica – Alopecurus myosuroides* community
- OV23 *Lolium perenne – Dactylis glomerata* community

6.5.15. Open-structured grassland with many ephemeral species was significantly more diverse than average and included populations of rare species such as Wall Bedstraw *Galium parisiense* and Common Cudweed *Filago germanica*.

6.5.16. Certain grassland communities were recognised as being of high ecological value and included within Lowland Meadow Priority Habitat.

6.5.17. The presence of grassland and open mosaic habitats qualifying as HPI is a material consideration to be considered during the development process. Impacts to sites containing unimproved grassland should be minimised.

6.5.18. The details of botanical surveys are provided below:

Hedgerows

6.5.19. Nine hedgerows fulfilled the criteria for 'important' hedgerows. Four of these were associated with parish boundaries, two were adjacent to public footpaths, two short hedges were species-rich, and one supported a Red Data Book (RDB) insect.

6.5.20. Several hedgerows which did not meet the criteria for 'important' hedges under the Hedgerow Regulations, were also noted as being of high ecological value

6.5.21. The extent of this survey area will be confirmed once maps are available and following the updated scoping survey. Methodology within the Hedgerow Survey Handbook[46] should be followed, and hedgerows should be assessed based on criteria published in the Hedgerow Regulations 1997. Hedgerow surveys can be undertaken between April and October.

Semi-natural woodland NVC

6.5.22. The flora of the W8a *Fraxinus excelsior – Acer campestre – Mercurialis perennis* woodlands was not particularly diverse and the mean number of species recorded from each quadrat was substantially below the published mean in the NVC. The ground flora of all samples showed evidence of

eutrophication. However, all woodlands contained areas of suckering Elm. One endemic Elm species was recorded, and it is likely that others are present.

Grassland NVC

6.5.23. Grassland supporting communities closely allied to MG1d *Arrhenatherum elatius* grassland, *Pastinaca sativa* sub-community; MG1e *Arrhenatherum elatius* grassland, *Centaurea nigra* sub-community and MG5b *Centaurea nigra – Cynosurus cristatus* grassland, *Galium verum* sub-community were present. These communities are recognised as being of high ecological value and are included within Lowland Meadow Priority Habitat. As well as having high intrinsic value, many of the grasslands are important components of sites supporting Open Mosaic Habitat. These include MG1 *Arrhenatherum elatius* grassland, MG9 *Holcus lanatus - Deschampsia cespitosa* grassland and MG10 *Holcus lanatus – Juncus effusus* rush pasture. Seven sites across the Site supported a diverse assemblage of grassland indicator species above the threshold for County Wildlife Site selection.

Arable field margins NVC

6.5.24. Much of the arable margin vegetation in the survey area was very species-poor and dominated by annual grasses such as Soft Brome *Bromus hordeaceus* and Barren Brome *Anisantha sterilis* with occasional herbaceous associates.

6.5.25. Two margins were of significantly higher interest, and the Site may therefore be of county significance for its arable flora.

Aquatic scoping survey

6.5.26. A walkover aquatic scoping survey should be undertaken from January to February 2022 by an aquatic ecologist to assess further survey requirements of all water bodies which will be impacted by the works. The walk over surveys may scope in further aquatic surveys such as:

- River Habitat Corridor surveys and assessment;
- Macrophyte surveys;
- Aquatic macroinvertebrate surveys; and
- Electrofishing surveys.

PROTECTED AND NOTABLE SPECIES

6.5.27. The results of the desk study and field surveys (including the Preliminary Ecological Appraisal) undertaken for protected[94] and notable[95] species to date are detailed below.

[94] Species protected under current environmental legislation such the Conservation of Habitats and Species Regulations (2017), Wildlife and Countryside Act (WCA) (1981, as amended) and the Badger Act (1992).

[95] Those species listed under S41 of the NERC Act (2006).

Bats

6.5.28. Biological records obtained in 2017[92] from the last 10 years indicated the presence of seven species of bats. These include brown long eared bat *Plecotus auritus*, common *Pipistrellus pipistrellus* and soprano pipistrelle *Pipistrellus pygmaeus*, Daubenton's bat *Myotis daubentonii,* noctule *Nyctalus noctula*, serotine *Eptesicus serotinus* and western barbastelle *Barbastella barbastellus*, including within the survey area.

6.5.29. Data provided from the Cambridgeshire Bat Group on Madingley Wood SSSI has identified the presence of barbastelle bats roosting within the woodland, of which one was a confirmed maternity roost (2010).

6.5.30. It is noted that barbastelle bat is cited as the key feature of Eversden and Wimpole Woods Special Area of Conservation (SAC), located approximately 6.5km to the south of the Site. Third party data has identified barbastelle activity (including roosts) within Bourn Airfield. Surveys undertaken to date found that the barbastelle bats present may be associated with the SAC, but no clear link was established. Habitat within Bourn Airfield provides suitable foraging and commuting habitat for this species and therefore is considered to be functioning habitat of the SAC. The proposed C2C Scheme would not result in direct habitat loss of the SAC and no known barbastelle roosts would be lost. However, the proposed C2C Scheme may require the removal of habitats along known bat flight lines used by barbastelles which may be part of the SAC population. The HRA that will be undertaken alongside the EIA will assess the potential for impacts on this species.

Stage 1 bat inspection survey

6.5.31. A Stage 1 bat inspection survey was undertaken between December 2018 and February 2019 on the trees and bridge (over Bin Brook) within the survey area of the C2C Scheme. Of the trees surveyed, 50 were considered to contain potential roost features suitable for roosting bats and were subject to emergence/re-entry surveys. No bats were found during the surveys and no signs indicating the presence of roosting/hibernating bats were found in any of the trees and/or bat boxes found on seven of the trees. There was no sign of roosting bats associated with the bridge over Bin Brook. The bridge was considered to have negligible potential to support roosting bats.

6.5.32. Within the wider survey area, most of the habitat area comprises arable land and therefore of limited benefit to bats. However, it was recognised that there were habitats within the survey area considered to provide a range of features suitable to support roosting sites, foraging area and commuting routes for bats.

6.5.33. Mature trees containing features suitable for roosting bats were present. In addition, the mature trees, hedgerows, linear tree planting, tall ruderal, waterbodies and semi-improved grassland habitat provided good foraging opportunities for bats and the network of hedgerows and linear features provided suitable commuting routes for bats.

6.5.34. An update Stage 1 Bat Inspection Survey and Preliminary Bat Roost assessment of trees and structures was undertaken in 2021. No bats were found during the surveys and no signs indicating the presence of roosting/hibernating bats were found in any of the trees or bat boxes that were searched or associated with the bridge over Bin Brook.

6.5.35. One new tree was considered to have moderate bat roost potential, in addition to those previously surveyed in 2019. Fourteen trees were considered to have low/negligible bat roost potential and the bridge over Bin Brook was considered to remain unsuitable to support roosting bats.

6.5.36. Due to survey limitations and access constraints, it was not possible to survey some sections of the route as part of the previous stage 1 roost potential surveys. Therefore, it is proposed that inspection surveys of structures and trees which could support bat roosts and may be impacted by the project will be undertaken in areas not previously accessed and where data has since expired.

Hibernating bat survey

6.5.37. Hibernating bat surveys of suitable trees within the RLB and up to 80m from the RLB and structures within the RLB and up to 500m from the RLB should be undertaken in January and February 2022. Survey of trees during the winter season will include the climbing of trees with potential to support hibernating bat roosts. Surveys should be undertaken with reference to standard methodology for bat surveys[96].

Stage 2 bat activity surveys and crossing point survey

6.5.38. Stage 2 bat activity surveys (emergence/re-entry and static surveys) were undertaken in 2019 for the trees containing suitable roost features and the network of hedgerows, lines of trees, woodland edges and field boundaries.

6.5.39. Update Stage 2 Bat Activity surveys were recommended on the 17 trees and one bungalow at T50, identified during the previous Stage 1 Bat Inspection Survey, plus the new tree at T51, and these were undertaken in 2021.

6.5.40. The 2021 Stage 2 bat activity surveys identified common pipistrelle bat roosts in two trees (T38 and T51). The roosts in the two trees comprised individual bats of a common species and were considered to comprise non-breeding summer roosts. None of the roosts were identified as maternity roosts. Commuting and foraging bat activity was also detected.

6.5.41. Species detected included common pipistrelle, soprano pipistrelle, barbastelle, brown long-eared bat, common noctule and *Myotis* sp.

6.5.42. Crossing point surveys were also undertaken across the C2C Scheme in 2021. Data obtained from crossing point and updated static surveys undertaken from May to July 2021 has not yet been published. A re-scoping exercise should be undertaken once this data has been received. Bat static and crossing point surveys should be updated where required based on standard guidelines. Details should be included regarding the timing of the crossing point surveys during the night to ensure this is targeted at when potentially more vulnerable bats e.g. barbastelle bats, are recorded as active. It is also noted that there were limitations such as access restrictions during the previous bat surveys. It is recommended that during the consultation with the Local Authority (and Natural England if

[96] Bat Conservation Trust (2016). Good Practice Guidelines: Bat Surveys for Professional Ecologists

required) the suitability of the existing surveys and the need for additional bat activity surveys to supplement the existing data is discussed, and an updated scope of works be agreed.

6.5.43. Follow up emergence/re-entry or tree climbing surveys to assess the presence/absence of bat roost and categorise any identified roosts should be carried out in 2022 on any data-deficient structure or tree assessed as suitable to support roosting bats during the 2022 Stage 1 Bat Inspection Surveys.

6.5.44. The presence of roosting bats and bats using the area as commuting and foraging habitat indicates that these species are therefore of material consideration for the C2C Scheme, as they may be affected by the C2C Scheme; consequently, an assessment of the potential adverse and positive effects on bats must form part of the ecological impact assessment.

Bat radio tracking survey

6.5.45. Detailed bat surveys targeted at barbastelle may be required to inform the HRA and this may include radiotracking surveys within the bat active season. The need for these surveys, taking into account any existing radio-tracking information, should be discussed during consultation with the Local Authority and Natural England.

Winter bat activity survey

6.5.46. Bats and in particular barbastelle can be active in the winter and therefore winter bat activity surveys using static bat detectors are being undertaken from November 2021 to April 2022.

Badger *Meles meles*

6.5.47. Surveys undertaken in 2018 identified active main, annex and outlier setts within 250m of the C2C Scheme. Most badger activity occurred in the areas between the M11 motorway and Grange Road with fewer signs of badger activity to the west of the M11 motorway.

6.5.48. An update badger survey will be undertaken in early 2022 to check for any new setts and confirm the activity status of previously identified setts. Surveyors will look for signs of badgers including setts, badger prints, latrines, mammal runs and badger hairs in line with best practice guidance for badger surveys[43] Information that could lead to the identification of badger setts will be presented in a confidential appendix to the ES.

Breeding birds

6.5.49. A total of 68 bird species were recorded during the breeding bird survey undertaken in 2018. These species reflect an assemblage typical of the habitat present at the site. Of the breeding, probable or possible breeding species, the survey area supported 14 bird species that were recognised for their

conservation importance and by being Species of Principal Importance (SPI) (Section 41 NERC Act 2006)[97]. These included:

- Grey partridge *Perdix perdix*;
- Marsh tit *Poecile palustris*,
- Skylark *Alauda arvensis*,
- Starling *Sturnus vulgaris*;
- Song thrush *Turdus philomelos*;
- Mistle thrush *Turdus viscivorus*;
- Spotted flycatcher *Muscicapa striata*;
- House sparrow *Passer domesticus*;
- Dunnock *Prunella modularis*;
- Bullfinch *Pyrrhula pyrrhula*;
- Linnet *Linaria cannabina*;
- Yellowhammer *Emberiza citronella*;
- Corn bunting *Emberiza calandra*; and,
- Reed bunting *Emberiza schoeniclus*.

6.5.50. A breeding bird survey undertaken in 2021 comprised the sections between the eastern entrance to Cambourne and Grange Road, Cambridge. The 2021 survey was required to update the breeding bird survey carried out in 2018, albeit covering a different survey area.

6.5.51. A total of 51 bird species were recorded in 2021, and 46 species were considered to be confirmed and/or probable/possible breeding species. Of the breeding/probable/possible breeding species, the survey area supported twelve bird species (Grey Partridge, Skylark, Starling, Song Thrush, Mistle Thrush, House Sparrow, Dunnock, Bullfinch, Linnet, Yellowhammer, Corn Bunting and Reed Bunting) that are recognised for their conservation importance and by being Principal Species of Importance (Section 41 NERC Act 2006). None of the species found were considered rare, and none were listed as being Schedule 1 species of the Wildlife & Countryside Act 1981 (as amended).

6.5.52. Most nesting bird activity in the survey area was associated with the linear vegetation (hedgerows, wet ditch, waterbodies, woodland and scrub) and unmanaged grassland areas. Of the species of conservation importance; the arable fields and the hedgerow and wet ditch margins were favoured by grey partridge, skylark, corn bunting, yellowhammer and reed bunting. The residential gardens

[97] Section 41 of the NERC Act contains a list of Species of Principle Importance (SPI) and Habitats of Principle Importance (HPI) for the conservation of biodiversity in England. These HPI and SPI are national conservation priorities. Definitions for HPI were produced by the Biodiversity Reporting and Information and Group (Reference: Biodiversity Information and Reporting Group BRIG (2011) UK Biodiversity Action Plan; Priority Habitat Descriptions, JNCC, Peterborough). HPIs and SPIs were formerly known as UK Biodiversity Action Plan (UK BAP) priority habitats and priority species.

and commercial areas favoured breeding dunnock, song thrush, starling and house sparrow. The woodland, parkland and scrub were favoured by the breeding mistle thrush, linnet and bullfinch.

6.5.53. A fishing kingfisher *Alcedo atthis* was recorded during a white-clawed crayfish survey undertaken in September 2021. This species is listed under Schedule 1 species of the Wildlife & Countryside Act 1981 (as amended) and is therefore afforded additional protection.

6.5.54. The presence of breeding birds within the survey area will be accommodated by the C2C Scheme. This applies especially to the species of conservation importance.

6.5.55. Due to access constraints, it was not possible to survey some sections of the route as part of the 2021 bird surveys. It is proposed to undertake breeding bird surveys between March and June in 2022 in all potentially important areas that were not surveyed within and up to 250m beyond the RLB of the C2C Scheme, the extent of which will be confirmed once maps are available and following the updated scoping exercise. Territory mapping techniques as detailed in Bibby et al (2000) should be employed to create maps for protected / notable bird species (i.e. Schedule 1 Birds (Wildlife and Countryside Act 1981) and those Amber or Red listed under the Birds of Conservation Concern[98].

6.5.56. A presence/absence kingfisher survey should also be undertaken in the breeding season (April – June) in 2022 to ascertain the presence of nests within or adjacent to the Site

Barn owl *Tyto alba*

6.5.57. Desk records confirmed presence of barn owl, a Schedule 1 species, within 2km of the C2C Scheme. However, following the Stage 1 and Stage 2 surveys undertaken in 2019, no potential breeding locations for barn owls were identified within the study area for the C2C Scheme. Suitable foraging habitat for this species is present such as suitable grassland habitat east of Bin Brook.

6.5.58. It is proposed to undertake updated barn owl surveys in 2022 following best practice guidelines published by Shawyer[99], and in line with a desk study report on the C2C Scheme[100].

6.5.59. Update surveys will include Stage 2 and 3 on-site surveys whereby trees with potential for roosting barn owls should have endoscopic inspections to check for Active Roost Sites (ARS) and Potential Nest Sites (PNS). Trees and structures with ARS and PNS should then be revisited in June/July to

[98] Eaton, M. Aebischer, M, J. Brown, A, F. Hearn, R. (2015). Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man.

[99] Shawyer, C. R (2011). Barn Owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting. IEEM, Winchester.

[100] Shawyer, C. Cannings, P. (2020). Cambourne to Cambridge (C2C) and Cambridge South East Transport (CSET) Phase 2. The Greater Cambridgeshire Partnership.

check for nesting barn owls. Endoscopic inspections should be undertaken by a barn owl licensed ecologist.

Wintering birds

6.5.60. Wintering bird surveys undertaken between November 2018 and March 2019 identified 62 species. Of these species, four species with specific legal protection under Schedule 1 of the Wildlife and Countryside Act (1981) were identified (barn owl, kingfisher *Alcedo atthis*, fieldfare *Turdus pilaris* and redwing *Turdus iliacus*[101]).

6.5.61. Golden plover *Pluvialis apricaria*[102], little egret *Egretta garzetta* and kingfisher were identified and are on protected under the Wildlife and Countryside Act 1981.

6.5.62. Twelve species recorded were listed as SPI under Section 51 of the NERC Act 2006 or the Cambridgeshire and Peterborough Biodiversity Action Plan (BAP):

- Grey partridge[103];
- Marsh tit;
- Skylark[104];
- Starling;
- Song thrush;
- House sparrow;
- Dunnock;
- Bullfinch;
- Linnet;
- Corn bunting;
- Yellowhammer; and
- Reed bunting.

6.5.63. Species listed as Birds of Conservation Concern[98] (BoCC) recorded at the C2C Scheme comprised:

[101] Fieldfare and redwing are listed on Schedule 1 by virtue of having small UK breeding populations that are confined to Northern Scotland. In winter they are common and widespread in lowland England including Cambridgeshire (Baker et al, 2013)

[102] A very common winter visitor, and passage migrant. Not a breeding species. Utilises arable and wetland habitats, often found in mixed flocks on arable fields with lapwing. Widespread across Cambridgeshire in the winter (Cambridge Bird Atlas (2007-2011) – Louise Bacon, Alison Cooper, Hugh Venables).

[103] A scarce resident, population much declined and fairly local (some releases). A resident, sedentary species. Major concentration is in the southern chalk areas (Cambridge Bird Atlas (2007-2011) – Louise Bacon, Alison Cooper, Hugh Venables).

[104] A common but much declined, resident, very common passage migrant and winter visitor. Occur widely through the county in the breeding season, avoiding urban areas (Cambridge Bird Atlas (2007-2011) – Louise Bacon, Alison Cooper, Hugh Venables).

- Fourteen Red List Birds of Conservation Concern: grey partridge, woodcock *Scolopax rusticola*, marsh tit, skylark, starling, fieldfare, redwing, song thrush, mistle thrush, house sparrow, grey wagtail *Motacilla cinerea*, linnet, corn bunting and yellowhammer.
- Fourteen Amber List Birds of Conservation Concern: mute swan *Cygnus olor*, mallard *Anas platyrhynchos*, teal *Anas crecca*, snipe *Gallinago gallinago*, black-headed gull *Chroicocephalus ridibundus*, common gull *Larus canus*, lesser black-backed gull *Larus fuscus*, stock dove *Columba oenas*, kingfisher, kestrel *Falco tinnunculus*, dunnock, meadow pipit *Anthus pratensis*, bullfinch and reed bunting.

6.5.64. Areas identified as particularly important to the wintering bird assemblage included:

- The area around the balancing pond, which is located between the A1303 and A428, north of Hardwick;
- Woodland and grassland associated with the Waterworks site and Madingley Wood SSSI;
- The arable fields between Madingley Rise and Coton;
- The land around Coton Orchard and Coton Country Park;
- Game cover crop on arable land;
- The network of hedgerows to the east of the M11 motorway; and
- The mosaic of fields, scrub, network of hedgerows and grassland adjacent to Bin Brook, including the various city and county wildlife sites.
- It was agreed that an update wintering bird survey of the C2C Scheme should be undertaken during consultation with the Local Authority in December 2021. The update wintering bird survey should be undertaken within suitable habitats within and up to 250m beyond the RLB of the C2C Scheme. Transect surveys should be undertaken using binoculars and a telescope, and best practice guidance followed in the Winter Farmland Bird Survey by the British Trust for Ornithology[105].

6.5.65. It was agreed that an update wintering bird survey of the C2C Scheme should be undertaken during consultation with the Local Authority in December 2021. It is proposed to undertake the updated wintering bird survey within suitable habitats within and up to 250m beyond the RLB of the C2C Scheme. Transect surveys will be undertaken using binoculars and a telescope, and best practice guidance followed in the Winter Farmland Bird Survey by the British Trust for Ornithology[105].

Great crested newt *Triturus cristatus*

6.5.66. eDNA surveys undertaken in June 2017 identified a positive result for great crested newt (*Triturus cristatus*) within one pond (in the Cambridge University Sports Ground). This was further surveyed

[105] Gillings, S. Wilson, A, M. Conway, G, J. Vickery, J, A. Fuller, R, J. Beavan, P. Newson, S, E. Noble, D, G. Toms, M, P. (2008). Winter Farmland Bird Survey. BTO Research Report No. 494.

using traditional survey methods in April to June 2018. The results of these further surveys were negative for great crested newt (GCN).

6.5.67. eDNA sampling surveys were repeated on eleven of the waterbodies in June 2019. A further five were dry at the time of the survey and three were inaccessible. The eDNA analysis determined ten of the eleven waterbodies sampled to be negative for GCN DNA. One waterbody produced a positive result for GCN DNA.

6.5.68. An update GCN eDNA survey of eleven of the 20 waterbodies/ponds identified within 250m of the C2C Scheme was undertaken in May 2021. Ten samples returned a negative result for Great Crested Newt eDNA. One sample returned a positive result, however the amount of eDNA detected was reported as small, and a further sample returned a negative result. The two waterbodies that had resulted in positive GCN eDNA samples in previous years were both negative in 2021.

6.5.69. Due to access constraints, it was not possible to undertake habitat assessments for great crested newts (GCN) within Coton Orchard, or to survey the following ponds:

- Coton Village TL 41686 58695
- Clare College TL 43600 58334 (dry at time of survey)
- Clare College TL 43437 58303
- St Neots Access road pond TL 35861 59573
- Highfield Farm Pond T 35763 59359
- Wellington Way pond TL 34770 59484

6.5.70. Features that have not previously been surveyed will be assessed for their potential to support GCN, and further surveys will be undertaken if they are considered suitable for GCN.

6.5.71. Further it is proposed that GCN eDNA surveys will be undertaken periodically (e.g. 12-24 months) of all suitable waterbodies due to the intermittent positive GCN eDNA results obtained from 2017 to 2021. This would be in order to keep this information up to date and inform the consent application and impact assessment process.

6.5.72. Repeat eDNA surveys are therefore also recommended for:

- Broadway Pond TL 33534 59440; and
- Institute of manufacturing TL 42694 58783.

6.5.73. For all eDNA surveys, methodologies published in the Natural England Advice Note[106] should be followed and samples should be sent to a laboratory which participates in annual eDNA proficiency

[106] Biggs J, Ewald N, Valentini A, Gaboriaud C, Griffiths RA, Foster J, et al. (2014). Analytical and methodological development for improved surveillance of the Great Crested Newt. Oxford, U.K: Freshwater Habitats Trust.

testing. If eDNA surveys have positive results, then population surveys should be undertaken following best practice methodology[107].

Reptiles

6.5.74. Two species of reptile (grass snake *Natrix helvetica* and common lizard *Zootoca vivipara*) were identified during the 2018 reptile survey. The population of grass snake was assessed as low and located towards the eastern end of the survey on land just south of the West Cambridge site, adjacent to the University Sports Ground. The population of common lizard was also assessed as low and located on the grassland associated with the covered reservoir on the Waterworks site. Other areas of grassland habitats throughout the survey area were suitable to support the life cycle of common lizard.

6.5.75. An update survey undertaken in 2021 again recorded the presence of low populations of grass snake and common lizard only, however this survey focussed only on the areas where reptiles were previously recorded. The presence of juvenile grass snake indicated that this species was still breeding within and/or directly adjacent to the survey area. The grass snake population was located towards the eastern end of the survey on land just west and south of the West Cambridge Site of the University of Cambridge, adjacent to the University Sports Ground. The low population of Common Lizard was still located on the grassland associated with the covered reservoir south of the A1303 at Madingley Rise next to Long Road.

6.5.76. Due to access constraints, it was not possible to survey some sections of the route as part of the 2021 reptile surveys. In addition, the 2021 survey focussed on areas that previously supported reptiles. It is proposed that a re-scoping exercise is undertaken to identify any areas within the revised Survey Area that may have become suitable for reptiles since the 2018 surveys. Reptile surveys will be undertaken from April to May 2022 in all suitable areas that were not surveyed in 2021, the extent of which should be confirmed once maps are available and following the updated protected species scoping survey. Reptile surveys should be undertaken in appropriate weather conditions and should follow published methodologies[108].

Invertebrates

6.5.77. The invertebrate surveys undertaken between April to September 2018 inclusive identified a total of 15,014 records comprising 1,866 taxa. One hundred and fifty-eight of the species recorded had national conservation statuses: twenty of these were Red Data Book or equivalent and 134 were Nationally Scarce or equivalent. Four recorded species were Priority Species under Section 41 of

[107] Langton, T.E.S., Beckett, C.L., and Foster, J.P. (2001). Great Crested Newt Conservation Handbook, Froglife, Halesworth.

[108] Draper A. (2015) Surveying for reptiles. Tips, techniques and skills to help you survey for reptiles. Froglife.

the NERC Act 2006 but had no other status. A further two species were listed as Cambridgeshire and Peterborough species of additional interest (CPASI) but had no national conservation status.

Invertebrate species of particular interest included:

- Tree snail *Balea perversa* (very local);
- Rare beetle *Ischnomera caerulea*, (nationally rare);
- Saproxylic beetle *Osphya bipunctata* (nationally scarce);
- Lace-winged planthopper *Reptalus quinquecostatus* (nationally notable);
- Brown planthopper Flastena fumipennis (new to Britain);
- Groundbug *Nysius graminicola* (Red Data Book category 3 rare);
- Green hairstreak *Callophrys rubi* (Cambridgeshire and Peterborough Additional Species of Interest);
- White-letter hairstreak *Satyrium w-album* (IUCN Endangered);
- Common green grasshopper *Omocestus viridulus* (Cambridgeshire and Peterborough Additional Species of Interest); and,
- Stripe-winged grasshopper *Stenobothrus lineatus* (Nationally Scarce).

6.5.78. The survey identified 14 areas considered to be of high importance and 14 separate areas of secondary importance to the invertebrate fauna/assemblage. The greatest invertebrate interest was found in habitats dominated by woody vegetation. A high quality saproxylic assemblage was recorded. Interest predominantly occurred in isolated trees and mature hedgerows and plantations.

6.5.79. Much of the remaining invertebrate conservation interest was found in open mosaic habitats and grasslands. The grassland associated with the Waterworks site at Madingley Mulch was considered to be of most conservation significance and has established as a site of high value for invertebrates.

6.5.80. Other habitats present on the Site were of less significance, although some, especially wetland, make a notable contribution to the overall interest of the Site .

6.5.81. An invertebrate habitat assessment was undertaken in 2021 to examine the key areas for invertebrates identified in the 2018 survey. No formal sampling of invertebrates was undertaken. The survey report determined all the landscape types and habitats identified in 2018 to be present in the survey corridor of the red route and considered that the conclusions of the 2018 survey report remain correct.

6.5.82. Due to access constraints, it was not possible to undertake surveys in some sections of the route as part of the previous invertebrate surveys. Invertebrate surveys should be undertaken between April and September 2022 in all areas with potential importance for invertebrates that were not surveyed previously within and up to 250m beyond the RLB of the C2C Scheme. The extent of survey should be confirmed once maps are available and following the updated scoping survey. A range of methods can be used such as sweep netting and pit fall trapping, and these vary depending on habitat. Methodology should be clarified once the habitats have been mapped, following best practice guidance by Natural England (2007).

Water Voles *Arvicola amphibius* and Otters *Lutra lutra*

6.5.83. Surveys of watercourses and water bodies within and up to 250m of the C2C Scheme were undertaken in 2018. No evidence of water vole *Arvicola amphibius* or otter, was found during the surveys. Most of the watercourses on arable land provided sub-optimal habitat for these species. The water quality appeared to be poor with lots of algal growth indicating nutrient rich water. An

update water vole and otter survey undertaken in 2021 determined water vole and otter to be absent from the survey area.

6.5.84. Due to access constraints, Bin Brook was surveyed south of the published route only during previous surveys. Additionally, the 2021 water vole survey did not include a site visit in the second half of the breeding season (July to September) as per best practice guidelines.

6.5.85. It was agreed during consultation with the council in December 2021 that surveys should be updated in 2022 to comprise one survey visit in the first half of the breeding season (April-June 2022) and a second visit in the second half of the breeding season (July to September 2022) to be in line with best practice guidelines for water vole[47]. The requirement for survey should be informed by an updated scoping survey, which should include an assessment of habitat data to determine whether the section of Bin Brook to the north of the proposed crossing point should be included. The updated scoping exercise should also determine whether further surveys for otter will be required.

White-clawed crayfish *Austropotamobius pallipes*

6.5.86. A habitat assessment of the suitability of waterbodies along the entire C2C Scheme to support white-clawed crayfish was undertaken in September 2021. A white-clawed crayfish survey of a section of Bin Brook that was considered to have potential to support this species was also undertaken during this period. The methodology followed standard guidance for white clawed crayfish surveys[48].

6.5.87. No white-clawed crayfish or signs of white-clawed crayfish presence were identified in the survey area. White-clawed crayfish were determined to be absent in the section of Bin Brook that was surveyed and in proximity to the proposed route.

6.5.88. The assessment of other waterbodies (linear and individual) within 250m of the proposed route, determined that they mostly comprised man-made and/or heavily engineered features associated with arable field and road drainage ditches or landscaped lakes and ponds associated with residential, commercial and road scheme developments. The likelihood of a population of white-clawed crayfish being present in any of the waterbodies within the survey area was considered negligible.

6.5.89. Due to access constraints, it was not possible to survey the section of the Bin Brook downstream of the potential crossing point of the C2C Scheme and the 2021 survey was therefore unable to determine if white-clawed crayfish were present in this section. A scoping survey of the section of Bin Brook downstream of the C2C crossing point should be undertaken in early 2022 to inform the requirement for further survey in this area.

Aquatic species

6.5.90. Bullhead *Cottus gobbio* and a species of freshwater mussel were identified during the white-clawed crayfish survey undertaken in September 2021. Bullhead is an Annex II species and is an interest feature used in the selection of Special Areas of Conservation (SAC), which are strictly protected under the Conservation of Habitats and Species Regulations 2017 (as amended).

6.5.91. A walkover aquatic scoping survey should be undertaken from January to February 2022 by an aquatic ecologist to assess further survey requirements of all water bodies which will be impacted by the works. The walk over surveys may scope in further aquatic surveys such as:

- River Habitat Corridor surveys and assessment;

- Macrophyte surveys;
- Aquatic macroinvertebrate surveys; and
- Electrofishing surveys

Other fauna

6.5.92. Brown hare *Lepus europaeus* surveys undertaken in 2018 to 2019 identified two main populations within the survey area. One population was located between the M11 motorway and Grange Road, to the south of the West Cambridge site at the eastern end of the survey area and comprised a peak count of 11 individuals. The other, larger population, comprising a peak count of 22 individuals was located west of Coton towards Hardwick in arable fields south of the A1303, especially in the arable area between the Chrome Lea Business Park and the Waterworks site. Most brown hare observations were made in arable land, within fields containing winter cereal crops as well as fallow fields, bare-earth, stubbles and grassland. It was agreed with the council during a consultation meeting in December 2021 that no further brown hare surveys are required as the 2018 – 2019 survey data identified the locations of main brown hare populations across the route. Incidental records for brown hare should be taken during the 2022 surveys for other ecological receptors.

6.5.93. There may be habitat loss impacts to other SPIs, including hedgehog *Erinaceus europaeus* and toad *Bufo bufo*, for which species-specific surveys are not considered necessary but their potential presence (based on the suitability of habitats present within the C2C Scheme) are of consideration. Records of toad migration routes will be sought in 2022 as part of the request for updated biological records.

6.5.94. Enhancement measures for SPI species will be incorporated within the scheme design where possible though where these comprise measures that do not require planning permission they will not be taken into account in the assessment of likely significant effects. An outline CEMP should identify parts of the C2C Scheme where these ecological features may occur, or are present, and should identify measures to control likely effects.

Hazel dormouse *Muscardinus avellanarius*

6.5.95. Following the results of the preliminary ecological appraisal and additional habitat suitability assessments, hazel dormouse *Muscardinus avellanarius* has been scoped out due to the absence of suitable habitat for this species, lack of connectivity to known populations within the wider area, and restricted distribution of this species across Cambridgeshire.

6.6 POTENTIAL IMPACTS

6.6.1. The construction and operation of the C2C Scheme has potential to affect ecological features. The high-level assessment of the likely impacts and effects of the C2C Scheme takes into account both on-site effects and those that may occur outside of the site to more distant ecological features.

CONSTRUCTION

6.6.2. The potential impacts of construction on biodiversity are:

- Construction activities that disturb or damage habitats and species, causing direct mortality;
- Removal of habitats would result in habitat loss, fragmentation and severance;
- Construction vehicle movements increase the risk of direct mortality of some species; and
- Lighting for security or operational working areas or high levels of noise or vibration may result in the displacement sensitive species.

OPERATION

6.6.3. The potential permanent impacts on biodiversity are:

- Increased lighting of retained habitats within and adjacent to the C2C Scheme and disturbance to species;
- Partial or complete severance of wildlife corridors within and adjacent to the C2C Scheme;
- Increased noise disturbance within and adjacent to the C2C Scheme;
- Increased traffic and risk of collision within the C2C Scheme;
- The damage and deterioration of retained habitats from polluted spray or maintenance activities may also impact the biodiversity; and
- The damage and deterioration of riparian and aquatic habitats due to increased shading as a result of the new bridge structure over Bin Brook.

6.7 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

6.7.1. Table 6-6 outlines activities, impacts and ecological features potentially affected during construction and operation of the C2C Scheme. As the design for the C2C Scheme evolves and further field survey data is collected this list will be developed.

Table 6-6 – Likely impacts and effects requiring assessment

Impacts	Effects	Justification	Key ecological features potentially affected
Construction			
Construction activities	Disturbance or damage to habitats/ species. Direct mortality	Protected or important habitats/species could be damaged or disturbed as a result of an increase in noise, vibration and other activities associated with construction (excavation / removal of suitable refuge / release of pollutants); Impacts may arise on non-statutory designated sites where vegetation may be sensitive to elevated levels of airborne dust from the works. Construction activities in proximity to watercourses may result in the accidental release of potential pollutants.	Scrubland east of the M11 (City Wildlife Site), Bin Brook CiWS and Coton Path Hedgerow (County Wildlife Site) would be directly impacted by the C2C Scheme. Adjacent designated sites/habitats to the C2C Scheme could be disturbed as a result of an increase in noise, vibration, dust, air pollution and other activities associated with construction. Increased disturbance to badgers, bats, great crested newts, wintering birds, breeding birds, barn owl, reptiles, brown hare, invertebrates, white clawed crayfish, fish species, otter and water vole.
Habitat Removal	Fragmentation and severance, by removal	Change in land use would result in the removal of existing habitats; loss of drainage ditch; loss of HPI habitats. Less mobile species, or animals that are young or hibernating, are likely	Habitat loss may affect badgers, bats, great crested newts, wintering birds, breeding birds, barn owl, reptiles, brown hare, invertebrates, otter and water vole.

Impacts	Effects	Justification	Key ecological features potentially affected
	of habitats or wildlife corridors	to be those most vulnerable to direct mortality during construction Given the predominantly arable landscape, the severance (including temporary severance during construction) of existing wildlife corridors along the C2C Scheme (such as field margins, hedgerows) could have significant impacts on species in the area. Resulting in loss of resources critical throughout a given species' life-history such as those for breeding and rearing, shelter and resting, foraging, dispersal and migration.	The C2C Scheme would bisect the scrubland east of the M11 (City Wildlife Site), Bin Brook CiWS and Coton Path hedgerow (County Wildlife Site) resulting in a permanent loss of habitat within these local non-statutory designated sites.
Vehicle movements	Direct mortality	Increased movements from construction vehicles.	Mortality of badgers, great crested newts, barn owl, reptiles, brown hare, invertebrates, otter and water vole.
Use of lighting for security purposes or to illuminate operational working areas	Disturbance and/or displacement of species	Sensitive species may actively avoid sources of light disturbance and search for alternative foraging habitats/commuting routes leading to a reduction in the distribution of these species within suitable habitats resulting in a reduction of energy intake and/or an increase in energy expenditure potentially leading to a reduction in survival and productivity rates.	Disturbance and/or displacement of badgers, bats, great crested newts, wintering birds, breeding birds, barn owl, brown hare, invertebrates, white clawed crayfish, fish species, otter and water vole.
Operation			
Traffic movement	Disturbance: noise and light	Increased traffic, lighting of retained habitats within and adjacent to the C2C Scheme; disturbance and severance of wildlife corridors; abandonment of refuge by light sensitive species.	Increased traffic movements will result in greater levels of disturbance to adjacent habitats as a result of increase in noise, vibration, light and other activities associated with operation. Disturbance to badger, bats, great crested newts, wintering birds, breeding birds, barn owl, reptiles, brown hare, invertebrates, otter and water vole.
	Damage/ deterioration of retained habitats	Impacts on vegetation from polluted spray from road traffic. Maintenance activities may result in the accidental release of pollutants. Increased movements from bus vehicles.	Reduced/deteriorated habitat availability to badgers, bats, great crested newts, wintering birds, breeding birds, barn owl, reptiles,

Impacts	Effects	Justification	Key ecological features potentially affected
			brown hare, invertebrates, otter and water vole. Increased root compaction for retained hedgerows and trees.
Vehicle movements	Direct mortality	Increased movements from bus vehicles.	Mortality of badgers, bats, great crested newts, barn owl, reptiles, brown hare, invertebrates, otter and water vole (if present).
Bridge structure	Damage/ deterioration of riparian and aquatic habitats	Increased shading of marginal and aquatic plant species due to bridge structure over Bin Brook. May result in deterioration of habitats and associated negative effects on species which utilise them.	White clawed crayfish, fish, invertebrates, otter and water vole.

SCOPED OUT

6.7.2. Based on a lack of suitable habitat available, negative survey results and the baseline habitat conditions remaining the same, the ecological features scoped out of further assessment are hazel dormice.

6.7.3. All ecological features listed in Table 6-6 will be considered during the EIA as the baseline surveys continue.

7 GREENHOUSE GASES

7.1 INTRODUCTION

7.1.1. This chapter considers the C2C Scheme's impact on climate and any likely significant effects. It sets out the proposed methodology for the climate assessment and identifies those impacts that can be scoped out of the ES

7.2 LEGISLATION AND STANDARDS

NATIONAL

7.2.1. The UK is a member of the United Nations Framework Convention on Climate Change (UNFCCC) which drives international action on climate change. The UK has pledged to reduce emissions under the Paris Agreement[109], as a part of a joint pledge by members of the European Union (EU). This provides an overarching commitment by the UK.

7.2.2. The EIA Requirements stipulate that the information to be included within the ES report should include the '*impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change*'.

7.2.3. The NPPF[110] sets out the core planning principle of supporting "the transition to a low carbon future in a changing climate…". Chapter 9: Promoting Sustainable Transport[111] - considers how people should be offered a choice of transportation modes, encouraging a movement away from the use of single private vehicles, the latter being understood to contribute to a significant proportion of total UK carbon emissions. For example, between 1990 and 2007, domestic transport comprised 24% of total UK emissions; the largest share was from road passenger cars at 86%[111]. In 2013, domestic and international transport accounted for 26% of all UK greenhouse gas emissions.

7.2.4. In addition, this chapter has been prepared in accordance with the Government's National Planning Practice Guidance[112].

[109] United Nations (2015). Paris Agreement. Available at: https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf [Accessed 01 December 2021].

[110] Department for Levelling Up, Housing and Communities (2021). National Planning Policy Framework. Available at: https://www.gov.uk/guidance/national-planning-policy-framework [Accessed 02 December 2021].

[111] Department for Levelling Up, Housing and Communities (2012). National Planning Policy Framework Chapter 9. Available at: https://www.gov.uk/guidance/national-planning-policy-framework/9-promoting-sustainable-transport [Accessed 02 December 2021].

[112] Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (2021). National Planning Practice Guidance. Available at: https://www.gov.uk/government/collections/planning-practice-guidance [Accessed 02 December 2021].

LOCAL

7.2.5. Cambridge City Council declared a Climate Emergency in January 2019, and have produced a Climate Change Strategy (2021-2026)[113] and a supporting Carbon Management Plan (2021-2026)[114].

7.2.6. SCDC has committed to "*deliver 50% reduction in carbon emissions from the South Cambridgeshire area by 2030 relative to a 2018 baseline, reducing to net zero carbon by 2050 at the latest*"[115].

7.2.7. Cambridge County Council (CCC) adopted their Cambridge Local Plan[116] in 2018. GHG policies within the Local Plan include Policy 28: Carbon reduction, community energy networks, sustainable design and construction, and water use which states that "all developments should take the available opportunities to integrate the principles of sustainable design and construction into the design of proposals… including carbon reduction."

7.2.8. SCDC adopted their Local Plan in 2018[117]. GHG policies within the Local Plan include Policy CC/1: Mitigation and Adaptation to Climate Change, which states that proposals should "embed the principles of climate change mitigation and adaptation into the development." Policy CC/3: Renewable and Low Carbon Energy in New Developments requires developments for new dwellings or other buildings to reduce carbon emissions.

GUIDANCE

7.2.9. The following guidance documents have been used during the preparation of this chapter:

- Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance[118];
- Highways England DMRBLA114 Climate[119];

[113] Cambridge City Council (2021). Climate Change Strategy. Available at: Climate Change Strategy - Cambridge City Council [Accessed 02 December 2021].

[114] Cambridge City Council (2021). Carbon Management Plan. Available at: https://www.cambridge.gov.uk/carbon-management-plan [Accessed 02 December 2021].

[115] South Cambridgeshire District Council (2020). Zero Carbon Strategy. Available at: https://www.scambs.gov.uk/media/15058/scdc-zero-carbon-strategy-web.pdf [Accessed 02 December 2021].

[116] Cambridge City Council (2018). Cambridge Local Plan. Available at: https://www.cambridge.gov.uk/media/6890/local-plan-2018.pdf [Accessed 02 December 2021].

[117] South Cambridgeshire District Council (2018) South Cambridgeshire Local Plan. Available at: https://www.scambs.gov.uk/media/17793/south-cambridgeshire-adopted-local-plan-2018.pdf [Accessed 02 December 2021].

[118] Institute of Environmental Management and Assessment (IEMA) (2017). IEMA's Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance.

[119] Design Manual for Roads and Bridges (DMRB) (2019). Sustainability & Environment Appraisal, LA114 Climate, Revision 0, October 2019.

- TAG Unit A3 Environmental Impact Appraisal - Chapter 4 Greenhouse Gases[120]; and,
- PAS2080:2016 Carbon Management in Infrastructure[121]- PAS2080 sets out a common approach and understanding of whole life carbon management in the provision of economic infrastructure as a result of the Infrastructure Carbon Review. It promotes reduced carbon, reduced cost infrastructure delivery, more collaborative ways of working and a culture of challenge in the infrastructure value chain.

7.3 STUDY AREA FOR IMPACTS ON CLIMATE

7.3.1. The GHG assessment is not restricted by geographical area but instead includes any increase or decrease in emissions as a result of the C2C Scheme, wherever that may be. This includes:

- Embodied and construction emissions from the C2C Scheme footprint but also related to the transport of materials to and from the site and their manufacture (this may be distant from the C2C Scheme location, for example emissions from the manufacture of steel); and
- Operational emissions (increase or reduction) which result from the end-use of the C2C Scheme and any shifts in transport modes/patterns which may occur. Such emissions include those for traffic using the C2C Scheme as well as the surrounding regional road network to gain access.

7.4 ASSESSMENT METHODOLOGY

ASSESSMENT APPROACH

7.4.1. The assessment approach considers the likely magnitude of GHG emissions (or avoided emissions) in comparison to the baseline scenario without the C2C Scheme. It considers emissions throughout the lifecycle of the C2C Scheme including:

- Embodied and construction stage e.g. embodied emissions associated with materials, transportation of materials to site and waste/arisings from site, and the construction process; and
- Operation e.g. operation of lighting and controls, maintenance and replacement of original materials, as well as emissions (or avoided emissions) from end-user vehicles.

7.4.2. For all lifecycle stages of the C2C Scheme, the assessment will include the following:

- Collection of available data/information on the scale of GHG emitting activities (e.g. tonnes concrete, litres of fuel, kWh electricity) for the baseline scenario and for the C2C Scheme. In each case this will cover the whole study period; and
- Calculation of the GHG emissions by applying a suitable emissions factor (tCO2e per unit of emissions generating activity).

[120] UK Government (2021) TAG unit A3 environmental impact appraisal

[121] PAS2080:2016 Carbon Management in Infrastructure.

7.4.3. Emissions calculations for all sources other than end-user emissions (traffic), will be completed within an industry recognised carbon calculation tool which focuses on emissions throughout the C2C Scheme lifecycle. For this assessment, National Highways' Carbon Emissions Calculation Tool[122] will be used.

7.4.4. Traffic emissions will be quantified in accordance with the DMRB LA 114[119] (hereafter referred to as LA 114) and quantified using WebTAG data from the Department of Transport[123]. This method will take into account the proportions of the vehicle types, fuel type, forecast fuel consumption parameters and emission factors. From this, emissions will be quantified for each year over the lifetime of the C2C Scheme. Values will be reported as tonnes of carbon dioxide equivalents (tCO2e).

SIGNIFICANCE CRITERIA

7.4.5. There are no agreed thresholds for what level of GHG emissions is considered significant in an EIA context. As such the magnitude of emissions, in conjunction with the Climate Change Act 2008, carbon budgets, development plan policy, Government policy (including the Net Zero Strategy and related strategies) and guidance from IEMA as appropriate will inform professional judgement of significance of emissions.

7.5 BASELINE

Existing Baseline

7.5.1. In the baseline (Do Minimum) scenario, GHG emissions occur constantly and widely as a result of human and natural activity including energy consumption (fuel, power), industrial processes, land use and land use change. The GHG assessment will only consider instances in which the C2C Scheme results in additional or avoided emissions in comparison to the baseline scenario and its assumed evolution. The baseline conditions therefore focus on those emissions sources subject to change between the baseline scenario and the C2C Scheme. Table 7-1 for context[124].

Table 7-1 - Transport emissions for South Cambridgeshire and nationally

[122] National highways (2021). Carbon Emissions Calculation Tool. Available at: https://nationalhighways.co.uk/industry/carbon-emissions-calculation-tool/ [Accessed 02 December 2021].

[123] Department for Transport (2021). TAG data book. Available at: https://www.gov.uk/government/publications/tag-data-book [Accessed 02 December 2021].

[124] Department for Business, Energy & Industrial Strategy (2021). UK local authority and regional carbon dioxide emissions national statistics: 2005 to 2019. Available at: https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-to-2019 [Accessed 02 December 2021].

Category	South Cambridgeshire (kt CO_2)	National (ktCO_2)
I. Road Transport (A roads)	357	49,581
J. Road Transport (Motorways)	122	27,602
K. Road Transport (Minor roads)	107	42,886
L. Diesel Railways	5.2	1,794
M. Transport Other	10	2,4340
Transport Total	**601**	**124,303**

7.5.2. The 'Do Minimum' (baseline) scenario involves no construction activities and therefore the construction baseline is zero emissions.

7.5.3. The total end-user GHG emissions from traffic flows in the 'do nothing' scenario will be modelled using the C2C Scheme traffic data. The modelling includes the total GHG emissions for vehicles covered by the traffic model, covering the road network in the area of the C2C Scheme and its surroundings. At present, this data for the end-user emissions is not available for inclusion but this data will be reported in the next stage of climate assessment in the ES.

7.5.4. The operation and management of the existing assets under the baseline scenario are likely to require a small number of components (for example, light bulbs and signage) as well as some bulk material (cement, concrete, sand and gravel) for minor works and repairs of the highway and ancillary infrastructure. These materials will have embodied emissions associated with them, and the installation of these materials will result in emissions due to the transport of these materials, and plant use. These baseline emissions are expected to be negligible, and as such will not be quantified.

7.5.5. Emissions from current agricultural land use are also expected to be negligible and as such will also not be quantified.

7.6 FUTURE BASELINE

7.6.1. The future baseline scenario involves no construction activities and therefore the construction baseline is zero emissions.

7.6.2. The future baseline scenario for the operational phase will be modelled, based on projected traffic data for the existing road network.

7.7 POTENTIAL IMPACTS

7.7.1. The potential sources of GHG emissions associated with the C2C Scheme are identified in Table 7-2.

Table 7-2 - Potential emissions sources

Lifecycle Stage (as per Pas 2080)[125]	Potential Sources Of Emissions (Not Exhaustive)
Construction	

Lifecycle Stage (as per Pas 2080)[125]	Potential Sources Of Emissions (Not Exhaustive)
Product stage (manufacture and transport of raw materials to suppliers) A1-3	Embodied emissions associated with extraction and manufacturing of the required raw materials.
Transport of materials to site A4	Emissions from fuel and electricity used in vehicles transporting materials to site
Plant and equipment use during construction A5	Emissions from fuel and electricity used in plant and equipment on site
Transport of waste A5	Emissions from fuel and electricity used in vehicles transporting materials away from site
Disposal of waste A5	Emissions from the final disposal of waste materials.
Land use, land use change and forestry A5	Change in emissions associated with the clearance and disposal of biomass (cleared vegetation) due to the construction of C2C Scheme
Operation	
Maintenance, repair, replacement, refurbishment B2-5	Embodied emissions, and emissions from transport and plant associated with maintenance, repair, replacement, and refurbishment.
Operational energy use B6	Energy used for the operation of the C2C Scheme (e.g. lighting)
Operational water use B7	Emissions associated with water use in the C2C Scheme
Land use, land use change and forestry B8	Change in emissions associated with the existence of the C2C Scheme hindering or promoting the sequestration of carbon dioxide into biomass (for example through decrease or increase in the number of trees).
End-user emissions (regional traffic flows) - traffic B9/D	Vehicles using highways infrastructure constructed as part of the C2C Scheme
Decommissioning	
Decommissioning process C1	Emissions from decommissioning work (i.e. fuel/electricity)
Transport and disposal of materials C2-4	Emissions sources as fuel/energy consumption from the transport of materials to disposal sites or recovery.

7.8 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

7.8.1. Based on the emissions sources identified in Table 7-2 and using guidance from IEMA, professional judgement has been used to determine which sources to scope out from further consideration in the ES.

7.8.2. The effect of the PAS 2080[125] lifecycles scoped into the assessment on climate and their study areas are explored in Table 7-3 below.

Table 7-3 – Lifecycle stages within scope of assessment

Lifecycle scope	Phase	Justification
Product stage (manufacture and transport of raw materials to suppliers) A1-3	Construction	Raw materials required for the C2C Scheme will result in embodied emissions and have the potential to be large.
Transport of materials to site A4	Construction	Construction stage emissions from fuel / energy consumption due to the delivery of material to site have the potential to be large.
Plant and equipment used during construction A5	Construction	Fuel / energy consumption of plant and equipment used during construction would generate GHG emissions.
Transport of waste A5	Construction	Emissions from fuel / energy consumption due to the transport of waste materials, particularly fill, have the potential to be large.
Maintenance B2	Operation	The C2C Scheme may require maintenance, these activities would release emissions.
Replacement B4	Operation	The replacement of the C2C Scheme (such as resurfacing) would release emissions.
B6 Operational energy use	Operation	Emissions from operational energy use within the proposed travel hub in the C2C Scheme have the potential to be large, for: - EV charge point infrastructure) - Lighting (Road) - Lighting (Travel Hub) - Fuel used by the buses
End-user emissions (regional traffic flows) - traffic B9/D	Operation	Changes to regional traffic flows are expected and this has the potential to result in a large change in GHG emissions.

SCOPED OUT

7.8.3. The effect of the PAS 2080[125] lifecycles scoped out of the assessment on climate and their study areas are explored in Table 7-4 below.

Table 7-4 - Lifecycle stages outside of the scope of assessment

Lifecycle scope	Phase	Justification
Disposal of waste A5	Construction	Emissions from the disposal of waste are unlikely to be large, as the waste types are likely to be inert.
Land use, land use change and forestry A5	Construction	Emissions from the disposal of biomass are not expected to be large, as there are not expected to be trees, or mudflats/bogs lost due to the C2C Scheme.
Repair and Refurbishment B3, B5	Operation	Road schemes do not typically design for repair and refurbishment, therefore these activities are unlikely to take place.
Operational water use B7	Operation	Emissions from operational water use in the C2C Scheme are unlikely to be large, as the quantity of water used in the travel hub is likely to be small.
Land use, land use change and forestry B8	Operation	The change in carbon sequestration due to the C2C Scheme is not considered to be large, as there are no woods or mudflats/bogs affected by the C2C Scheme.
Decommissioning process C1	End of life	Expected timescales for decommissioning are so far into the future that there is insufficient certainty about the likelihood, type or scale of emissions activity to determine their likely magnitude, even if they take place at all. As such these emissions sources will not be considered.
Transport and disposal of materials C2-4	End of life	

7.9 MITIGATION

7.9.1. The magnitude of GHG emissions associated with the design, construction and operational phases of the C2C Scheme can be minimised by, amongst other measures:

DESIGN PHASE

- Design optimisation to reflect the carbon reduction hierarchy, detailed in PAS 2080[125];
- Reduce the elements required for the C2C Scheme;

[125] PAS 2080. Carbon Management in Infrastructure. Available at: https://www.carbontrust.com/what-we-do/assurance-and-certification/pas-2080-carbon-management-in-infrastructure [Accessed 8 December 2021].

- Reduce the requirement for construction materials;
- Designing, specifying and constructing the C2C Scheme with a view to maximising the operational lifespan and minimising the need for maintenance and refurbishment (and all associated emissions);
- Designing, specifying and constructing the C2C Scheme with a view to maximising the potential for reuse and recycling of materials/elements at the end-of-life stage.

CONSTRUCTION PHASE

- Substitute construction elements for lower-carbon alternatives (e.g. using low temperature asphalt);
- Use efficient construction processes, such as design for manufacture and assembly.
- Specify materials and products with reduced embodied GHG emissions including through material substitution, recycled or secondary content and from renewable sources;
- Specifying high efficiency mechanical and electrical equipment such as lighting and telecoms.
- Minimising the quantities of materials required to construct the C2C Scheme;
- Maximising the use of construction materials and products with recycled or secondary and low carbon content, from renewable sources, and offering sustainability benefit;
- Using locally-sourced materials where available and practicable to minimise the distance materials are transported from source to site;
- Using more efficient construction plant and delivery vehicles, and/or those powered by electricity from alternative/lower carbon fuels; and.
- Using innovative construction methods to reduce plant use.

OPERATION PHASE

- Specifying high efficiency mechanical and electrical equipment such as lighting and telecoms; and; and
- Operating, maintaining and refurbishing the C2C Scheme using best-practice efficient approaches and equipment.
- Consider the potential of onsite renewable electricity production.
- Ensure designs are focussed upon reduction of emissions from end-user vehicle movement (traffic) for example by providing the conditions for efficient low-carbon vehicles and for non-vehicular (active) transport.
- Consider additional tree planting.

7.10 LIMITATIONS AND ASSUMPTIONS

7.10.1. To ensure transparency within the EIA process, the following limitations and assumptions have been identified:

- Depending on the available information at the time of the assessment, there may be some uncertainty regarding the types and quantities of materials to be used in construction;
- The assessment of significance will be based, in part, on professional judgement;
- When calculating the end-user traffic emissions, there will be some uncertainty regarding forecast traffic modelling data as this is based on predicted future use; and
- Some small emissions sources have been excluded (as set out in Table 7-4) as emissions from these sources are not considered likely to be large and therefore not material to the assessment.

8 CLIMATE RESILLIENCE

8.1 INTRODUCTION

8.1.1. Climate change is inevitable and is expected to have significant implications for infrastructure assets in future, particularly those with long operational lifetimes. This makes them sensitive, not only to the existing climate at the time of their construction, but also to climate variations over the decades of their use. In addition, stringent targets have been set to reduce our national emissions to zero by 2050.

8.1.2. This chapter addresses how the impacts of climate change on the C2C Scheme will be assessed, both in terms of the vulnerability of the C2C Scheme to future impacts of climate; and how these impacts then might exacerbate wider impacts on the environment.

8.1.3. The potential requirement for further assessment will be identified within this chapter. Design, mitigation and enhancement measures undertaken throughout the design of the C2C Scheme will also be explored as part of the EIA. Where necessary, further assessment will be presented within the ES.

8.2 LEGISLATION AND STANDARDS

8.2.1. The contains a section on carbon emissions, particularly paragraph 5.17, which sets out how the impact of carbon will be assessed as part of the EIA process in order to meet the overarching national carbon reduction strategy as set out in the Carbon Plan (2011). Mitigation measures in both the design and construction will be presented as part of the assessment. The NPSNN is applicable to a public transport scheme as private vehicles will be using the national network first in order to reach any of the Travel Hub options.

8.2.2. Paragraphs 4.36 to 4.47 of the National Policy Statement for National Networks (NPSNN)[126] sets out how Applicants should take into account the effects of climate change and adaptation. Paragraph 4.40 states *"New national networks infrastructure will be typically long-term investments which will need to remain operational over many decades"… and "applicants must consider the impacts of climate change when planning location, design, build and operation"*.

8.3 STUDY AREA

8.3.1. The study area will include all areas of permanent land take and will consider the constructed elements of the C2C Scheme design being implemented within the permanent land take area.

[126] Department for Transport (2014). National Policy Statement for National Networks (NPSNN). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/387223/npsnn-web.pdf (Accessed March 2019).

CONSTRUCTION

8.3.2. Impacts of climate change on the construction phase are scoped out of this assessment due to the short timescales of the construction phase (construction is proposed to take place from 2023 until 2026). The focus of the assessment will be on the resilience of the operational infrastructure to climate change.

OPERATION

8.3.3. The climate change risk assessment will consider the 2080s (between 2070-2099) as the timeline for analysis. This choice is informed by the long lifespan of the key structures within the C2C Scheme, with the bridges having a lifespan of 100 years. The UK Climate Projections 2018 (UKCP18)[127] are used to set the future baseline, and the furthest projections available are for the 2080s time period. Where structures have a shorter lifespan (e.g. street lighting) this will be taken into account in the assessment when assessing the likelihood and consequence of the impact from climate change.

8.4 ASSESSMENT METHODOLOGY

8.4.1. Assessing the resilience of the C2C Scheme to climate change is fundamentally different to other EIA assessments, as it assesses the impact of an external event (climate change) on the C2C Scheme, where the receptors are the elements of the C2C Scheme.

8.4.2. A qualitative methodology for assessing the resilience of the C2C Scheme assets to climate change will be produced in line with DMRB LA 114 Climate and the IEMA Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation 2020[128].

In combination climate impacts:

8.4.3. A qualitative assessment of the in-combination climate impacts will be carried out in line with the IEMA Environmental Impact Assessment Guide to Climate Change Adaption and Resilience (2020)[128]. The assessment will be based on professional judgement of the information available where published quantifiable methods are not available. The assessment will consider on a topic by topic basis, where climate is exacerbating or conversely diminishing the effect of an existing impact of the C2C Scheme. The in-combination climate impacts will consider::

- Impacts due to the project on the current baseline (the assessments carried out by topics);
- How the environmental receptors will be affected by the future climate baseline; and

[127] Met Office (undated). UKCP 18: Regional (12km) and Local (2.2km) Projections, 2019. Available at: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/high-res-projections (Accessed April 2019).

[128] Institute of Environmental Management and Assessment (IEMA) (2020). Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation. June 2020. Available at: https://www.iema.net/resources/reading-room/2020/06/26/iema-eia-guide-to-climate-change-resilience-and-adaptation-2020 (Accessed November 2020).

- The impacts of climate change on the impacts of the project directly and/or through climate change impacting on the mitigation measures for the project.

SIGNIFICANCE CRITERIA

Resilience of the C2C Scheme to climate change

8.4.4. The evaluation of the significance of the effects are as follows:

- The impacts (hazards and opportunities) for each receptor (C2C Scheme assets) will be identified using available climate projections data. In the UK these are the UKCP18 projections, produced by the Met Office Hadley Centre. The resilience of the project to both normal weather and extreme weather-related disaster scenarios, throughout the project lifecycle, will be identified and reported.
- Once the climate change impacts (hazards and opportunities) have been identified, a risk assessment of those impacts on the project shall be undertaken using likelihood categories and consequence of impact.
- The outputs of the risk assessment will be used to report on the significance of effects.

8.5 BASELINE

8.5.1. The Met Office holds historical regional climate information, in which South Cambridgeshire is included in the East England region[129]. High-level climate observations for the East of England over a 30-year averaging period between 1981-2010 are presented in Table 8-1.

Table 8-1 – Historic climate baseline for the East of England (1981-2010)

Climatic conditions	Climate observations
Temperature	Mean daily minimum temperatures ranged from 0°C to 2°C in winter, whilst summer daily maximum temperatures were in the region of 21°C.
Rainfall	Atlantic depressions or convection are the source of the majority of rain in the east, particularly in autumn and winter where Atlantic Lows are more vigorous. Annual rainfall in the east averages at 700mm. Monthly rainfall is variable but is highest in the winter months. The number of days with rainfall totals greater than 1mm are 30 days in winter, dropping to an average of 25 days in summer.
Wind	Eastern England is one of the more sheltered parts of the UK. The strongest winds are associated with the passage of deep areas of low pressure close to or across the UK. The frequency and strength of these depressions is greatest in the winter half of the year when mean speeds are approximately 8 knots and mean wind gusts at 55 knots. Eastern England has the greatest frequency of tornadoes in the UK.

[129] The Met Office (2016). East England: Climate. Available at: https://www.metoffice.gov.uk/climate/uk/regional-climates/ee (Accessed January 2020).

Climatic conditions	Climate observations
Sunshine	Average annual sunshine totals were between 1500 and 1700 hours. Industrial pollution can reduce sunshine amounts however, since a decline in heavy industry.
Air Frost	The average number of days with air frost varies from 30 to 55 days per year.

Source: Met Office Regional Climate Data

8.6 FUTURE BASELINE

The UK Climate Projections developed by the Met Office Hadley Centre include regional climate projection data, for which Cambridge is included in the East of England region. The East of England is projected (under a range of emissions scenarios modelled in UKCP18) to experience hotter and drier summers, and warmer and wetter winters (See Table 8-2).

For the EIA, climate projections data for the 2080s (2070-2089) under Representative Concentration Pathway (RCP) 8.5[130] (the highest scenario available in UKCP18) have been selected.

Projected changes in key climate variables under the RCP 8.5 emissions scenario, for the 2080s, are summarised in Table 8-2.

Table 8-2 – Future climate projections for the 2080s (RCP 8.5 scenario)

Climatic conditions	Climate observations
Temperature	The average summer temperature is projected to increase by 4.4°C under the central estimate, which represents "as likely as not" probability of change (50th percentile), and average winter temperature is estimated to increase by 3°C (50th percentile).
Rainfall	The average summer rainfall rate is estimated to decrease by 31%, whereas the average winter rainfall rate is estimated to increase by 20% (in the 50th percentile or central estimate for both)
Wind	Climate projections for wind are more uncertain than those for temperature and precipitation, due to inherent difficulty in modelling future wind conditions. However, overall an increase in extreme weather, including wind, is projected.

Source: UKCP18 Climate Projections[131]

[130] RCP: Representative Concentration Pathways. RCPs are the new scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) and used by the UKCP18 climate projections. RCPs are based on the projected concentration of greenhouse gases in the atmosphere in 2100, e.g. RCP 8.5 is a radiative forcing of 8.5 in 2100. These replace the previous Low, Medium and High scenarios. There are 4 RCPs in UKCP18 (2.6, 4.5, 6.0 and 8.5). These do not directly map onto the Low, Medium, High scenarios used previously.

[131] Met Office (2018). UKCP18 Climate Projections: Key results. Available at: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Key-results.xlsx (Accessed February 2020).

8.7 POTENTIAL IMPACTS

8.7.1. During the C2C Scheme's 60-year appraisal period (the anticipated lifetime of the C2C Scheme) and 100 year lifespan for the bridges, changes in climate as outlined in Table 8-2 and Section 8.6 are likely to be experienced in the study area. This has the potential to pose a risk to the C2C Scheme assets such as deformation and deterioration of asphalt surfacing associated with extreme temperatures and changes in precipitation affecting the foundation strength and deterioration of the road surface, with the potential to lead to an increased flood risk.

8.7.2. Changes in climate also have the potential to pose risks to the environmental receptors detailed throughout this report. For example, increased frequency and quantity of rainfall can affect the resilience of species included in landscape planting designs.

8.8 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

8.8.1. The assessment will be limited to only consider climate impacts on C2C Scheme assets such as pavements, drainage and geotechnical receptors in addition to the in-combination impacts of climate change on the environmental receptors. In this assessment, the ability to replace and upgrade assets will be taken into account. It will be vital to ensure any assets that will be built once, and which could be impacted by changes in climate, are designed to take into account these future potential vulnerabilities.

8.8.2. The operational impacts on the C2C Scheme as a result of climate change will be considered. This will be informed by the lifespan of key elements within the C2C Scheme design and availability of UK Climate Projections.

8.8.3. The impacts of the C2C Scheme in combination with climate change will be assessed for all topics. Each topic will assess the in-combination impacts of climate change as part of the ES to ensure consideration of the extent to which climate change exacerbates or ameliorates effects of topic specific impact of the project are captured.

SCOPED OUT

8.8.4. The resilience of the C2C Scheme to climate during the construction stage is being scoped out, due to the short construction period (2023 until 2026) not being affected by the changing climate which occurs over longer periods of time.

9 COMMUNITY AND HUMAN HEALTH

9.1 INTRODUCTION

9.1.1. This chapter considers the identification and assessment of likely significant effects on community and health receptors during the construction and operation of the C2C Scheme. It provides an overview of the community and health baseline within the study area and details the likely significant community and health effects. It sets out the proposed methodology for assessing the impact of the C2C Scheme on community and health and identifies those impacts which can be scoped out of the ES.

9.2 LEGISLATION AND STANDARDS

9.2.1. The community and health assessment is guided by national EIA requirements and the Government's planning policy and guidance, including:

- National Planning Policy Framework (2019); and
- Countryside and Rights of Way Act (2000).

9.2.2. It is also guided by the Highways England DMRB LA 112 guidance on population and human health assessments. This is considered the most up-to-date and relevant piece of guidance for a linear transport scheme. However, professional judgement is also used to guide the assessment where appropriate.

9.2.3. At a local level, the main policy documents relevant to this project are the South Cambridgeshire Local Plan (2018), which includes:

- Policy S/2 'Objectives of the Local Plan' sets out strategic objectives for South Cambridgeshire, including promoting economic growth, strong communities, healthy lifestyles, and sustainable modes of transport.
- Policy SC/2 'Health impact assessment' states that "New development will have a positive impact on the health and wellbeing of new and existing residents" and that the Plan should "provide for development in a way that supports and encourages active and healthy lifestyles."

9.2.4. Cambridge Local Plan (2018) sets out 15 strategic objectives for Cambridge, including promoting economic development, sustainable transport and the ambition to "promote a safe and healthy environment, minimising the impacts of development and ensuring quality of life and place."

9.3 STUDY AREA

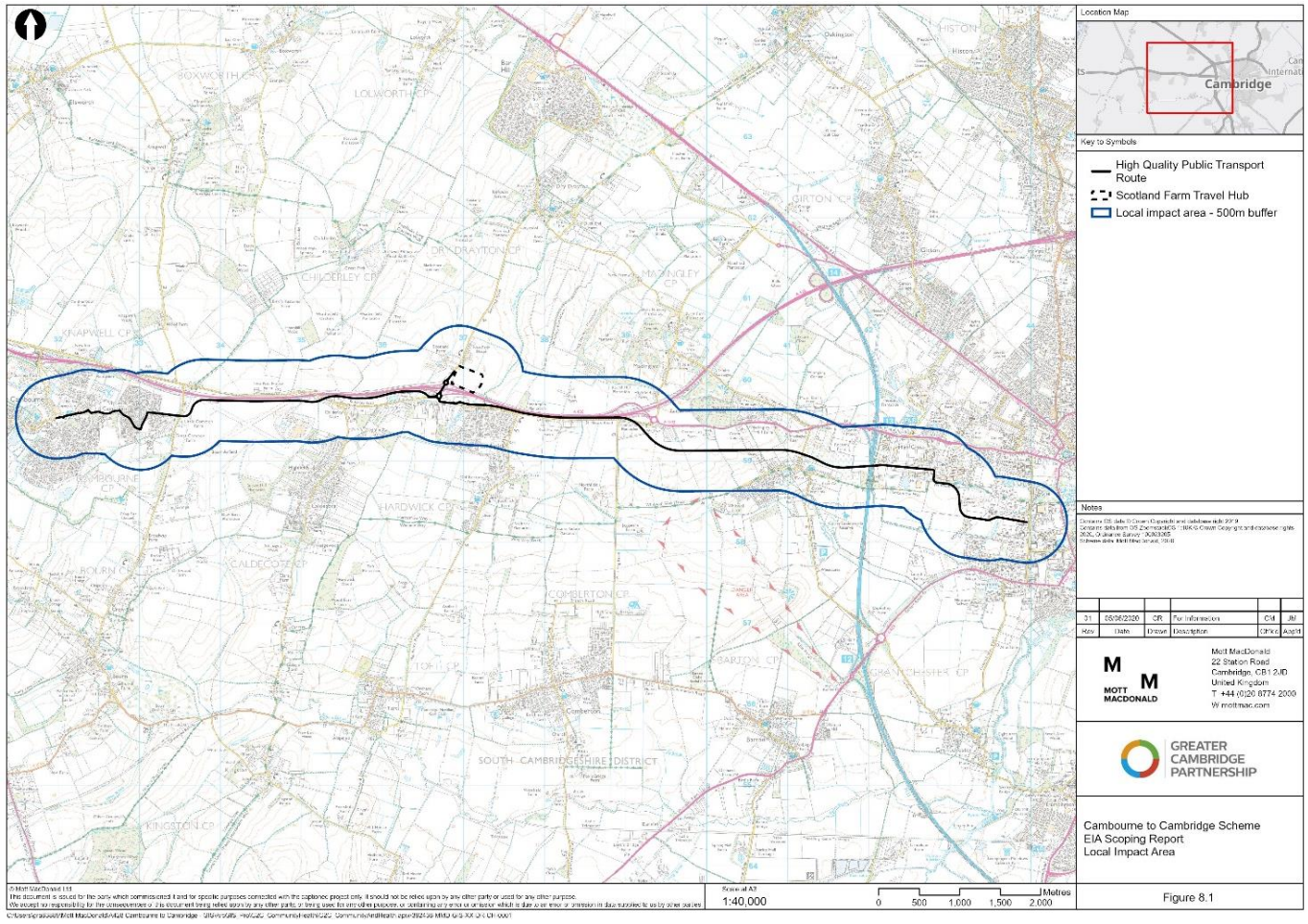
9.3.1. Baseline data has been calculated for a Local Impact Area (LIA) and Wider Impact Area (WIA). The LIA and WIA have been created based on guidance and professional judgement[132] and are defined as follows:

- LIA: the area located within a 500m distance of the likely C2C Scheme options[133] and the Travel Hub site at Scotland Farm will be referred to as the LIA. This is the primary study area for this topic and is designed to capture most potential community and health effects of the C2C Scheme. This is shown in Figure 9-1.
- WIA: the area covered by the local authorities of Cambridge City and South Cambridgeshire forms the WIA due to the location of the C2C Scheme on the boundary between these two authorities. The WIA includes the extent of the area that may be affected by the operation of the C2C Scheme and related GCP schemes and is used for the consideration of community and health effects in a broader area. This is shown in 9-2 - Wider impact area.

[132] DMRB LA112 Population and Human Health has been used as relevant guidance, with professional judgement used where there is no standard definition of the study area for some effects like employment.

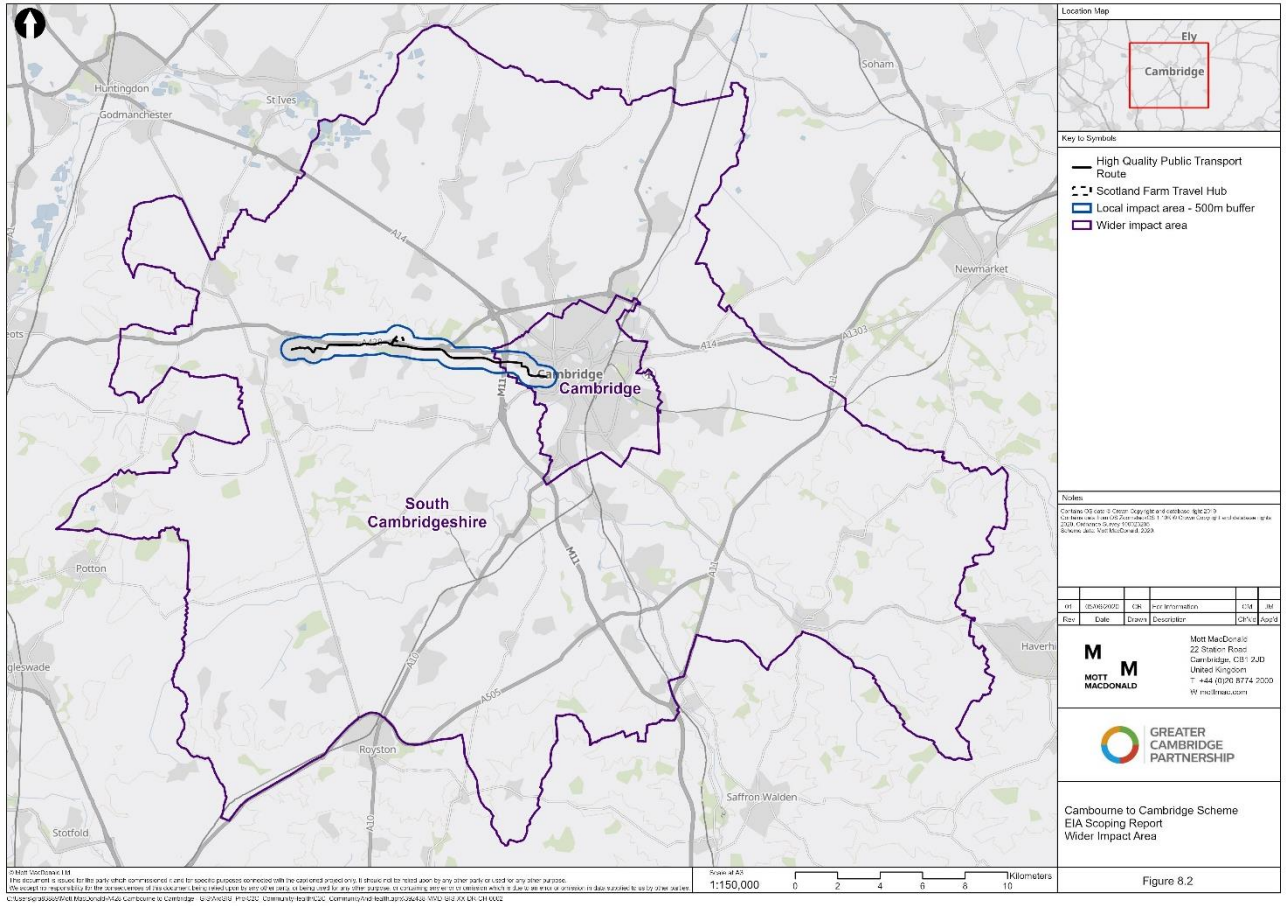
[133] This comprises 500m from the centrelines of the current likely C2C Scheme options and the Scotland Farm Travel Hub site, in order to capture the full range of likely impacted areas. This may be revised at a later stage as the design is finalised. However, only the Outline Business Case Preferred Route is shown in figures. See Chapter 2 'Scheme Description' for more detail on the C2C Scheme route options.

Figure 9-1 - Local impact area



Source: Mott MacDonald (2020)

Figure 9-2 - Wider impact area



Source: Mott MacDonald (2020)

9.4 ASSESSMENT METHODOLOGY

SURVEYS

9.4.1. A range of publicly available datasets will be used to form the baseline and inform the assessment. This includes Office for National Statistics datasets including the 2011 Census, Population Estimates, and the Annual Population Survey as well as Ordnance Survey Address Base, English Indices of Multiple Deprivation and data from Public Health England 'Fingertips'. Information on PRoWs and other walking and cycling routes has been obtained using data from CCC.

9.4.2. Surveys relevant to determinants of human health such as noise or air quality will be undertaken by the relevant environmental topic assessments.

9.4.3. Surveys of agricultural land use will be undertaken and reported within Chapter 12 Landscape and Visual although the community and health assessment will report on impacts on the function of farm businesses as part of the community assessment. No other specific surveys are assessed as necessary for community impacts.

ASSESSMENT APPROACH

9.4.4. The construction and operational phases of the C2C Scheme have the potential to result in significant effects on community and health within the study area. The assessment on community and health will consider both direct and indirect effects arising as a result of the construction and operation of the C2C Scheme. Where appropriate this will follow guidance on community and health impact assessment including DMRB LA 112.

9.4.5. The assessment of the impact on private property and housing, community land and assets and development land and businesses and cyclists, pedestrians and equestrians will be completed in accordance with DMRB LA 112. As stated in Chapter 16.1, the assessment of impacts on cyclists, pedestrians and equestrians, within the Community and Health Assessment, will include changes to journey length and severance.

9.4.6. The approach to assessing impacts on agricultural land holdings, health impacts and employment are described below.

Agricultural land

9.4.7. As mentioned above interviews with agricultural landowners and tenants will be undertaken to ascertain the following:

- The type, location and number of agricultural land holdings at risk of demolition (currently assessed as zero) or from which land will be required/access affected by a project;
- The level of existing severance/accessibility restrictions to agricultural land holdings within the study area; and
- The frequency of use and nature of use of the agricultural holdings/assets within the study area.

Health impacts

9.4.8. There is no formal guidance on considering health within the context of EIA. IEMA have published 'Health in Environmental Impact Assessment; A Primer for a Proportionate Approach[134].

9.4.9. The assessment of human health will be undertaken utilising this guidance as a basis. The key aspects of the approach to assessing health effects are:

- Health pathways
- Receptors
- Assessment
- Evaluation of significance.

9.4.10. Establishing credible health pathways will determine the relationship between project activities and potential health impacts on the population and will therefore help to establish the scope of the assessment.

9.4.11. A number of other EIA topics are relevant to the determinants of health and will therefore provide inputs to the potential effects requiring assessment. These are:

- Air quality and odour;
- Landscape and visual amenity;
- Noise and vibration; and
- Traffic and transport.

9.4.12. The assessment of each health effect will draw on quantitative and qualitative analysis and stakeholder engagement. The assessment will be based on professional judgements with appropriate reference to supporting evidence.

Employment Impacts

9.4.13. The C2C Scheme will deliver a range of direct and wider economic benefits, through the creation of employment and the provision of sustainable public transport. An assessment of employment and economic output that would be generated by the C2C Scheme will be undertaken as part of the EIA process. Such outputs include data about the working age population, employment and unemployment levels and the economically active population. This analysis will be used to inform the significance of effect rating presented in this chapter. Land-use impacts on existing businesses and development land are considered separately.

[134] IEMA, Health in Environmental Impact Assessment; A Primer for a Proportionate Approach, 2017.

9.4.14. A separate Outline Business Case for the Cambourne to Cambridge Better Public Transport Project was published in January 2020. Where appropriate this will be used to inform the assessment of direct and wider economic benefits outlined above.

Significance criteria

9.4.15. The assessment will focus on those impacts that are likely to have significant effects on community and health conditions. Significance is determined by considering the sensitivity of the receptor, as well as the magnitude of the impact on those receptors.

9.4.16. Table 9-1 below sets out broad criteria that will be used to describe and assess the sensitivity of community and healthy receptors apart from the assessment on agricultural land. Table 9-2 provides criteria specifically for defining the sensitivity of agricultural land.

Table 9-1 – Sensitivity of receptors

Sensitivity	Sensitivity criteria
High	• An already vulnerable receptor with very little capacity and means to absorb changes. • No alternative resources, access arrangements or opportunities are available within an easily accessible distance. • A highly or frequently accessed resource
Medium	• A non-vulnerable receptor with limited capacity and means to absorb changes. • A limited range of alternative resources, access arrangements or opportunities are available within and easily accessible distance. • A moderately, or semi-frequently accessed resource.
Low	• A non-vulnerable receptor with sufficient capacity and means to absorb changes. • A wide range of alternative resources, access arrangements or opportunities are available within an easily accessible distance. • An infrequently accessed resource.

Table 9-2 – Sensitivity of agricultural receptors

Sensitivity	Sensitivity criteria
High	• Areas of land in which the function is dependent on the spatial relationship to key agricultural infrastructure; and • Access between land and key agricultural infrastructure is required on a frequent basis (daily or weekly)
Medium	• Areas of land in which the function is partially dependent on the spatial relationship to key agricultural infrastructure; and • Access between land and key agricultural infrastructure is required on a frequent basis (monthly)
Low	• Areas of land in which the function is partially dependent on the spatial relationship to key agricultural infrastructure; and

Sensitivity	Sensitivity criteria
	• Access between land and key agricultural infrastructure is required on a frequent basis (monthly or less frequent)

9.4.17. The magnitude of impacts will be assessed following the principles below. Table 9-3 below sets out broad criteria that will be used to describe and assess the impact on community and health receptors**.** Table 9-4 provides impact magnitude criteria specifically for agricultural land.

Table 9-3 – Impact magnitude criteria

Magnitude	Criteria
Major	• Affects receptors within the LIA and potentially beyond • Affects many receptors • A substantial change (positive or negative) from the baseline position • A large widening or narrowing of inequalities • Majority of communities affected have high levels of deprivation • The impact is permanent or long-term (e.g. more than a year) • Requires considerable intervention to return to the baseline
Moderate	• Affects receptors beyond the application site into the LIA • Affects a moderate number of receptors • A notable change (positive or negative) from the baseline position • A widening or narrowing or inequalities • Majority of communities affected have average or above average levels of deprivation • The duration over which the impact is experienced is medium-term (e.g. between six months and a year) • May require some intervention to return to the baseline
Minor	• Affects receptors in the LIA only, and mostly within the application site • Affects a small number of receptors • A slight change (positive or negative) from the baseline position with evidence available to demonstrate change • A slight widening or narrowing of inequalities with evidence available to demonstrate change • Few people in a community affected (positively or negatively) • The duration over which the impact is experienced is short-term (e.g. between three and six months) • Baseline returns without intervention or with only limited intervention
Negligible	• Affects receptors within the site boundary only • Baseline remains consistent/no discernible change (positive or negative) from the baseline position

Magnitude	Criteria
	• Majority of communities affected are not deprived • Impact is very short-term (e.g. less than three months) • Affects the well-being of very few receptors

Table 9-4 – Impact magnitude criteria for agricultural land

Magnitude	Criteria
Major	• Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements. e.g. direct acquisition and demolition of buildings and direct development of land to accommodate highway assets; and/or • Introduction (adverse) or removal (beneficial) of complete severance with no/full accessibility provision.
Moderate	• Partial loss of/damage to key characteristics, features or elements, e.g. partial removal or substantial amendment to access or acquisition of land compromising function of property, businesses, community assets or agricultural holdings; and/or • Introduction (adverse) or removal (beneficial) of severe severance with limited / moderate accessibility provision
Minor	• A discernible change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements, e.g., amendment to access or acquisition of land resulting in changes to operating conditions that do not compromise overall function of property, businesses, community assets or agricultural holdings; and/or • Introduction (adverse) or removal (beneficial) of severance with adequate accessibility provision.
Negligible	• Very minor loss or detrimental alteration to one or more characteristics, features or elements a discernible change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements, e.g. acquisition of non operational land or buildings not directly affecting the viability of agricultural land holdings, amendment to access or acquisition of land resulting in changes to operating conditions that do not compromise overall function of the agricultural holdings; and/or • Very minor introduction (adverse) or removal (beneficial) of severance with ample accessibility provision.

9.4.18. Effects are evaluated by combining the assessments of magnitude and sensitivity as above to determine the significance of effect (as negligible, minor, moderate or major), as explained in Section 4 ‘Environmental Impact Assessment Methodology’. Effects can be neutral, beneficial or adverse and temporary or permanent. Only effects that are moderate or major are considered significant in EIA terms.

9.5 BASELINE

9.5.1. A range of publicly available data sources have been used to determine the community and health baseline. These include statistics on population and employment from the Office for National Statistics (ONS) and data from local authorities.

POPULATION, RESIDENTIAL PROPERTY AND ECONOMIC ACTIVITY

9.5.2. The total population of the LIA as of 2018 is 12,990. The total population of the WIA is 283,277 (125,758 in Cambridge and 157,519 in South Cambridgeshire). The table below shows the population and age baseline in the LIA and WIA.

Table 9-5 – Population baseline data

Area	Total population	Age		
		Under 16	16 - 64	65+
LIA	12,990	23%	68%	9%
WIA	283,277	19%	65%	16%
Cambridge	125,758	17%	70%	13%
South Cambs.	157,519	20%	60%	19%
England	55,977,178	19%	63%	18%

Source: ONS Population Estimates 2018.[135]

9.5.3. The population of the LIA has a relatively high proportion of children and a relatively low proportion of older people compared to the WIA as a whole and nationally.

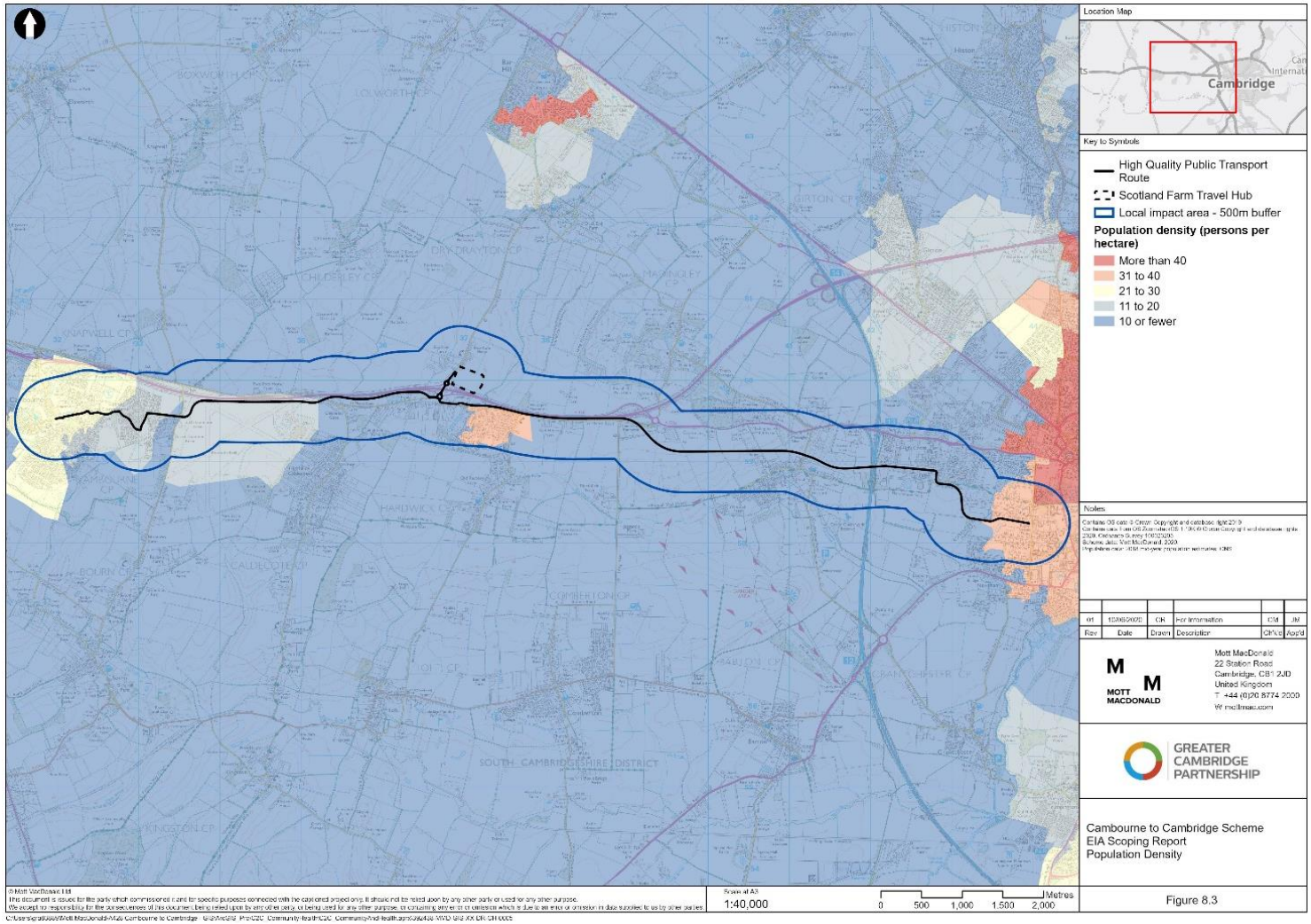
9.5.4. There are approximately 4,650 residential properties within the LIA. This includes properties in the settlements of Hardwick, Highfields and Coton as well as properties in Cambourne and Cambridge. The properties closest to the C2C Scheme are mainly along the St Neots Road at Hardwick, as well as properties at either end of the route in Cambourne and Cambridge including alongside Rifle Range road. There are some properties on the northern edge of Coton that are approximately 50m from the C2C Scheme. There are also properties to the north of the proposed Travel Hub.

9.5.5. Communities in the LIA and WIA include Cambourne, Hardwick, Highfields Caldecote, Coton and the western fringe of Cambridge. Of these Cambourne is the largest with a population of

[135] ONS Population Estimates 2018 [Online] available at https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2018 last accessed November 2021

approximately 10,400 people. Figure 9-3 shows the population density along the Cambourne to Cambridge route.

Figure 9-3 - Population Density



Source: Mott MacDonald (2020)

EMPLOYMENT AND ECONOMIC ACTIVITY

9.5.6. The following table shows the economic baseline for the WIA. Employment is relatively high and unemployment is relatively low in the WIA authorities compared to the national average.

Table 9-6 – Economic activity and employment baseline data

Area	Economically active (16-64)	Employment rate (16-64)	Unemployed (16-64)	Total Jobes (2018)
WIA	84%	83%	-	195,000
Cambridge	81%	85%	2.5%	109,000
South Cambs.	86%	80%	2.0%	87,000
England	79%	76%	4.0%	26,842,000

Source: ONS Population Estimates 2018[136]

9.5.7. While the settlements of Cambourne, Hardwick, Highfields Caldecote and Coton contain local-level services and businesses, the main employment centres in the WIA are in Cambridge. This is the main centre for study and regional-level services in the WIA, containing major universities as well as a major shopping and office centre and several science and medical employment centres. Major industries of employment in the WIA are shown in the table below. The largest industry groups in the WIA are high-skills industries such as professional, scientific and technical industries (20%), education (16%) and health (13%).

Table 9-7 – Industries of employment

Industry	WIA	Cambridge	South Cambs.	England
Agriculture, mining, utilities (A, B, D, E)	2%	1%	3%	3%
Manufacturing (C)	6%	2%	12%	8%
Construction (F)	4%	1%	6%	5%
Wholesale, retail and motor trades (G)	10%	9%	10%	15%

[136] ONS Population Estimates 2018; ONS Annual Population Survey, 12 months to June 2019; ONS Model-Based Estimates of Unemployment, 12 months to June 2019; Business Register and Employment Survey, 2018

Industry	WIA	Cambridge	South Cambs.	England
Transport & storage (incl postal) (H)	2%	2%	2%	5%
Accommodation & food services (I)	8%	9%	5%	8%
Finance, ICT and Property (J, K, L)	10%	10%	9%	10%
Professional, scientific & technical (M)	20%	16%	25%	9%
Business administration & support services (N)	6%	5%	6%	9%
Public administration & defence (O)	2%	2%	1%	4%
Education (P)	16%	23%	7%	9%
Health (Q)	13%	15%	10%	13%
Arts, entertainment, recreation & other services (R,S,T and U)	4%	5%	3%	5%

Source: Business Register and Employment Survey (2018)[137]

DEPRIVATION

9.5.8. The English Indices of Multiple Deprivation (IMD) 2019 are commonly used for the measurement and comparison of relative levels of deprivation (poverty). Most LIA residents (85%) live in the 20% least deprived neighbourhoods in the country. This is higher than the WIA and national averages. Figure 9-4 shows the index of multiple deprivation along the Cambourne to Cambridge route.

[137] Business Register and Employment Survey (2018)

Table 9-8 – Population by deprivation quintiles

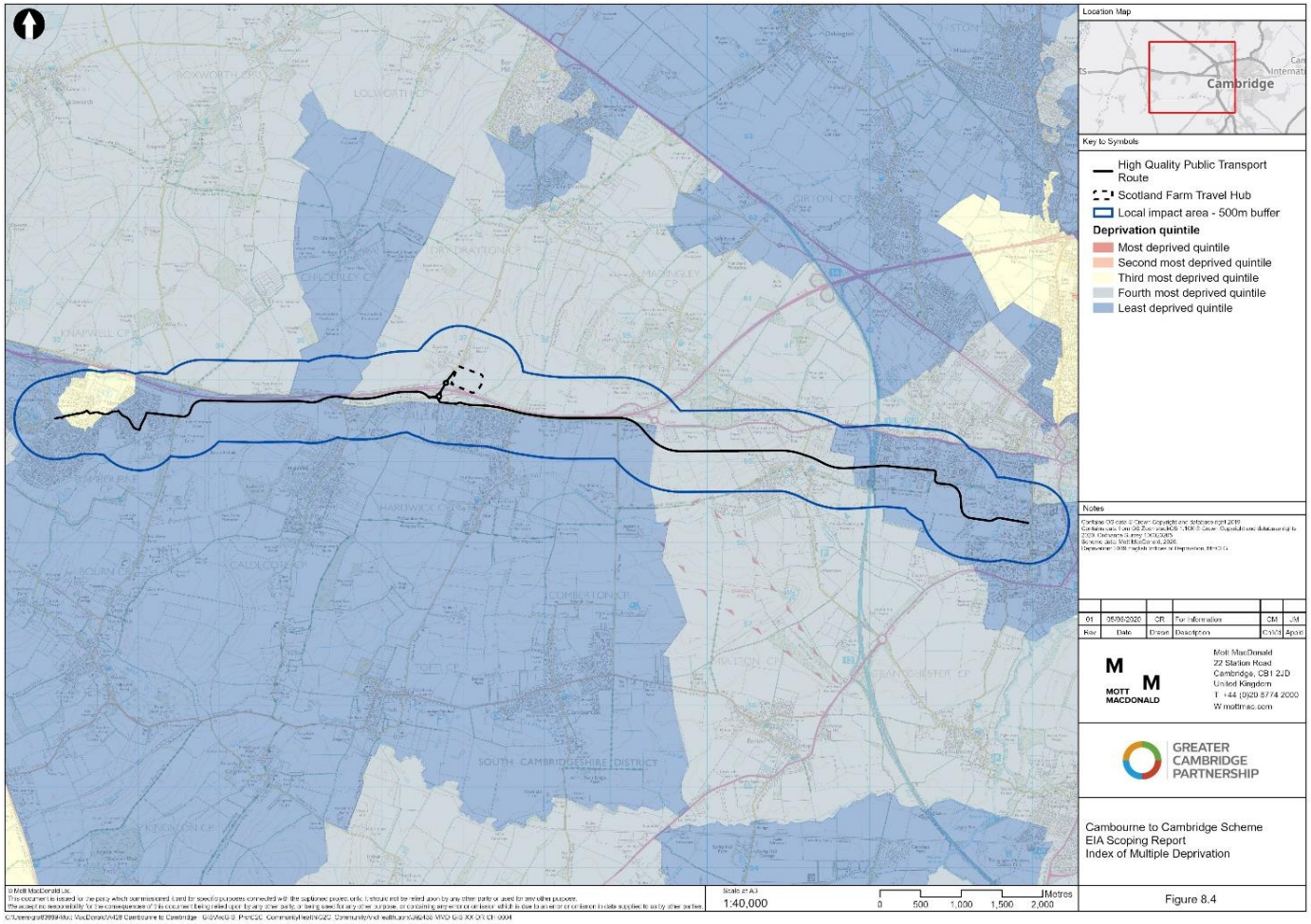
Location	Most Deprived	Second most deprived	Third most deprived	Fourth most deprived	Least deprived
LIA	0%	0%	9%	5%	85%
WIA	2%	5%	19%	32%	43%
Cambridge	4%	10%	31%	31%	25%
South Cambs.	0%	1%	10%	33%	56%
England	20%	21%	20%	20%	19%

Source: Indices of Multiple Deprivation (2019)[139]

[138] IMD measures relative deprivation of Lower Super Output Areas (LSOAs), ranking all English LSOAs from most to least deprived. Population change since LSOAs were created in 2011 means the population is slightly higher in the second most deprived quintile.

[139] Indices of Multiple Deprivation (2019)

Figure 9-4 - Index of multiple deprivation



Source: Mott MacDonald (2020)

HEALTH

9.5.9. The table below present key health indicators within the WIA. Both Cambridge and South Cambridgeshire generally perform better than the national average on public health indicators, including for conditions sensitive to environmental factors such as respiratory diseases.

Table 9-9 – Public health baseline data

Measure	Cambridge	South Cambs.	East of England	England
General health, self-reported (bad/very bad, 2011)	4%	3%	5%	5%
Long-term health problem or disability (2011)	13%	14%	17%	18%
Life expectancy at birth (male, 2015-17)	80.8	82.3	80.4	79.6
Life expectancy at birth (female, 2015-17)	83.5	85.4	83.7	83.1
Under-75 mortality rate, respiratory diseases (per 100,000, 2016-18)	26.8	17.7	29.8	34.7
Under-75 mortality rate, cardiovascular diseases (per 100,000, 2016-18)	63.6	43.4	63.4	71.7
Mortality rate, chronic obstructive pulmonary disease (COPD) (per 100,000, 2016-18)	41.9	28.7	46.4	51.7
Physically active adults (%, 2017/18)	80.1	68.3	65.4	66.3

Source: Census (2011)[140]; Public Health England, Fingertips, (2020)[141]

9.5.10. In addition, areas and communities sensitive to changes in environmental health determinants as a result of the C2C Scheme such as air quality management areas or areas sensitive to noise will be identified by the relevant environmental assessments and used to inform the human health assessment.

COMMUNITY RESOURCES

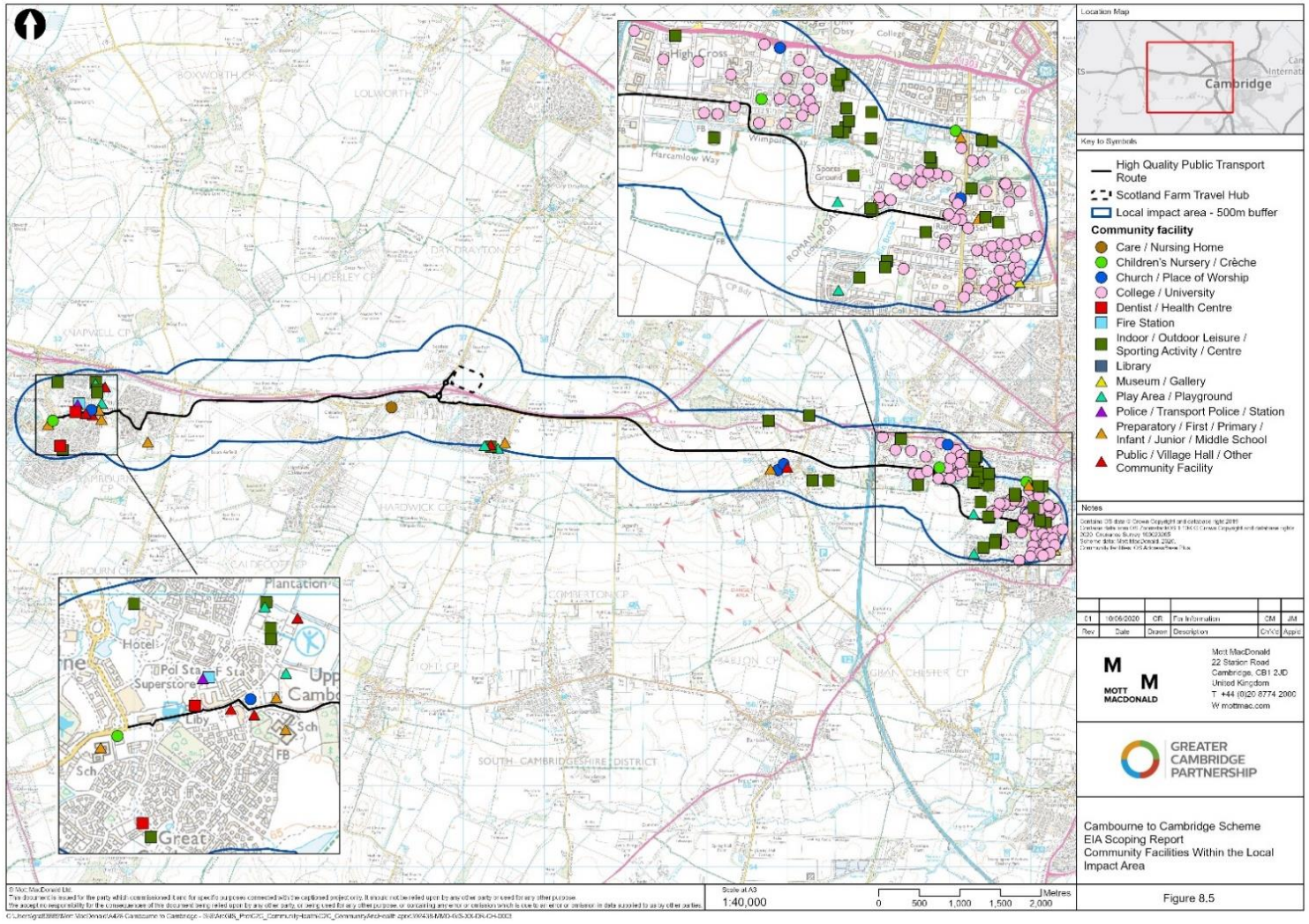
9.5.11. There are multiple community resources located in the LIA in adjacent villages and in Cambourne and Cambridge, as shown in Figure 9-5 - Community facilities. In particular, there are a large number of university-owned facilities at the eastern end of the C2C Scheme, including research

[140] Office of National Statistics (2011). Census. Available at: https://www.ons.gov.uk/census/2011census [Accessed 8 December 2021].

[141] Public Health England (2020). Fingertips. Available at: https://fingertips.phe.org.uk/ [Accessed 8 December 2021].

institutes, laboratories, libraries and university sports facilities. There are several schools in the LIA. Cambridge city also contains major regional-level public services such as the Cambridge Biomedical Campus and Cambridge and Anglia Ruskin universities, which people in the LIA and WIA may access.

Figure 9-5 - Community facilities



Source: Mott MacDonald (2020)

NON-MOTORISED USERS, PROWS AND PUBLIC TRANSPORT

9.5.12. Two unsegregated cycle lanes run along either side of the St Neots Road at Hardwick (linking with the Madingley Road to Cambridge), close to the C2C Scheme. One off-road cycle and pedestrian path runs to the south of the West Cambridge site, crossing the C2C Scheme. There are also unsegregated cycle lanes on Grange Road at the eastern end of the route.

9.5.13. There are no National Cycle Network (NCN) routes in the LIA, but there are NCN routes running through Cambridge city centre including NCN Route 51 to Oxford from Cambridge and Regional Cycle Network Route 24, which run north-west of Cambridge towards St Ives which cyclists on the local network may travel onward to.

9.5.14. There are 17 PRoWs within or partly within the LIA, including three bridleways. Other pedestrian routes include non-designated footpaths along the St Neots Road and in Cambourne, Hardwick, Highfields Caldecote, Coton and Cambridge.

9.5.15. Existing public transport includes a direct bus service from Cambourne to Cambridge, with approximately 3 buses per hour at 20-minute intervals, with stops along the St Neots Road at Hardwick.

DEVELOPMENT LAND, BUSINESSES AND AGRICULTURE

9.5.16. There are approximately 430 business properties within the LIA. Business properties are primarily located within the eastern part of the LIA, most of which are university facilities such as research institutes, laboratories and other university uses. There are also some business properties located close to the C2C Scheme along the St Neots Road at Hardwick.

9.5.17. Most land outside of settlements within the LIA is within agricultural use. Agricultural businesses in the LIA include a range of farm types and sizes.

9.5.18. The following land within the LIA is allocated in local plans for major development:

- Grange Farm off Wilberforce Road (Cambridge Local Plan Reference: U3) – allocated for student housing.
- West Cambridge Site (Local Plan Reference: M13) – allocated for university development and related uses including research institutes, laboratories, student accommodation, supporting infrastructure and related services and community facilities.
- Bourn Airfield New Village (South Cambridgeshire Local Plan Reference: SS/7) – allocated for a new settlement of 3,500 homes as well as supporting services and facilities.

9.5.19. However, of these only West Cambridge and Bourn Airfield are crossed by the C2C Scheme.

9.6 POTENTIAL IMPACTS AND EFFECTS

9.6.1. The C2C Scheme will see the construction and operation of a public transport route between Cambourne and Cambridge, an adjacent path for non-motorised users and a Travel Hub at Scotland Farm.

LANDTAKE

9.6.2. The C2C Scheme requires temporary, as well as permanent land take within the LIA. This permanent land take is not anticipated to affect residential property or community land. However,

construction of the C2C Scheme will require the use of agricultural land along the route and at Scotland Farm, potentially impacting the functioning of agricultural businesses.

9.6.3. Temporary and permanent land take could also impact on development land and businesses within West Cambridge and at Bourn Airfield. At West Cambridge the C2C Scheme is proposed to run on existing roads and is not expected to have a significant impact on allocated uses.

9.6.4. The C2C Scheme would support the sustainable development of Bourn Airfield through provision of public transport infrastructure. A revised planning application submitted in 2019 provides safeguarding for a public transport route through Bourn Airfield. Assuming the proposed C2C Scheme aligns with designs for Bourn Airfield New Village, beneficial impacts would occur.

TEMPORARY ACCESS

9.6.5. The C2C Scheme would also result in temporary changes in access during construction. This could impact the use of four PRoWs (labelled 39/31, 39/30, 55/2 and 66/17 on the Cambridgeshire Rights of Way map), including three footpaths and a bridleway. There may also be temporary closures or diversions for other footpaths and cycle routes where these cross the C2C Scheme during construction, including part of the local cycle network along St. Neots Road at Hardwick and a cycle and pedestrian path to the south of the West Cambridge site. These potential temporary diversions or closures to these PRoWs, footpaths cycle paths could result in temporary disruption to users from increased journey lengths.

9.6.6. Temporary changes to access could also impact the entrances to residential properties, community resources and businesses on the St Neots Road at Hardwick due to the construction of the C2C shared use path between these properties and the road.

9.6.7. The C2C Scheme is anticipated to result in temporary changes to the local environment which may affect the amenity and/or health of communities. Potential adverse impacts could include result from noise and air quality impacts during construction impacting amenity and/or health of communities.

9.6.8. The proposed C2C Scheme requires a construction workforce to deliver it, which would likely result in direct beneficial, indirect and induced indirect effects from temporary employment in the WIA.

PERMANENT ACCESS

9.6.9. The C2C Scheme is not expected to impact direct access from the existing road network to residential or business properties. Access to residential and business properties on the St Neots Road would not be impacted during operation, as the proposed pedestrian and cyclist path would maintain access to all properties. There would be no permanent closures or diversions of PRoWs during operation of the C2C Scheme. Where the route crosses PRoWs, crossings would be provided for NMUs and as a result no significant impact is expected. However, the increased public transport on roads at either end of the route may also impact the local cycling network.

OPERATIONAL EFFECTS

9.6.10. The C2C Scheme may result in permanent changes to the local environment which may affect the amenity and/or health of communities, such as new sources of noise. However, during operation of the C2C Scheme there would be increased provision of public transport along the route and active travel modes. This could result in beneficial changes in air quality and noise that could beneficially impact the local environment and subsequently have beneficial impacts on human health. The provision of public and active transport modes between Cambourne and Cambridge is also likely to

enhance access to employment sites and education (schools) as well as other key facilities in both locations. The new walking and cycling provision along the C2C Scheme may also encourage people to use active travel modes, bringing potential health benefits to the population.

9.6.11. The C2C Scheme may also create additional permanent employment throughout its operation. This is likely to take place within the WIA. It would also deliver wider economic benefits to the economy of the WIA through delivering improved public transport and supporting greater productivity and investment.[142]

9.7 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

9.7.1. The C2C Scheme requires temporary and permanent land taken within the LIA which will require the use of agricultural land along the route. Therefore, impacts on the function of agricultural businesses as a result of temporary and permanent land take will be assessed in the ES.

9.7.2. Potential impacts on residential properties and businesses are anticipated to arise in relation to disruption to access during construction of the new cycle path.

9.7.3. Impacts on pedestrians, cyclists and equestrians are anticipated to arise in relation to their ability to access and use PRoW and non-designated public routes, changes to the accessibility and usability of routes (during both construction and operation).

9.7.4. The C2C Scheme could potentially impact on human health during construction through environmental impacts such as noise or air quality impacts, and during operation by the provision of public transport, active travel infrastructure, and employment[143].

9.7.5. Impacts on the local economy and employment are anticipated to arise in relation to job creation, the supply chain, and employment opportunities for the local population during both construction and operation.

9.7.6. The provision of public and active transport modes between Cambourne and Cambridge is also likely to enhance access to employment sites and key facilities in both locations. This will be further assessed in the ES.

9.7.7. Potential impacts on development land within the LIA will be considered during both construction and operation as there is land within the LIA is allocated in local plans for major development.

[142] The wider economic impact of the C2C Scheme is set out in detail in the Outline Business Case, particularly the Strategic Economic Narrative & Economic Impacts Report.

[143] The assessment of human health will be included within the Community and Health Chapter of the EA. A separate Health Impact Assessment will not be required.

SCOPED OUT

9.7.8. There is not expected to be any loss of residential or community land as a result of the C2C Scheme, and this is proposed to be scoped out during both construction and operation.

9.7.9. Access to residential and business properties is not expected to be impacted during operation of the C2C Scheme. This is proposed to be scoped out for the operational period.

10 HISTORIC ENVIRONMENT

10.1 INTRODUCTION

10.1.1. This chapter describes the proposed approach for the identification and assessment of likely significant effects of the C2C Scheme on the historic environment. Statutory provision for the safeguarding of heritage assets has been made at a national and local level. These might comprise below and above ground archaeological remains, buildings, structures, monuments or heritage landscape within or immediately around the site, identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Such assets are identified as having a degree of significance meriting consideration in planning decisions and include designated heritage assets and assets identified by the local planning authority (including local listing), and non-designated assets.

10.2 LEGISLATION AND STANDARDS

NATIONAL

10.2.1. The over-arching legislation in relation to the historic environment in England is provided by the Ancient Monuments and Archaeological Areas Act 1979; and the Planning (Listed Buildings and Conservation Areas Act) 1990. Should any burial remains be present within the C2C Scheme footprint, development affecting any former burial ground is regulated by statute, principally the Burial Act 1857, the Disused Burial Grounds Act 1884 and 1981, and the Pastoral Measure 1983.

10.2.2. National planning policy is set out in the NPPF[144] and supporting revised National Planning Practice Guidance in 2018[145]. Section 16 of the NPPF deals with 'Conserving and Enhancing the Historic Environment'. The NPPF recognises that heritage assets are an irreplaceable resource which 'should be conserved in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of existing and future generations' (para 189). The NPPF requires the significance of heritage assets to be considered in the planning process, whether designated or not.

LOCAL POLICY

10.2.3. The current local planning policies and guidance relevant to the historic environment is contained in the adopted (2018) South Cambridgeshire Local Plan[146] and the (2018) City of Cambridge Local

[144] Ministry of Housing, Communities and Local Government (MHCLG) (2021). July 2021 National Planning Policy Framework.

[145] Ministry of Housing, Communities and Local Government (MHCLG) (2018). July 2018 Conserving and Enhancing the Historic Environment: Planning Practice Guide.

[146] South Cambridgeshire District Council (2018). South Cambridgeshire Local Plan, Adopted September 2018.

Plan[147]. The relevant policy in the South Cambridgeshire Local Plan is Policy NH/14: Heritage Assets, while the relevant policy in the City of Cambridge Local Plan is Policy 61: Conservation and enhancement of Cambridge's historic environment and Policy 62: Local heritage assets.

GUIDANCE

10.2.4. The guidance used during the preparation of this Chapter is summarised as follows.

- Chartered Institute for Archaeologists (CIfA) 2014, *Standard and Guidance for Historic Environment Desk-based Assessment*;
- Historic England, 2017, *Conservation Principles, Policies and Guidance Consultation Draft*[148]*;*
- Historic England, 2019 *Statements of Heritage Significance: Historic England Advice Note 12*[149];
- Historic England, 2017, *The Setting of Heritage Assets, Historic Environment Good Practice in Planning: Note 3, Second Edition*[150];
- Highways Agency (2019) DMRB, Volume 10, Section 5, LA 116 Cultural heritage asset management plans[151];
- Highways Agency (2019) DMRB, Volume 11, Section 2, LA 104 Environmental assessment and monitoring (*ibid*)[152];
- Highways Agency (2019) DMRB, Volume 11, Section 3, LA 106 Cultural heritage assessment (*ibid*)[153].

10.3 ASSESSMENT METHODOLOGY

10.3.1. The ES will set out the planning framework in respect of the historic environment along with the methodology for assessing the environmental effects predicted during the construction and operation (completed development) phases. It will provide a summary overview of the baseline conditions. The EIA will:

- Quantify predicted heritage assets that may be affected by the C2C Scheme;
- Assess any previous impacts which may have affected asset survival;

[147] Cambridge City Council (2018). Cambridge Local Plan 2018.

[148] Historic England (2017). Conservation principles, policies and guidance. Consultation Draft. Swindon

[149] Historic England (2019). Statements of Heritage Significance: Historic England Advice Note 12.

[150] Historic England (2017). The setting of heritage assets. Historic Environment Good Practice Advice in Planning Note 3, Second Edition.

[151] Highways England (2019). Design Manual for Roads and Bridges (DMRB) LA 116 – Cultural Heritage Asset Management Plans. Available at: LA 116 - Cultural heritage asset management plans - DMRB (standardsforhighways.co.uk) [Accessed December 2021].

[152] Highways England (2020). Design Manual for Road and Bridges (DMRB) LA 104 – Environmental assessment and monitoring. Available at: https://www.standardsforhighways.co.uk/prod/attachments/0f6e0b6a-d08e-4673-8691-cab564d4a60a?inline=true [Accessed December 2021]

[153] Highways England (2020). Design Manual for Road and Bridges (DMRB) LA 106 – Cultural heritage assessment. Available at: https://www.standardsforhighways.co.uk/dmrb/search/8c51c51b-579b-405b-b583-9b584e996c80 [Accessed December 2021].

- Evaluate the significance of heritage assets, based on existing designations and professional judgment where such resources have no formal designation, and considering historical, archaeological, architectural / artistic interest as outlined in the NPPF[154] and Historic England's Conservation Principles[155];
- Evaluate the contribution that setting makes to the overall significance of above ground heritage assets selected for assessment[156];
- Predict the magnitude of change upon the known or potential heritage significance of assets and the likelihood and resulting significance of environmental effect;
- Consider the mitigation measures that have been included within the C2C Scheme and any additional mitigation that might be required in order to avoid, reduce or off-set any significant negative effects; and
- Quantifying any residual effects (those that might remain after mitigation) and, where required, cumulative effects.
- Consider the appropriateness of monitoring measures in respect of mitigation for likely significant effects

10.3.2. Additional information will include a fully illustrated historic environment desk-based assessment (HEDBA). This will include a detailed baseline compiled through a broad and standard range of data sources (see below). The assessment will also include a targeted site walkover inspection to determine the topography of the site and existing land use and the nature of the existing buildings on the site. Areas where access is restricted or hazardous (for example, alongside busy roads) will instead be viewed on Google Earth. The walkover will extend to selected designated heritage assets beyond the C2C Scheme to consider potential impacts to their setting (e.g. visible changes to historic character and views).

10.3.3. The assessment will also include a fully illustrated Heritage Statement (HS) for the West Cambridge conservation area. A HS will be required since the far eastern end of the C2C Scheme extends into the West Cambridge conservation area and therefore represents a physical impact on the conservation area. The HS will include a full historic background of the conservation area and its heritage significance, including to what extent setting contributes to its significance. The report will include an impact assessment of the C2C Scheme, and put forward recommendations to mitigate any harmful effects, if appropriate. The baseline will be compiled through a broad and standard range of data sources (see below). The conservation area will be visited as part of the HEDBA site visit.

[154] Ministry of Housing, Communities and Local Government (MHCLG) (2021). July 2021 National Planning Policy Framework.

[155] Historic England (2017). Conservation principles, policies and guidance. Consultation Draft. Swindon.

[156] Historic England (2017). The setting of heritage assets. Historic Environment Good Practice Advice in Planning Note 3, Second Edition.

10.3.4. Additional consultation and liaison, where necessary, with the local planning authority (LPA) Archaeological Advisor, Conservation Officer and Historic England will also be undertaken.

10.3.5. The work would be undertaken in accordance with the requirements of the NPPF and to standards specified by the Chartered Institute for Archaeologists and Historic England.

BASELINE CHARACTERISATION

10.3.6. In order to determine the full historic environment potential of the C2C Scheme site, a broad range of standard documented and mapping information, including results from any archaeological investigations in the site and a study area around it will be examined in order to determine the likely nature, extent, preservation and significance of any known or possible heritage assets that may be present within or adjacent to the C2C Scheme.

10.3.7. Occasionally there may be reference to assets beyond this study area, where appropriate, e.g., where such assets are particularly significant and/or where they contribute to current understanding of the historic environment.

10.3.8. Professional judgement will be used to determine an appropriate size of the study area around the C2C Scheme.

10.3.9. A broad range of standard sources will be consulted, including:

- Historic England - information on statutory designations including scheduled monuments and listed buildings;
- Cambridgeshire Historic Environment Record (CHER) - primary repository of historic environment information, including past investigations, find spots, etc.;
- Cambridgeshire Archives Service - historic maps and published histories;
- Landmark Envirocheck - historic Ordnance Survey maps from the first edition (1860-70s) to the present day;
- British Geological Survey (BGS) - solid and drift geology digital mapping; online BGS geological borehole record data;
- Historic England Archive, Swindon - vertical and specialist (oblique) aerial photographs;
- The client - where available: existing topographic survey data; architectural and engineering plans and sections of existing buildings and of the C2C Scheme, information on massing, height, materials and elevations, and existing geotechnical data;
- Internet - web-published material including the local plan, and information on conservation areas and locally listed buildings.

10.3.10. In addition, the results of the geophysical survey undertaken over the C2C Scheme areas during 2018[157]; and, if relevant, any subsequent archaeological trial trenching in relation to the C2C Scheme will be consulted.

ASSESSING ASSET SIGNIFICANCE

10.3.11. The NPPF defines significance as 'The value of a heritage asset to this and future generations because of its heritage interest. That interest may be historic, archaeological, architectural or artistic.' The determination of the significance in this assessment is based on statutory designation and/or professional judgement against four values identified in Historic England Conservation Principles[158] and Historic England Statements of Heritage Significance[159]:

- Evidential value: the potential of physical remains to yield evidence about past human activity. This might consider date; rarity; state of preservation; diversity/complexity; contribution to published priorities; supporting documentation; collective value and comparative potential.
- Historical value: the ways in which past people, events and aspects of life can be connected through a place and/or heritage asset to the present. This tends to be illustrative or associative.
- Aesthetic value: the ways in which people draw sensory and intellectual stimulation from a place and or heritage asset, considering what other people have said or written.
- Communal value: the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory.

10.3.12. These values encompass the criteria that Historic England are obliged to consider when statutorily designating heritage assets. Each asset is evaluated against the range of criteria listed above on a case-by-case basis. Unless the nature and exact extent of buried archaeological remains within any given area has been determined through prior investigation, significance is often uncertain.

10.3.13. In relation to designated heritage assets, the assessment considers the contribution which the historic character and setting makes to the overall significance of the asset.

10.3.14. The table below gives examples of the significance of designated and non-designated heritage assets.

Table 10-1 – Significance of heritage assets

[157] WYAS Archaeological Services (2018). Cambourne 2 Cambridge, Busway Options and Park and Ride Sites, Cambridgeshire, Geophysical Survey. WYAS Archaeological Services (2018). 'Cambourne 2 Cambridge, East of M11, Cambridgeshire, Geophysical Survey'.

[158] Historic England (2017) Conservation principles, policies and guidance. Consultation Draft. Swindon.

[159] Historic England (2019) Statements of Heritage Significance: Historic England Advice Note 12.

Heritage asset description	Significance
World heritage sites Scheduled monuments Grade I and II* listed buildings Grade I and II* registered parks and gardens Designated historic battlefields Protected Wrecks Undesignated heritage assets of high national importance	Very High
Grade II listed buildings Grade II registered parks and gardens Conservation areas Burial grounds Protected heritage landscapes (e.g. ancient woodland or historic hedgerows) Undesignated heritage assets of lower national, regional or county importance	High
Heritage assets with a district value or interest for education or cultural appreciation Locally listed buildings	Medium
Heritage assets with a local (i.e. parish) value or interest for education or cultural appreciation	Low
Item with no significant value or interest	Negligible
Heritage assets that have a clear potential, but for which current knowledge is insufficient to allow significance to be determined	Uncertain

10.4 LIMITATIONS AND ASSUMPTIONS

10.4.1. To ensure transparency within the EIA process, the following limitations and assumptions have been identified:

- The nature of the archaeological resource is buried and not visible. As a result it can be difficult to predict accurately the presence and likely significance of buried assets, and consequently the impact upon them, based primarily on a desk-based sources. The principal source of information is the CHER. The information provides an initial indication of assets present rather than a definitive list of all potential archaeological assets because the full extent of a buried heritage resource cannot be known prior to site-specific archaeological field investigation.
- Notwithstanding this limitation, the methodology is robust, utilising reasonably available information, and conforms to the requirements of local and national guidance and planning policy. Typically, appropriate standard archaeological evaluation techniques are utilised to reduce the uncertainties inherent in any desk-based assessment, as part of an overall mitigation strategy.
- The assessment relies on available data, and best endeavours have been made to ensure that the data are accurate and up to date. It is assumed that information on the CHER database is accurate.

10.5 BASELINE

10.5.1. A full baseline assessment will be carried out as part of the EIA. The baseline presented in this scoping chapter is based on a rapid top-level review of designated assets within the C2C Scheme and a 250m study area around it, as identified on the Historic England National Heritage List for England (NHLE), and undesignated assets and past archaeological investigations recorded on the CHER within and adjacent to the C2C Scheme (the past archaeological investigations include a geophysical survey conducted in 2018[160] in connection with the C2C Scheme). The South Cambridgeshire District Council and City of Cambridge websites have been consulted in relation to the location of conservation areas within the C2C Scheme and study area.

10.5.2. A more comprehensive review of CHER data, and NHLE data and of historic maps, documented sources, geotechnical data, architectural and engineering drawings, archaeological reports and aerial photographs normally contained within a HEDBA has not been carried out to date, nor has a site walkover or built heritage settings assessment been undertaken.

BUILT HERITAGE

10.5.3. The designated heritage assets within the 250m study area include the 12th century Grade I Listed Church of St Peter, Coton (National Heritage List England (NHLE 1127774) which lies 90m south of the C2C Scheme and the Grade I registered park and garden: the WW2 American Military Cemetery (NHLE 1001573) which lies 310m north of the Scheme. Although the WW2 American Military Cemetery is outside the 250m buffer, and therefore significant effects are considered unlikely, it is retained within the scope of the assessment at this stage as a provision for a more detailed assessment of effects on the setting of this important asset.

10.5.4. There are a number of designated heritage assets within the 250m study area, the setting of which may be a material consideration, together with (potentially) other designated assets in the wider area, given the relatively flat topography. This potential impact of the C2C Scheme on these heritage assets will be more fully assessed in the HEDBA.

10.5.5. The designated heritage assets within the 250m study area include the 12th century Grade I Listed Church of St Peter, Coton (NHLE 1127774) which lies 90m south of the C2C Scheme.

10.5.6. There are also five Grade II* listed buildings within the 250m study area:

- The 13th century Church of St Peter and St Paul (NHLE 1162717) in Dry Drayton 170m from the new path to the village from the travel hub;

[160] WYAS Archaeological Services (2018). Cambourne 2 Cambridge, Busway Options and Park and Ride Sites, Cambridgeshire, Geophysical Survey. WYAS Archaeological Services (2018). 'Cambourne 2 Cambridge, East of M11, Cambridgeshire, Geophysical Survey'

- The 1960s History Faculty Building (NHLE 1380217) 210m south-east of the eastern end of the C2C Scheme;
- The 1980s Schlumberger Gould Research Centre and attached perimeter wall to the north (NHLE 1438644) 45m north of the C2C Scheme (this section of the C2C Scheme will make use of an existing route) ; and
- Clare Hall, Herschel Road, Cambridge (NHLE 1454213), dating to the 1960s and 1980s, adjacent to the eastern end of the C2C Scheme by the University of Cambridge Rugby Club.

10.5.7. There are 27 Grade II listed buildings within the 250m study area for the C2C Scheme, mainly within Cambridge at the eastern end of the C2C Scheme and within Coton and Dry Drayton.

10.5.8. The C2C Scheme also lies within 30m of the Coton Conservation Area. The Grade II listed Clare College registered park and garden (NHLE 1000617), originally laid out in the 17th century, also extends into the far eastern end of the 250m study area, 220m from the eastern end of the C2C Scheme.

10.5.9. There are no scheduled monuments or registered battlefields within the 250m study area.

HISTORIC LANDSCAPE

10.5.10. A historic landscape characterisation has currently not been undertaken for Cambridgeshire. However, there are some broad non designated historic landscape areas that are definable, along the route of the C2C Scheme.

10.5.11. Between Cambourne and the Madingley Mulch roundabout the C2C Scheme runs along the Bourn Valley northern ridge plateau. For much of the way, the route follows the historic alignment of the Cambridge/St Neots Road, which may have Roman/prehistoric foundations as a ridgeway.

10.5.12. Between the Madingley Mulch and just to the west of the M11, the C2C Scheme drops off the ridgeline and runs across the south facing slope of the Bin Brook Valley. This area is associated with the historic village of Coton, part of which is a designated Conservation Area.

10.5.13. Between the M11 and the West Cambridge Conservation Area, the C2C Scheme runs through the West Cambridge Campus, before running through agricultural fields. This area is historically part of the Cambridge West Fields, an area of formerly open farmland with a strong historic connection with the core of Cambridge[161]. This area has also been used as the University Rifle Range (between 1859 and 1939) and for short period after World War II for the University of Cambridge's first Radio Telescope.

[161] Hall, C. & Ravensdale, J. (1976). The West Fields of Cambridge. Cambridge University Press.

10.5.14. At the junction of Rifle Range Lane and Grange Road the C2C Scheme is located within the West Cambridge Conservation Area. An area of historic townscape which was developed during the late 19th century, through the modern period. This area was formerly part of the Cambridge West Fields.

BURIED ARCHAEOLOGY

10.5.15. There are no scheduled monuments within the C2C Scheme or the 250m study area. There have been 21 past archaeological investigations within the footprint of the C2C Scheme, which have comprised:

- Three archaeological excavations ECB3235, ECB2935, ECB374);
- Eight archaeological evaluations (ECB154, ECB3844, ECB2942, ECB2087, ECB5484, ECB1461, ECB765, ECB1065);
- Five geophysical surveys (ECB5540, ECB5434, ECB3036, ECB1874, ECB4694);
- One fieldwalking survey (ECB1827, though ECB2942 also included fieldwalking);
- One archaeological monitoring of geotechnical test pits (ECB2986); and
- Three aerial photograph assessments (ECB4614, ECB1249, ECB2101).

10.5.16. A further 89 past archaeological investigations have been conducted within the wider 250m study area, meaning the area is fairly well understood archaeologically, although few of these investigations have comprised full archaeological excavations.

10.5.17. The archaeological investigations conducted within the C2C Scheme have identified numerous archaeological features, most particularly features thought to represent Iron Age and Roman settlement and agricultural activity (including a small number of Roman burials) as well as evidence of medieval and post-medieval activity (ridge & furrow, field boundaries, drove roads/trackways).

10.5.18. The CHER identifies the following key buried archaeological remains within or adjacent to the C2C Scheme.

- In Upper Camborne and Bourn Airfield the CHER identified:
  - the World War II Airfield (CB15128), which extends across the C2C footprint, together with possible WW2 beacons (MCB26813, within the C2C Scheme);
  - Iron Age/Roman remains (MCB16808), a Mesolithic pick (MCB16812, within the C2C Scheme), pits (MCB16335), ditches (MCB16334) and a medieval routeway (MCB16809), which were recorded during the construction of the A428; and
  - Iron Age/Roman enclosures identified from aerial photographs within the airfield (MCB21977), and later identified as an Iron Age Roman settlement during archaeological evaluation on the airfield (ECB5484);

- Former ridge and furrow[162] (MCB28479, in Upper Cambourne and MCB11378, at Bourn Airfield, both extending into the C2C Scheme) and a former turnpike road (MCB31312, extending across various part of the eastern end of the C2C Scheme);
- The site of a former school building at the eastern edge of the airfield, within the footprint of the C2C Scheme (MCB20905);
- At the eastern edge of Bourn Airfield near Childerley Gate the CHER identifies a Roman field system (MCB17870, within the C2C Scheme), the site of a former milepost (MCB20889, within the C2C Scheme), an Iron Age coin findspot (03304), a post medieval moated garden feature (01099, within the C2C Scheme), a post-medieval field boundary ditch (MCB25547, within the C2C Scheme) and an undated ditch (MBC26812, within the C2C Scheme);
- Between Childerley Gate and the A428 St Neots Road Junction at Hardwick, the CHER records a Roman settlement (MCB16337, within the C2C Scheme), and a Roman droveway (MCB18507, within the C2C Scheme) recorded during the construction of the A428, as well as ridge and furrow (MCB16336) adjacent to the C2C Scheme;
- Along the St Neots Road corridor between Hardwick and Long Road, the CLHER records an Iron Age/Roman enclosure (MCB21424, within the C2C Scheme), undated features recorded during the construction of the A428 (MCB16813) and the site of a former milestone (MCB20890, within the C2C Scheme). Also recorded within the C2C Scheme in this area are the remains of a Roman settlement (MCB31122, in the region of Long Road) and further evidence of ridge & furrow (09581 and MCB4199), and medieval field boundaries (MCB25535). The A428 itself is thought to follow the line of a former Roman road from Cambridge to Bolnhurst (MCB30152), which possibly originated as a prehistoric ridgeway;

- Around the proposed Scotland Farm Travel Hub site and the northern extension to Dry Drayton the CLHER records:
  - A concentration of fifteen quarry pits (MCB16811) excavated during A428 archaeological investigations (ECB2935), adjacent to the Scotland Farm Travel Hub site;
  - Medieval ridge and furrow (09573 and MCB27835) in the area of the Scotland Farm Travel Hub site, together with medieval to post-medieval field boundaries (MCB28613) and post-medieval field boundaries (MCB25523), all extending into the C2C Scheme;

[162] Ridge and furrow is the earthwork remains of arable cultivation in open fields involving the use of a horse drawn plough. Corrugation of the surface of the ground, which often survives as low earthworks, resulted from the practice of turning the sod inwards towards the centre as the plough was guided along a narrow plot of land. Fields were divided into individual strips, usually in blocks, which often ran at right angles to each other to produce a characteristic patchwork pattern.

- Undated furlong boundaries extending into the C2C Scheme to the north of the Scotland Farm Travel Hub site (MCB27320)

- Between Madingley Mulch and the M11 the CHER records:
  - A single Lower/Middle Palaeolithic hand axe of unknown provenance (MCB19251) found in/near Coton, adjacent to the C2C Scheme;
  - A curvilinear enclosure and associated ditches (MCB24832, within the C2C Scheme), possibly of Iron Age/Roman origin, visible as cropmarks on aerial photography to the south of Madingley Mulch. The enclosure was also identified during geophysical survey (ECB5434);
  - Iron Age and Roman occupation features just east of the Madingley Hill waterworks recorded during archaeological fieldwork for the Coton to Bourn pipeline, which included parts of the C2C Scheme (ECB2942).
  - A Roman brooch and grey ware findspot (MCB17753) within the footprint of the C2C Scheme at Coton Orchard;
  - The geophysical survey in connection with the C2C Scheme in 2018 (ECB5434) identified potential former field boundaries to the north east of the Coton covered reservoir; potential archaeological features were also identified to the west of Cambridge Road, Coton and between Coton Orchard and the M11;
  - Medieval to post-medieval field boundaries (MCB28485, within the C2C Scheme and MCB25528, adjacent) and a possible, undated burnt feature (MCB26830, within the C2C Scheme) are also recorded in this area.

- Between the M11 and Grange Road, Cambridge, the CHER records:
  - An Iron Age/Roman settlement (MCB26827) recorded during the geophysical survey for the C2C Scheme (ECB5540) in Cambridge West Fields;
  - A Roman pottery findspot (04405, within the C2C Scheme) at Herschel Rd, Cambridge;
  - The course of a Roman Road to the west of Grange Road (crossing the C2C Scheme in the West Fields area);
  - A sub-circular Middle Saxon enclosure (MCB19989), recorded during archaeology fieldwork at Leckhampton House, Corpus Christi College (ECB2594) 70m south of the C2C Scheme;
  - A medieval/post medieval boundary ditch (MCB15915) and a late medieval/early post medieval track way/droveway at ‘High Cross’, West Cambridge, located adjacent to the C2C Scheme;
  - The former 19th century University Rifle Range (MCB20898), though which the C2C Scheme runs;
  - The site of a World War II Pillbox (CB15069, within the C2C Scheme), formerly just to the east of Bin Brook near the University Rugby grounds; and
  - Two undated ditches (MCB26828 and CB15463) towards the eastern end of the C2C Scheme.

10.6 POTENTIAL IMPACTS AND EFFECTS

TEMPORARY CONSTRUCTION EFFECTS

10.6.1. Construction activity may also have an impact on the setting of a number of designated and undesigned assets (including historic landscapes) in the surrounding area, including the West

Cambridge Conservation Area. However, the effect of these works will be temporary and therefore unlikely to be significant.

PERMANENT AND OPERATIONAL EFFECTS

Built Heritage

10.6.2. There will be a physical impact within the West Cambridge Conservation Area as the C2C Scheme is proposed to extend into its western edge and therefore result in the introduction of new transport infrastructure on its fringe.

10.6.3. The infrastructure and operational impacts, such as movement of buses, will represent a physical impact on the West Cambridge Conservation Area (an asset of high heritage significance). Changes to the eastern edge of the conservation area from the C2C Scheme have the potential of altering how the asset is appreciated by introducing new transport infrastructure (including junction works) within the conservation area, potentially changing its character or appearance. New infrastructure outside the conservation area may also have an impact on the setting of the conservation area.

10.6.4. The C2C Scheme may also have an impact on a number of other designated and undesignated assets in the vicinity of the C2C Scheme, including the Grade I Church of St Peter, Coton, an asset of very high heritage significance, the Coton Conservation Area (an asset of high value), the Grade II* Clare Hall (very high heritage significance, as well as other Grade II*, Grade II and locally listed buildings in the vicinity of the C2C Scheme. The C2C Scheme would bring new transport infrastructure (potentially including new lighting) closer to these assets, and may also affect how they are viewed and appreciated from the wider landscape. The heritage assets in Cambridge, including the Grade II* Clare Hall, are generally inward-looking, however, and their key relationships are with other heritage assets within Cambridge, particularly those which are part of the university, which will minimise the impact of the C2C Scheme. Similarly, the fact that St Neots Road (the A1303) currently runs between the American Military Cemetery and the C2C Scheme, will limit the C2C Scheme's impact on this asset.

Historic Landscapes

10.6.5. It is not anticipated that the C2C Scheme will impact the non-designated historic landscape character of the Bourn Valley northern ridge plateau, given the presence of the A285 and the A1303). However, there is potential for impacts on the non-designated historic landscape character of the Coton, Bourn Valley/Bin Brook area and the fringes of the Cambridge West Fields historic landscape area, through the introduction of new transport infrastructure to these landscapes.

Buried Archaeology

10.6.6. There is potential for the partial or complete loss of buried heritage assets where ground disturbance is proposed. Such assets potentially include:

- Prehistoric remains, potentially of medium or high heritage significance, most particularly from the Iron Age. Iron Age/Roman remains and a Mesolithic pick were recorded during the construction of the A428 in the vicinity of Bourn Airfield, while Iron Age/Roman enclosures (a possible settlement) have been identified from aerial photographs within the airfield. The A428 may also have originated as a prehistoric ridgeway;
- Roman remains, potentially of medium or high heritage significance. The A428 to the north of the C2C Scheme is thought to follow the line of a former Roman road from Cambridge to

Bolnhurst. The course of a further Roman Road is also recorded on the CHER to the west of Grange Road (crossing the C2C Scheme in the West Fields area). There is therefore potential for Roman roadside activity, including burials, within the C2C Scheme. Roman settlement remains, enclosures and evidence of other Roman activity (including cremation/burial remains) have been recorded at various points along the length of the C2C Scheme, including at Bourn Airfield, in the vicinity of Long Road and in Cambridge West Fields;

- Later medieval/post medieval agricultural remains (e.g. evidence of former ridge and furrow and former field boundaries), and a former post-medieval school building adjacent to the eastern side of Bourn airfield, of low heritage significance. At the eastern end of the C2C Scheme, there is also potential for remains of the former 19th century University Rifle Range, of low or medium heritage significance.
- Modern remains associated with the WW2 airfield at Bourn Airfield of low heritage significance.

10.6.7. The potential for such remains will be highest in those areas which have not previously been developed (i.e. where the route runs through agricultural fields) but also on Bourn airfield. Where the C2C Scheme runs immediately adjacent to or along existing roads, survival is likely to be lower, since the construction of these is likely to have truncated or completely removed any earlier remains, though the bases of cut features may have survived below the levels of truncation caused by the roads.

10.7 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

10.7.1. The following are proposed to be scoped in, because significant environmental effects are anticipated as a result of the C2C Scheme.

- Partial or complete loss of buried heritage assets in areas where ground disturbance is proposed.
- Permanent physical impact on the West Cambridge Conservation Area;
- Permanent change to the setting of the West Cambridge Conservation Area;
- Permanent change to the setting of selected designated heritage assets within the study area.

SCOPED OUT

10.7.2. The following are proposed to be scoped out on the basis that there is unlikely to be a significant environmental effect as a result of the C2C Scheme:

Temporary construction impact

- Temporary physical impact on the West Cambridge Conservation area;
- Temporary effects on the setting of the West Cambridge Conservation Area;
- Temporary effects on the setting of other designated heritage assets within the study area.

Permanent and operational impact

- Effects on buried heritage assets, on the basis that, once the C2C Scheme has been constructed, no further ground disturbance will occur as a result of the C2C Scheme;
- Effects on the setting of designated above ground heritage assets, where they are considered insignificant. The scope will only include those assets that may be subject to a 'significant'

change to their setting in accordance with the stepped approach set out in Historic England's *The Setting of Heritage Assets*[163]*;*

- Effects on the setting of non-designated above ground heritage assets beyond the C2C Scheme on the basis that such assets are not considered significant enough to warrant a settings assessment, in line with the proportionality set out in the NPPF[164];
- Cumulative effects on buried heritage assets. Cumulative effects are 'elevated' effects which occur where the combined effect of the C2C Scheme with other proposed schemes in the vicinity, on a discrete and significant shared buried heritage asset, is more severe than that reported at the C2C Scheme site. This is on the basis that for intangible and deeply buried heritage assets it is not feasible to quantify accurately the nature of the resource across the study area, which would enable the identification of a cumulative impact and potential elevated effect.

[163] Historic England (2017) The setting of heritage assets. Historic Environment Good Practice Advice in Planning Note 3, Second Edition.

[164] Ministry of Housing, Communities and Local Government (MHCLG) (2021). July 2021 National Planning Policy Framework.

11 LANDSCAPE AND VISUAL

11.1 INTRODUCTION

11.1.1. This chapter sets out the proposed scope for the identification and assessment of the likely significant effects of the C2C Scheme on landscape character and visual amenity. The Landscape and Visual Impact Assessment (LVIA) will address two separate but related issues:

- Effects on landscape as a resource in its own right; and
- Effects on people's views and visual amenity.

11.1.2. The assessment of landscape effects is also linked to the following environmental topics: historic environment, ecology, socio-economy, noise and traffic.

11.2 LEGISLATION AND STANDARDS

11.2.1. The following provides details of planning policy that is relevant to the LVIA.

NATIONAL PLANNING POLICY FRAMEWORK (2021)

11.2.2. The NPPF[165] sets out the Government's planning policies for England and how these should be applied. It promotes a presumption in favour of sustainable development with policies which should be considered in developing local plans and reviewing planning applications. NPPF paragraph 112 states that application for development should:

"…create places that are safe, secure and attractive – which minimise the scope for conflicts between pedestrians, cyclists and vehicles, avoid unnecessary street clutter, and respond to local character and design standards…"

11.2.3. The importance of design in the NPPF is described in paragraph 126 as:

"Good design is a key aspect of sustainable development, creates better places in which to live and work and helps make development acceptable to communities".

NATIONAL PLANNING PRACTICE GUIDANCE

11.2.4. To support the policies of the NPPF, the Government produced its National Planning Practice Guidance (PPG) covering a number of topics. Paragraph 037 of PPG (Ref. ID: 8-037-20190721) under the heading of Natural Environment, sub-heading Landscape, supports the use of landscape character assessment as a tool for understanding the character and local distinctiveness of the

[165] Ministry of Housing, Communities & Local Government (2021). National Planning Policy Framework.

landscape to inform planning and decision making in addition to Natural England's National Character Area Profiles.

CAMBRIDGE LOCAL PLAN (2018)

11.2.5. Relevant Cambridge local policies include:

- Policy 4: The Cambridge Green Belt.
- Policy 8: Setting of the City.
- Policy 59.
- Policy 71: Trees.

SOUTH CAMBRIDGESHIRE DISTRICT COUNCIL LOCAL PLAN (2018)

11.2.6. Relevant South Cambridgeshire local policies include:

- Policy NH/2: Protecting and Enhancing Landscape Character.
- Policy NH/6: Green Infrastructure.
- Policy NH/8: Mitigating the Impact of Development in and adjoining the Green Belt.

11.3 STUDY AREA

11.3.1. The study area for the landscape and visual assessment included in the ES will comprise the area from which the C2C Scheme is likely to be visible, and therefore with the potential of experiencing a significant adverse or beneficial effect. The study area will be agreed with the LPA in advance of the assessment.

11.3.2. A preliminary viewshed analysis has been plotted using Google Earth. The preliminary analysis is supported by review of OS maps, satellite imagery, Google street view and previous field work. The analysis is based on a height of 4.5m above ground to account for high sided buses. From this initial study the C2C Scheme site experiences a high degree of visual containment within a 2km radius. Subsequent to this the study area for landscape and visual assessment has been defined up to a 2km extent from the C2C Scheme site boundary. The study area will be subject to review upon the establishment of a second computer generated 'with screening' Zone of Theoretical Visibility (ZTV) and confirmed and amended as required following further field work, design coordination and consultation with relevant stakeholders.

11.3.3. The study area for the assessment of landscape character will reflect the agreed ZTV but expand to ensure inclusion of all relevant and impacted (directly or indirectly) identified landscape character areas in their entirety. By this approach the predicted effect on the entirety of the character area will be assessed.

11.4 ASSESSMENT METHODOLOGY

SURVEYS

11.4.1. A desk-based review of previous field work, policy, guidance, and published landscape character assessments has been undertaken to gain an understanding of the existing landscape and visual environment. This has informed an assessment of how the landscape might be affected by the C2C Scheme and to establish the study area. Further site survey will be carried out for the landscape and visual baseline assessment and to take photographs in summer and winter to illustrate existing

views. Photography for visual assessment will be undertaken using a full frame SLR digital camera with a 50-millimetre focal length lens, mounted on a tripod with a levelled panoramic head.

ASSESSMENT APPROACH

11.4.2. For the ES, a landscape and visual assessment will be prepared in accordance with DRMB guidance, LA 107 Landscape and Visual Effects[166] and informed by the GLVIA3, where the latter places greater emphasis on the explanation and justification for assessment criteria and conclusions, appropriate to the C2C Scheme being assessed.

11.4.3. The LVIA will identify and report on:

- The likely nature, extent and scale of the project to determine effects of change and development;
- The likely nature and scale of landscape effects (adverse, neutral or beneficial) during the construction and operation of the project; and
- The likelihood of the project to affect the aesthetic and perceptual aspects of the landscape, its distinctive character and its elements.

11.4.4. Key sources of information will include OS mapping, aerial photography, published landscape character assessments and historic landscape characterisation documents.

SIGNIFICANCE CRITERIA

Landscape

11.4.5. Landscape effects relate to any direct physical change on the landscape caused by the C2C Scheme, or how the landscape is perceived following the development. Landscape impact assessment considers these effects, both in terms of the individual components of the landscape and on the structure, coherence and character of the landscape as a whole.

11.4.6. The landscape baseline has been considered based on the constituent elements, features and other factors that contribute to existing landscape character within the study area including:

- The physical influences on the landscape resource - including topography, geology, soils, microclimate, water bodies and water courses;
- The influence of human activity – including land use, open space, transport routes, public rights of way, land management, the character of settlement and buildings, the night-time environment, and the pattern and type of fields and enclosure;
- The aesthetic and perceptual aspects of the landscape – including scale, complexity, openness, tranquillity, and wildness; and

[166] Highways England (2019). LA 107 Landscape and Visual Effects (Revised January 2020).

- Habitats and heritage features – including nature reserves, sites of special scientific interest, conservation areas, listed buildings, registered parks and gardens and other elements contributing to historic landscape character.

11.4.7. For effects on the landscape resource, the assessment of their significance is determined by considering the magnitude of impact arising from the C2C Scheme on each of the features and elements that make up the character of the resource, bearing in mind the value of the landscape (and/or of specific features and elements), and the ability of the landscape to accommodate change of the type proposed (i.e. its sensitivity).

11.4.8. Landscape sensitivity will depend on the character of the receiving landscape, the nature of the C2C Scheme and the type of change. Indicative sensitivity criteria guidance for the landscape resource is set out in LA 107, paragraph 3.18 - 3.22 (Table 3.22)[167].

11.4.9. The magnitude of impact on the landscape resource is the degree of change that would arise if the C2C Scheme were to be completed (i.e. 'Do Something'), as compared with a 'Do Minimum' situation. Factors to consider are the scale of the impact, the nature of the impact, whether it is an adverse or beneficial change, and the timescale involved (i.e. temporary, short, medium or long term/permanent). Indicative criteria guidance is set out in LA 107, paragraph 3.23 - 3.24 (Table 3.24).

11.4.10. Significance of effect categories are set out in LA 104, paragraph 3.5 - 3.9 (Table 3.7), using a five-point scale ranging from Neutral to Very Large.

11.4.11. LA 107 makes it clear that these criteria are not prescriptive, and in making qualified judgements the landscape professional needs to be able to demonstrate to others a consistent and justifiable argument.

Visual

11.4.12. Visual effects relate to changes in the composition and character of views available in the area affected by the C2C Scheme. Visual impact assessment considers the changes to the views available to people who experience these effects, who may be living or working in the area, enjoying recreational activities or simply passing through.

11.4.13. For effects on visual amenity, the assessment of their significance is determined by considering the sensitivity of the visual receptor with the magnitude of the impact on that visual receptor arising from the C2C Scheme.

11.4.14. Visual sensitivity is categorised by the sensitivity of the visual receptor and will include people in their homes, users of public rights of way and other areas of open space or recreational landscapes,

[167] Highways England (2019). LA 107 Landscape and Visual Effects (Revised January 2020).

people at work and people travelling along roads or railway lines. Indicative sensitivity criteria guidance for visual amenity is set out in LA 107, paragraph 3.40 – 3.41 (Table 3.41) [168].

11.4.15. The identification of viewpoints will take into account:

- The accessibility of the viewpoint;
- The number of receptors likely to be affected;
- The viewing direction and distance from the site of the C2C Scheme;
- The nature of the viewing experience; and
- Cumulative views, in conjunction with other projects.

11.4.16. Viewpoints will also be identified according to their scenic quality or cultural associations or to demonstrate a specific issue. The selection of viewpoints will be based on the extent of the ZTV, the findings of the site survey, a review of planning policy documents and discussion with SCDC and City Council.

11.4.17. The value of the view will be determined based on indicators including:

- the value attached to a view in relation to a heritage asset, through planning designation and by visitors to the area; and/or
- views described in guidebooks, shown on maps and/or referred to in literature or art.

11.4.18. Photographs will be taken during winter and summer to represent the character of the landscape and existing views. Previous photography that was undertaken for the visual assessment used a full frame SLR digital camera with a 50-millimetre focal length lens, mounted on a tripod with a levelled panoramic head.

11.4.19. The magnitude of impact on visual amenity is the degree of change that would arise if the C2C Scheme were to be completed (i.e. 'Do Something'), as compared with a 'Do Minimum' situation.

11.4.20. Factors to consider are the scale of the impact, the nature of the impact, whether it is an adverse or beneficial change, and the timescale involved (i.e. temporary, short, medium or long term/permanent). Indicative criteria guidance is set out in LA 107, paragraph 3.42 – 3.43 (Table 3.43).

11.4.21. Significance of effect categories are set out in LA 104, paragraph 3.5 - 3.9 (Table 3.7), using a five-point scale ranging from Neutral to Very Large.

11.4.22. As per landscape, LA 107 makes it clear that these criteria are not prescriptive, and in making qualified judgements the landscape professional needs to be able to demonstrate to others a consistent and justifiable argument.

[168] Highways England (2019) LA 107 Landscape and Visual Effects (Revised January 2020).

11.4.23. Cumulative landscape and visual effects of the C2C Scheme in association with other proposed developments will be considered as required, along with identification of mitigation and enhancement where appropriate.

11.4.24. The text will be accompanied by suitable figures and plans including:

- Landscape Character and Designations Plan;
- Viewpoint Location Plan and Zone of Visual Influence; and
- Viewpoint Photograph Sheets.

SIGNIFICANCE OF EFFECTS

11.4.25. An assessment by an experienced landscape practitioner will be used to determine the overall level of significance of effects on landscape and visual receptors by weighing the sensitivity of the receptors against the magnitude of change. The evaluation of the significance of effects will be guided by the matrix in the table below, with significant effects generally equivalent to those deemed moderate or higher.

Table 11-1 – Significance of effects

Sensitivity	Magnitude of impact				
	Major	Moderate	Minor	Negligible	No Change
Very high	Very Large	Large/Very Large	Moderate/ Large	Slight	Neutral
High	Large/Very Large	Moderate/ Large	Slight/ moderate	Slight	Neutral
Moderate	Moderate/ Large	Moderate	Slight	Neutral/ Slight	Neutral
Low	Slight/ Moderate	Slight	Neutral/ Slight	Neutral/ Slight	Neutral
Negligible	Slight	Neutral/ Slight	Neutral/ Slight	Neutral	Neutral

Source: Table 3.8.1 LA104 Environmental assessment and monitoring Revision 1 (2019)

PHOTOMONTAGES

11.4.26. To support the assessment a number of photomontage visualisations will be prepared. These will show the C2C Scheme in both year 1 and year 15 to give an impression of the immediate impact of the C2C Scheme post construction and how the C2C Scheme will appear in 15 years' time once mitigation has established. Photomontage locations will be chosen in consultation with relevant stakeholders.

11.5 BASELINE

LANDSCAPE

National Character Area Assessments

11.5.1. The study area lies within National Character Area 88: Bedfordshire and Cambridgeshire Claylands. The key characteristics of the study area in relation to landscape character are:

- Gently undulating, lowland plateau dissected by shallow river valleys;
- Underlying geology of Jurassic and Cretaceous clays overlain with boulder clay and sand and gravel on the river valleys;
- Lime-rich, loamy and clayey soils;
- Variable woodland cover comprises woodland belts, plantations, copses, secondary woodland, pollarded willows and poplar along river valleys and clusters of ancient woodland.
- Open arable farmland landscape of planned and regular fields bound by open ditches and trimmed, often species poor hedgerows;
- Major transport routes, including the M11 cross the area; and
- Larger settlements cluster along major road and rail corridor and smaller settlements often nucleated around a church or village green.

Local Landscape Character Assessment

11.5.2. The Cambridge Inner Green Belt Study[169] and Cambridge Inner Green Belt Study Supplement[170] provide the most up to date local landscape character assessment of the part of the study area within the Cambridge Green Belt. The section of the route between Hardwick and Cambourne is not included in the Green Belt assessment but is covered by an earlier assessment in the South Cambridgeshire District Design Guide[171]. The Cambridge Inner Green Belt Study (and supplement) is not a statutory planning document, but it was an important background document that formed the evidence base of the current SCDC and the City Council Local Plans. In both assessments, the study area is located within the Western Claylands LCA (landscape character area). The key characteristics of the study area in relation to this are:

- The gently undulating topography is divided by broad, shallow valleys;
- It is a predominantly open and intensive arable landscape. Fields are either bounded by open ditches, or closely trimmed hedgerows, both with a variable number of hedgerow trees;

[169] LDA Design (2015). Cambridge Inner Green Belt Study.

[170] LDA Design (2016). Cambridge Inner Green Belt Study.

[171] District Design Guide Supplementary Planning Document, 2010

- Woodlands are scattered. Large, ancient woodlands are particularly concentrated in the north and west of the area;
- Occasional parklands and orchards add interest and variety in the landscape; and
- Each village is identified by a church spire, or tower, which enliven the skyline.

11.5.3. The Cambridgeshire Landscape Guidelines[172], though published in 1991, remain relevant. The document also places the study area in the Western Claylands LCA, describing the LCA as: "a large-scale arable farmland with open fields, sparse trimmed hedgerows and watercourses often cleared of bankside vegetation. There are scattered woodlands and approximately half of these are ancient semi-natural woodlands of considerable importance in the county context. Elsewhere individual woods are of importance in visual and nature conservation terms, but they tend to be isolated incidents in an area dominated by arable farmland. The landscape of this part of Cambridgeshire has been greatly affected by modern agricultural practices. Increased mechanisation has led to the removal of hedgerows and amalgamation of fields. Many of the remaining hedges are 'gappy' and trimmed almost out of existence by regular cutting."

The Cambridge Landscape Character Assessment[173] identifies three LCA within the study area:

- Rural Lowland Mosaic: West Cambridge Claylands LCA – the defining characteristics are urban edge characteristics, brooks ditches and wetlands, views and fields bound by hedgerows;
- Residential: Residential Villas and Modern Movement LCA – there are no defining characteristics but there are several individual residential properties that are unique and special to Cambridge; and
- Residential: Post-war LCA – there are no defining characteristics special to Cambridge in the LCA.

Green Belt

11.5.4. The study area includes part of the Cambridge Green Belt between Cambridge and the eastern boundary of Hardwick.

Landscape Character Areas

11.5.5. During the C2C optioneering appraisal, it was felt that the single Western Claylands LCA identified in the published landscape character assessments should be further broken down to reflect the varied landscape characters of the study area west of the urban edge of Cambridge. The extensive redevelopment of West Cambridge since the Cambridge Landscape Character Assessment was published requires a revised approach to the landscape character areas within the city boundary.

[172] Cambridgeshire County Council (1991). Cambridgeshire Landscape Guidelines -a Manual for Management and Change in the Rural Landscape.

[173] Cambridge City Council (2003). Cambridge Landscape Character Assessment.

The C2C Scheme study area will therefore include the following LCA:

- Cambourne LCA;
- Bourn Airfield LCA;
- Western Claylands LCA;
- Hardwick and Caldecote LCA;
- Coton Undulating Farmland LCA;
- Coton, Coton Orchard and Coton Countryside Reserve LCA;
- West Fields LCA; and
- Adams Road/Grange Road LCA.

Registered Parks and Gardens

11.5.6. There are two Registered Parks and Gardens of Special Historic Interest in England in the study area, namely Grade II Madingley Hall and the Grade I American Military Cemetery. However, with no intervisibility between the scheme proposals and these designated features, no significant effects are likely and they are omitted from the scope of the assessment.

Conservation areas

11.5.7. The study area includes the following conservation areas:

- Hardwick, designated in 1988;
- Madingley, designated in 1976;
- Coton, designated in 1978 and extended in 1988; and
- West Cambridge, designated in 1972 and extended in 1984 and in 2011.

Important landscape features

- Ancient Woodland - Madingley Wood Ancient and Semi-Natural Woodland is an ash-maple woodland, characteristic of clayland landscapes in eastern England. The woodland is used by the University of Cambridge for research and education and is designated as a SSSI by Natural England;
- Traditional Orchards - there are several small traditional orchards in the study area. Coton Orchard is the largest.
- Topography - the A428 and A1303 follow a ridgeline which descends into Cambridge east of the American Military Cemetery. The land slopes away from the ridge to the Fens in the north and the Bin Brook valley to the south.

VISUAL

Visual receptors

11.5.8. Visual receptors potentially affected by the C2C Scheme will include:

- People in residential properties;
- Walkers and visitors using PRoW, national trails and paths through a high-quality landscape;
- Visitors to heritage assets;
- People walking along footways in residential areas; and
- People travelling on rural roads.

11.5.9. The following visual receptors may experience views of the C2C Scheme:

- Residents on Sterling Way, Handley Drive, Vickers Way, Bristol Drive, Spitfire Road in Cambourne;
- Residents around the Childerley Gate entrance to Bourn Airfield;
- People in residential properties and pedestrians on the northern edge of Highfields;
- Residents on St Neots Road;
- Residents on Scotland Road;
- Residents in Coton;
- Residents on the West Cambridge site;
- Residents on Herschel Road and in Clare Hall;
- Visitors to Coton Countryside Reserve;
- Walkers on PRoW 52/1, by Common Farm;
- Walkers on PRoW 38/1, west of Highfield Farm;
- Walkers on PRoW 66/17 east of Scotland Road;
- Walkers on PRoW 20/1, the Whitwell Way;
- Walkers on PRoW 55/2 north of Coton Primary School; and
- Walkers on PRoW 39/31, the Coton path.

Views of the Cambridge Skyline

11.5.10. The Cambridge Skyline Guidance (Guidance for the application of Policy 3/13 (Tall Buildings and the Skyline) of the Cambridge Local Plan (2006)) is a material consideration in the review of planning applications submitted to the Council. The guidance identifies 13 strategic viewpoints of which three are relevant to this study area:

- The view from Castle Hill Mound, Castle Hill - Viewpoint 1 in the Cambridge Skyline Guidance looking towards the city centre in the east and south-east. The study area is west and south-west of Castle Hill so is unlikely to be affected;
- The view from public footpath 55/2 on Madingley Rise - Viewpoint 2 in the guidance looking towards the city centre in the east. The viewpoint is in the study area; and
- The view from Red Meadow Hill -Viewpoint 3 in the guidance looking north-east towards the urban edge of Cambridge.

11.6 POTENTIAL IMPACTS AND EFFECTS

11.6.1. The C2C Scheme runs between Cambourne and Cambridge. It includes three core elements: a new largely segregated and guided public transport route, a new Travel Hub with parking for about 2000 cars at Scotland Farm and a new route between Cambourne and Cambridge for NMU.

11.6.2. The route through Cambourne is largely on existing roads, but there will be a short section of a new paved route between Sterling Way and Broadway, currently a pedestrian/cycle path. Between Broadway and the St Neots Road/Scotland Road roundabout the route will travel on a new paved surface through the northern part of Bourn Airfield and the land between the St Neots Road and the A428. This land is currently in agricultural use with arable fields and pasture. The C2C Scheme will then run on a new paved route between the A428 and the St Neots Road, turning south just after the row of properties on St. Neots Road west of Long Road. The route will pass on a new paved surface through a gap on the existing hedgerow along Long Road and then through the farmland of the Bin Brook valley, north of Coton. It will cross Cambridge Road and continue on new paved surface through Coton Orchard, over the M11 on a new bridge and into the West Cambridge site along

Charles Babbage Road. On leaving the West Cambridge site the C2C Scheme will turn south and run along a track between Herschel Road and Cambridge University Rugby Club.

11.6.3. The effects of the C2C Scheme will be largely contained within a corridor of land along the route within approximately 1km of the centre line of the route, but more widespread effects will be considered, such as in the Bin Brook valley and from Red Meadow Hill where the landscape becomes more open.

TEMPORARY CONSTRUCTION EFFECTS

11.6.4. The most apparent changes to landscape and views will result from the temporary presence of construction plant and the construction compound and the construction of the C2C Scheme public transport route, shared use path, Travel Hub and bridge over the M11.

11.6.5. The potential impacts on landscape character and visual amenity during construction will include:

- Presence of construction traffic, construction plant and equipment;
- Construction activity, generating noise and movement;
- Earthworks, changes in landform and storage of soils and materials;
- Presence of a construction compounds, temporary security fencing and hoardings;
- Vehicle movements including private vehicles belonging to site staff; and
- Use of lighting, if night-time works are required and security lighting.

11.6.6. Environmental impacts will be avoided or reduced through an iterative design process to minimise the footprint of the C2C Scheme and the loss of existing vegetation and farmland. Construction will be carried out using in accordance with the draft CoCP and the later, more detailed CEMP for the C2C Scheme.

11.6.7. Visual receptors close to the C2C Scheme route will be affected by views of construction replacing existing views of farmland, rural roads and residential development in Cambourne, Hardwick, Coton and Cambridge. A revised alignment along the St Neots Road now avoids the loss of the tree belt to its north, thereby maintaining the screening of views of the A428 from houses along St Neots Road. Construction of the Scotland Farm Travel Hub will be prominent views from residential properties on Scotland Road.

PERMANENT AND OPERATIONAL EFFECTS

11.6.8. The most apparent changes to landscape and views will result from the removal of existing vegetation, opening up new views, and the introduction of a paved guided public transport route, shared use path and vehicles into the landscape. Views of the A428 from properties on St Neots Road will be opened up due to the loss of the vegetation between the two roads. The Scotland Farm Travel Hub and associated paving, lighting, signage and vehicle movements will change the existing farmland character of the landscape and views in the surrounding area.

11.6.9. The potential impacts on landscape character and visual amenity during operation will include:

- Loss of mature trees and vegetation;
- Presence of a large infrastructure components, particularly the Travel Hub; and
- Presence of a linear paved route and vehicles passing through farmland and urban areas.

Landscape

There will be direct impacts on the following LCA:

- Cambourne LCA;
- Bourn Airfield LCA;
- Western Claylands LCA;
- Hardwick and Caldecote LCA;
- Coton Undulating Farmland LCA;
- Coton, Coton Orchard and Coton Countryside Reserve LCA;
- West Fields LCA; and
- Grange Road LCA.

11.6.10. Topography and existing intervening vegetation will reduce the likelihood of effects on the Madingley LCA and the American Military Cemetery LCA.

Visual

11.6.11. Residential and recreational receptors close to the C2C Scheme route will be affected by views of the guided public transport route passing through farmland, adjacent to rural roads and through residential areas. Removal of vegetation from the land between St Neots Road and the A428, will open up views from residential properties along the road of the dual carriageway, currently screened by intervening vegetation. The Scotland Farm Travel Hub will be prominent in views from residential properties in Scotland Road. There will be clear and glimpsed views of the C2C Scheme from some residential properties in Coton. The C2C Scheme will also be visible from Clare Hall and residential properties along the southern side of Herschel Road.

11.7 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

11.7.1. The C2C Scheme has the potential to result in likely significant effects to landscape character and visual amenity during temporarily construction and in the long term and during operation. It is therefore considered necessary to undertake a landscape and visual impact assessment to understand the potential impacts of the C2C Scheme.

11.7.2. The impacts of the C2C Scheme on the openness of the Cambridge Green Belt will be included in the LVIA.

SCOPED OUT

11.7.3. It is not proposed that any elements of landscape and visual impact will be scoped out of the EIA.

12 NOISE AND VIBRATION

12.1 INTRODUCTION

12.1.1. This chapter sets out the approach we propose for the identification and assessment of likely significant noise and vibration impacts from the C2C Scheme.

12.2 LEGISLATION AND STANDARDS

NATIONAL

The Noise Policy Statement for England 2010

12.2.1. The Noise Policy Statement for England (NPSE)[174] was issued by Defra in 2010. Its purpose is to promote, "good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development". The three main aims are to:

- Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development;
- Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development; and
- Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

12.2.2. Within the aims stated above there are several key phrases that lead to additional concepts now considered in the assessment of noise impacts; these and their definitions are detailed below:

- Lowest Observed Adverse Effect Level (LOAEL): this is the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL): this is the level above which significant adverse effects on health and quality of life occur.

12.2.3. There are no pre-defined levels for these effect levels as it is acknowledged that they will be different for different sources, different receptors and at different times.

The National Planning Policy Framework 2021

12.2.4. The NPPF[175] was revised in 2021. Paragraph 174 of the NPPF states that:

[174] Department for Environment Food and Rural Affairs (DEFRA) (2010). The Noise Policy Statement for England.

[175] Ministry of Housing (2021). Communities and Local Government 2021, Planning Practice Guidance.

"Planning policies and decisions should contribute to and enhance the natural and local environment by:…e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability".

12.2.5. Paragraph 185 of the NPPF states that planning policy and decisions should aim to:

> *Mitigate, and reduce to a minimum, potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;* and
>
> *Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

National Planning Practice Guidance

12.2.6. National Planning Practice Guidance (PPG) [176] provides guidance on how the policy set out in NPPF may be interpreted in practice for a wide range of issues. There is a subsection of National PPG relating specifically to noise which states that *'plan-making and decision taking should take account of the acoustic environment and in doing so consider:*

- *Whether or not a significant adverse effect is occurring or likely to occur.*
- *Whether or not an adverse effect is occurring or likely to occur.*
- *Whether or not a good standard of amenity can be achieved.'*

12.2.7. In line with the Explanatory Note of the NPSE, this would include identifying whether the overall effect of the noise exposure (including the impact during construction wherever applicable) is, or would be, above or below the significant observed adverse effect level…"

12.2.8. National PPG provides a subjective noise exposure hierarchy which describes example outcomes associated with increasing effect levels as shown in Table 13-1.

Table 12-1 – National PPG noise exposure hierarchy

Response	Examples of outcomes	Increasing effect level	Action
No Observed Effect Level			
Not present	No effect	No observed effect	No specific measures required

[176] Ministry of Housing, Communities and Local Government 2021. Planning Practice Guidance.

Response	Examples of outcomes	Increasing effect level	Action
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No observed adverse effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant observed adverse effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable adverse effect	Prevent

LOCAL

12.2.9. The current local planning policy and guidance relevant to noise and vibration is contained in the adopted (2018) South Cambridgeshire and the City of Cambridge Local Plans.

12.2.10. The relevant policies for South Cambridgeshire are detailed below:

- Policy SC/10: Noise Pollution
- Policy TI/2: Planning for Sustainable Travel
- Policy SC/10 , which refers to Noise Action Plans and Noise Important Areas

12.2.11. The relevant policy for the City of Cambridge is Policy 35: Protection of human health and quality of life from noise and vibration.

12.2.12. The Greater Cambridge Sustainable Design and Construction Supplementary Planning Document was adopted in 2020 by South Cambridgeshire and City Councils and provides additional guidance for the consideration and assessment of noise and vibration due to noise generating development. Section 3.6 which relates to noise and vibration provides advice on effect level threshold values and the Agent of Change principle. The document also describes good acoustic design for noise generating developments within the context of planning policy aims and sustainable development.

GUIDANCE

BS5228-1&2:2009+A1:2014, Noise and Vibration

12.2.13. British Standard 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites' Part 1: Noise[177] provides a methodology for calculating noise levels generated by fixed and mobile plant used for a range of typical construction operations.

12.2.14. BS 5228-1 also provides guidance for the determination of the significance of noise effects due to construction activities which combines noise level thresholds and time periods of works. The Guidance also recommends mitigation and measures that can be applied to minimise noise impacts from construction works.

12.2.15. British Standard 5228-2:2009+A1:2014 Part 2: Vibration[178] provides guidance on the assessment of construction phase vibration impacts.

DMRB LA111 Noise and Vibration 2020

12.2.16. The DMRB LA111 'Noise and Vibration'[179] describes methodologies for the assessment of construction and operational phase noise and vibration effects from highways projects or projects involving significant changes to traffic flows on existing roads. It includes methods for the

[177] British Standards Institution (2014). BS 5228-2:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites" Part 1: Noise.

[178] British Standards Institution (2014). BS 5228-2:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites" Part 2: Vibration.

[179] Highways England (2019) Design Manual for Roads and Bridges, LA111 Noise and Vibration.

classification of impact magnitude based on both long and short-term effects, and for the determination of the significance of those impacts.

British Standard 8233:2014

12.2.17. BS 8233:2014 Guidance on sound insulation and noise reduction for buildings[180] provides guidance relating to noise levels in and around buildings. It includes recommendations for external amenity areas which states that it is desirable noise levels do no exceed 50 dB $L_{Aeq,T}$ with an upper guidance value of 55 dB $L_{Aeq,T}$. However, it is also recognized that:

> *"…these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces but should not be prohibited."*

Calculation of Road Traffic Noise 1988

12.2.18. Calculation of Road Traffic Noise (CRTN)[181] provides procedures for predicting noise levels for a given flow of road traffic at sensitive receptors. These methodologies are used in the determination of entitlement under the Noise Insulation Regulations and for other assessments undertaken in accordance with the DMRB assessment methodology.

Noise Advisory Council 1978

12.2.19. Noise Advisory Council (NAC) guidance[182] provides a method to predict noise levels from road traffic sources given flow, speed and percentage heavy goods vehicles using a Sound Exposure Level (SEL) based approach. This methodology provides a means to approximate noise levels from roads where traffic flow rates are below the minimum necessary for use of CRTN.

BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound

12.2.20. This Standard provides an assessment method for noise arising from commercial noise sources, including external plant and on-site vehicle movements and unloading, at residential receptors. It is a relative assessment approach whereby the predicted commercial sound level (suitably penalised for potentially annoying characteristics if appropriate) is compared with the prevailing background noise level. A summary of the BS 4142 approach is set out below.

[180] British Standards Institution (2014). BS 8233:2014 "Guidance on sound insulation and noise reduction for buildings".

[181] Department of Transport (1988). Calculation of Road Traffic Noise.

[182] The Noise Advisory Council (1978). A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level L_{eq}, 1978.

- Establish the specific sound level of the source(s);
- Measure the representative background sound level;
- Correct the specific sound level for on-time and any noise contributions from unrelated sources if necessary;
- Rate the specific sound level to account for distinguishing characteristics;
- Estimate the initial impact by subtracting the background sound level from the rating level; and
- Consider the initial impact estimation in the context of the noise and its environs.

12.2.21. Where the sound source is not yet present, the specific sound level is established by calculation. The representative background sound level is established by measurement at the receptor location.

12.2.22. The specific sound level can be upwardly adjusted, by adding feature corrections for one or more distinctive characteristics, to derive the sound rating level. The feature corrections are summarised below:

- Tonality up to 6 dB
- Impulsivity up to 9 dB
- Other sound characteristics up to 3 dB
- Intermittency 3 dB

12.2.23. An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level as described in section 11 of BS 4142. The results of this comparison are assessed on the basis of the following guidance:

- Typically, the greater the difference, the greater the magnitude of the impact;
- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context; and
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

12.2.24. All pertinent contextual considerations should be taken into account including the following:

- The absolute level of the sound;
- The character and level of the residual sound compared to the character and level of the specific sound; and
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

12.3 STUDY AREA

CONSTRUCTION

12.3.1. The study area proposed for construction will be the same as that defined for assessment of operational noise effects (see below).

OPERATION

12.3.2. For operational noise, LA111 states that the extent of the study area can be reduced or extended to ensure that it is proportionate to the risk of likely significant effects and should include:

> *"1) noise sensitive receptors that are potentially affected by operational noise changes generated by the project, either on the route of the project or other roads not physically changed by the project;*
>
> *2) noise sensitive receptors in areas where there is a reasonable stakeholder expectation that noise assessment is undertaken."*

12.3.3. The initial study area that will be utilised for operational noise will comprise representative receptors within 50m of the affected road links which are likely to experience a change of 1dB $L_{A10,18hr}$ upon C2C Scheme opening.

12.3.4. The study area will also include representative noise sensitive receptors to the north of the proposed transport hub.

12.3.5. It is thought that this initial study area is appropriate and proportionate to the scale of the development and the risk of potential impacts, however, it can be reviewed and extended if the initial assessments are indicative of wider impacts.

12.4 ASSESSMENT METHODOLOGY

SURVEYS

12.4.1. At the time of writing baseline noise surveys have not been undertaken. Baseline noise surveys will be undertaken for the purposes of establishing baseline noise levels to underpin the assessment of construction noise but will also be helpful in providing a check to basic noise levels predicted for the assessed road links. Measurements will be undertaken at locations representative of receptors or receptor groups which have the potential to be affected by changes in noise level from construction or operation of the C2C Scheme.

12.4.2. Consultation will be undertaken with local authorities prior to surveys to discuss the methodology and noise measurement locations. Desktop studies indicate that baseline noise levels at many receptor locations are dominated by road traffic noise sources. In the instance that ambient noise levels are at the time of the survey are thought to be unrepresentative of long-term conditions, due to Covid-19 restrictions, guidance issued by the relevant professional bodies (including the Institute of Acoustics) will be discussed and agreed with the local authorities to agree a suitable approach to establish representative baseline noise levels.

ASSESSMENT APPROACH

12.4.3. The different elements of the overall assessment will follow appropriate guidance and standards as set out below. Significance of effects will be considered on the basis of magnitude of impact and with respect to the LOAEL and SOAEL thresholds adopted for the respective sources and receptors.

Construction

12.4.4. Assessment of construction noise and vibration effects will be in accordance with BS 5228 with due regard to the relevant aspects of LA111.

12.4.5. Construction noise and vibration levels will be predicted at representative receptors and the magnitude and significance of effects derived in the absence of mitigation.

12.4.6. Following the initial assessment, mitigation measures will be incorporated as appropriate prior to the residual impacts being reassessed.

Operation

12.4.7. There is no single methodology for assessment of the different operational elements of the C2C Scheme so more than one approach is envisaged.

12.4.8. The principles of DMRB LA111 will be used for the assessment of traffic noise associated with alterations to the existing road network and for changes in traffic flow or composition on the wider network. LA111.

12.4.9. Basic Noise Level calculations will be undertaken using the available 2026 and 2036 traffic modelling. It is noted that the Opening Year is 2024 and DMRB LA111 guidance indicates a Future Year of +15 years from the Opening Year. The source information for the forecasted traffic is the Cambridge Sub Regional Model (CSRM2), which is a complex demand model with forecasts based on defined vision for developments and economic growth within Cambridgeshire. Based on the detailed assumptions embedded within these forecasts, it is considered proportionate to undertake calculations based on the available information for 2026 as a proxy for an Opening Year (2024) and 2036 for the Forecast Year (+10 Years).

12.4.10. This minor departure from the scenario years suggested in DMRB LA111 is considered proportionate as only relatively small increases in traffic flow would be expected between 2024 and 2026 in the absence of the C2C Scheme. Similarly, in the case of the Future Year, the development assumptions within this scenario are defined by CCC and present a representation of a defined potential future for Cambridgeshire. Developing a further independent forecast which includes an additional 5 years' growth would be a departure from this defined scenario. It would be considered disproportionate to generate an interpolated 2041 from a 2046, due to the influence of major developments beyond 2041 and the omission of demand model responses.

12.4.11. For assessment of noise from discrete events within the transport hub site and for the assessment of noise from public transport using the dedicated links from the site, an assessment based upon principles of BS 4142 will be used.

12.4.12. To assess the classification of impacts and determine change in road traffic noise the following comparisons are made between forecast scenarios in accordance with LA111 guidance:

- Do-Minimum scenario in the opening year against Do-Something in the opening year (short-term change with the C2C Scheme)
- Do-Minimum scenario in the opening year against Do-Something in the future year (long-term change with the C2C Scheme)
- Do-Minimum scenario in the opening year against Do-Minimum in the future year (long-term change without the C2C Scheme)

12.4.13. These comparisons will be assessed for the C2C Scheme at those representative receptors that have the greatest potential to be affected by each road link or C2C Scheme element.

12.4.14. Following assessment, mitigation measure will be suggested as appropriate.

SIGNIFICANCE CRITERIA

Construction

12.4.15. The derivation of impact magnitude for construction noise will be based on the element of BS 5228 which has been identified for such in LA111, which is the ABC method set out in BS 5228 Annex E.3.2.

12.4.16. For vibration, the values set out in Tables 3.31 and 3.33 of LA111 will be used to derived impact magnitude.

12.4.17. For both noise and vibration, the significance of the impacts will be determined in accordance with the advice in LA111 paragraph 3.34 which advises that:

'A Construction vibration shall constitute a likely significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

1) 10 or more days or nights in any 15 consecutive days or nights; or

2) a total number of days exceeding 40 in any 6 consecutive months'

Operation

12.4.18. Impact magnitude with respect to operational noise from the highway will be derived based on the guidance in LA111 based, initially, on the residential façades where the greatest change is predicted, and the short-term and long-term values set out in Tables 3.54a and 3.54b and the matrix in Table 3.58.

12.4.19. The final operational impact significance with respect to road traffic will be based on the initial values but modified as necessary and appropriate in accordance with LA111 Tables 3.55, 3.58 and 3.60.

12.4.20. The significance of potential noise impacts from the used of the Traffic Hub will be based on the principles of BS 4142 whereby a rating level in excess of 5 dB over the representative background sound level would be significant at a high sensitivity receptor.

12.5 BASELINE

12.5.1. At the time of writing baseline noise surveys have not been undertaken. Existing baseline conditions have therefore been reviewed through desktop study using the Extrium (available online at: http://extrium.co.uk/) noise map. Existing ambient noise levels at noise sensitive properties within approximately 200m of the A428 and approximately 850m of the M11 in the study area are typically between 55 - 60 dB $L_{Aeq,16hr}$.

12.5.2. Baseline noise levels in the immediate vicinity of the C2C Scheme area are generally characterised by road traffic noise arising from the use of the A428, M11 and the surrounding road network. As distance increases from the road traffic noise sources, the noise level contributions from road traffic reduce and the relative contribution from other environmental and anthropogenic sources increases (e.g. agricultural, commercial and industrial noise, as well as residential activities, birdsong, etc).

12.5.3. There are no noise important areas (NIAs) adjacent to or in proximity to the C2C Scheme. NIAs are viewable online at: http://extrium.co.uk/noiseviewer.html

12.5.4. The surrounding areas from the C2C Scheme route include noise sensitive receptors in Cambridge, Cambourne and villages along the C2C Scheme route including Hardwick, Coton and Highfields.

The C2C Scheme route terminations are located in noise sensitive residential areas in Cambourne and in Cambridge near Herschel Road.

12.6 POTENTIAL IMPACTS

CONSTRUCTION

12.6.1. Construction work areas are likely to include the main C2C Scheme route, new Travel Hub site and any construction compounds. Potentially affected areas include roads west of Cambridge including Herschel Road, Coton, Hardwick, Highfield and Cambourne.

12.6.2. Additional noise from diversion routes also has the potential to increase noise levels and result in adverse effects at receptors.

OPERATION

12.6.3. During operation there is the potential for traffic using the new C2C Scheme route, within the Travel Hub site and access roads, and changes to traffic flows on the existing road network, to result in noise level changes at sensitive receptors.

12.6.4. In order to attain an increase of 1dB, in broad terms, an increase of 25% of traffic volume using existing roads would be necessary. Similarly, in order to achieve an increase of 3dB, existing traffic flows would have to be doubled. Alternatively, noise changes could also occur as a result of significant changes in flow parameters such as speed and percentage HGV etc.

12.6.5. The C2C Scheme is not expected to result in substantial changes to traffic flows on the existing road network, although impacts could occur in localised areas around the C2C Scheme route. These areas include the western end of the C2C Scheme within Camborne, Coton and the eastern end of the C2C Scheme in Cambridge (area surrounding Herschel Road). These receptors are described in Section 12.5.

12.7 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

12.7.1. The following impacts have been scoped in:

- Construction noise and vibration from the site;
- Construction noise and vibration from movement of vehicles on the existing road network;
- Construction noise and vibration from the compound (depending on the location of the compound, vibration may be subsequently scoped out);
- Operational noise.

SCOPED OUT

Operational vibration has been scoped out. DMRB LA111 advises maintained road surfaces will be free from irregularities which avoids the potential for significant adverse vibration effects.

13 LAND AND PROPERTY

13.1 INTRODUCTION

13.1.1. Land and property would be acquired or used for the C2C Scheme in a number of different ways, including:

- Temporary use of land
- Permanent acquisition of land.
- The survey of land.
- Permanent acquisition of rights and restrictive covenants over land.

13.1.2. Temporary use of land is required where it is needed for construction purposes, but not for the future operation of the C2C Scheme. Permanent acquisition of land is required for both the siting of the permanent structures, equipment and its operation and maintenance, it is also required for landscaping and mitigation measures, for example for drainage, environmental mitigation and parcels of land severed by the route which would no longer be viable for their current purpose in the future (termed severance).

13.1.3. The land required to accommodate the C2C Scheme is the following:

- Land that is required for the construction of the C2C Scheme, for the construction of works to be carried out, together with all construction work sites and working areas.
- Land which will need to be acquired for the permanent structures and equipment associated with the C2C Scheme, or land over which rights will be required to maintain, operate and safeguard its operation.

13.1.4. GCP would seek to minimise land take, whilst ensuring that the extent is sufficient for the purposes of the construction and operation of the C2C Scheme, including working areas and work sites. As the development of the C2C Scheme progresses the amount of land required will further be defined and further assessment work will be required to inform its land requirements.

13.1.5. All interests in land within the Order limits will be identified as part of the land referencing process and any further or newly identified interests in land will be incorporated within the existing stakeholder engagement and land interest negotiations.

13.2 ASSESSMENT METHODOLOGY

13.2.1. The ES will include a chapter to describe the potential impact arising from land use and land take associated with the C2C Scheme. It will identify and assess the likely significant impacts of the C2C Scheme in terms of temporary land take during construction, and permanent land take during its operation, as well as changes to the pattern of land use during the operational phase of the C2C Scheme, including any interaction with committed developments.

13.2.2. There is no specific guidance available that relates to the assessment of land use and land take, but best practice techniques will be adopted to assess the impacts of the C2C Scheme both in quantitative and qualitative terms.

LEGISLATION AND STANDARDS

13.2.3. The assessment will be undertaken having regard to the requirements of the EIA Requirements. As with all aspects of the approach to EIA, it will be carried in accordance with best practice. In

particular, it will identify the short and long term impacts on the pattern of land use during the construction and operational phases of the C2C Scheme, and aspects of the environment likely to be significantly affected by the proposal.

STUDY AREA

13.2.4. The central alignment for the C2C Scheme is shown in Figure 1.2..

13.2.5. For the purposes of assessing land and property, the Study Area also incorporates land immediately adjacent to the C2C Scheme that is either subject to an allocation in an adopted Local Plan or has the benefit of an extant planning permission.

SURVEYS

13.2.6. The assessment will be carried out based on a detailed review of relevant land use planning documents, including:

- South Cambridgeshire Local Plan (September 2018);
- Cambridge Local Plan (October 2018);
- Relevant evidence base documents including the Strategic Housing Land Availability Assessment (2013) and Employment Land Review update (2013) for Cambridge City Council, and the Strategic Housing Land Availability Assessment (2013) and Employment Land Review Update (2012) for South Cambridgeshire District Council;
- Planning History Records;

13.2.7. A site walkover will also be undertaken.

SIGNIFICANCE CRITERIA

13.2.8. The impacts of the C2C Scheme on land use and property will be evaluated for both the construction and operational phases. Impacts will be categorised having regard to whether they would be direct or indirect, temporary or permanent, and whether they would result in a beneficial, adverse or neutral impact.

13.2.9. Effects will be predicted by setting the degree of change due to the project against the type and importance of each land use and extent of land take. The significance of the effects will be categorised as either ‘severe’ (national or regional importance), ‘major’ (local or district scale), ‘moderate’ (a number of effects of local scale that individually are minor, but in combination might amount to moderate effects), ‘minor’ (individual local scale), or no effect. ‘Severe’, ‘major’ and ‘moderate’ effects are regarded as ‘significant’ in EIA terms.

13.3 BASELINE

13.3.1. Baseline conditions will be established through desk basked research and a site visit to identify areas affected by land use and land take associated with the C2C Scheme. Planned and committed developments will be identified through a review of existing or proposed land use allocations, discussions with CCC planning officers, as well as City Council and SCDC planning officers, and reviewing the Council’s published planning records. This will include the time limits imposed on planning permissions to identify extant consents (committed developments).

13.3.2. Land uses adjacent to the C2C Scheme are typical of a rural environment, except the ends of the route at Cambourne and Cambridge, as well as along the northern edge of Hardwick, and are

characterised by agricultural with some residential and open space. New land take is required at sections of the route, largely from agricultural land.

13.3.3. There are a number of development sites along the route and the status of associated planning permission will be reviewed. This will include the pending outline planning permission for the West Cambridge allocation intended for uses related to the University of Cambridge (reference: 16/1134/OUT, no expected determination date). West Cambridge site has an existing consent for uses related to the University of Cambridge (C/97/0961/OP) and therefore has existing development on this site. The new outline planning permission is to update and intensify the uses of the existing site.

13.3.4. The C2C Scheme also runs through the land south of the A428 based on Bourn Airfield, which is allocated for the development of a new village and has a pending application for outline planning permission (reference: S/3440/18/OL, determination expected 28th February 2020).

13.4 POTENTIAL IMPACTS

13.4.1. Potential impacts on land use and land take during the construction and operational phases are summarised in Table 13-1 and Table 13-2 respectively.

TEMPORARY CONSTRUCTION

Table 13-1 – Potential construction impacts on land use

Aspect of C2C Scheme Construction Works	Construction Impact
Establishment of site compounds and haul roads	Temporary change in use of land, disruption to movement in and out of buildings, disruption to use of fields and field access, disruption to the road network
Severance of land parcels used for agricultural production	Permanent change to land access for farmers fields – affecting agricultural viability
Soil strip for construction	Permanent change in land use and impact on agricultural viability.
Closure of roads for construction activities	Temporary change in use of land, disruption to movement in and out of buildings, disruption to the road network
Closure and diversions to PROWs	Temporary change in use of land, disruption to PROW network

13.4.2. Temporary road closures and PROW closures and diversions will be identified and discussed with the relevant local county officers to identify mitigation measures to include in the ES. These will also be documented in the Code of Construction Practice (or other appropriate document).

13.4.3. Impacts on land use due to construction compounds, haul roads and from severance resulting in potential impacts on agricultural viability will be assessed through engagement with affected landowners. This will include identifying temporary or permanent changes to field access and temporary or permanent changes to farmers use of fields. As parts of this engagement information relating to soil type and drainage in the fields will also be collected. This ES chapter will document

the potential impacts on farm viability and of the impact of any topsoil strip. It will identify mitigation and assess the significance of effects based on professional judgement and best practice.

13.4.4. It is not intended to carry out soil sampling to identify soil types. If required, this information will be collected to inform a soil management plan to be produced by the appointed contractor for construction (if the C2C Scheme is approved to be constructed). The soil sampling would therefore form part of pre-construction works and would be identified as part of the mitigation plan reported in the ES.

PERMANENT

Table 13-2 – Potential permanent impacts

Aspect of C2C Scheme Operation	Operational Impact
Operation of the High Quality Public Transport Service	Permanent changes in land use (including land and properties acquired and/or demolished to accommodate the route alignment)
Shared use pathway, environmental mitigation (e.g. landscaping and habitat creation), drainage system for the C2C Scheme, electrical sub stations, bus stops along the route, etc	Permanent changes in land use (including land and properties acquired and/or demolished to accommodate ancillary development)

14 SOILS, GEOLOGY AND LAND CONTAMINATION

14.1 INTRODUCTION

14.1.1. This chapter sets out the approach to identifying and assessing likely significant effects of the C2C Scheme on soils, geology and in respect of existing land contamination.

14.2 LEGISLATION AND STANDARDS

LEGAL FRAMEWORK

14.2.1. The Environmental Protection Act 1990 (EPA)[183] principally applies to sites where individual historical contamination linkages present a Significant Possibility of Significant Harm (SPOSH) or a Significant Possibility of Significant Pollution to Controlled Waters (SPOSPCoW) representing an unacceptable level of contamination risk for each linkage.

14.2.2. The EPA Part 2 statutory regime seeks to secure remediation of contaminated land that poses unacceptable risks to human health or the environment where this is unlikely to come forward voluntarily, such as through redevelopment. The standard to which remediation can be required under the Part 2A regime is that which is necessary to remove significant harm or the likelihood of significant harm for the existing use of the land concerned.

14.2.3. Part 2A of the EPA defines “contaminated land” and provides for the Secretary of State to issue guidance on how local authorities should determine if land is contaminated land or not.

14.2.4. It states that “contaminated land” is any land which appears to the local authority in whose area it is situated to be in such as condition, by reason of substances, in or under the land that:

- Significant harm is being caused or there is a significant possibility of such harm being caused; or
- Significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused.

14.2.5. The legacy of contaminated land on England is regulated by the 2006 regulations, which were amended in 2012[184]. The accompanying 2012 statutory guidance (‘Defra Contaminated Land Statutory Guidance’) introduces a four-category test which is intended to clarify when land does, and does not, need to be remediated. The guidance describes a risk assessment methodology in terms

[183] HMSO. (1990). Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance.
[184] HMSO (2012) Contaminated Land (England) (amendment) Regulations.

of ‘significant contaminants’ and ‘significant contaminant linkages’ within a contaminant-pathway-receptor conceptual model

14.2.6. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017[185] transposed the Water Framework Directive and provide for the enhancement of the status and the prevention of further deterioration of aquatic ecosystems and associated wetland, through, amongst other things, progressive reduction of groundwater pollution.

14.2.7. The Environmental Permitting (England and Wales) Regulations 2016[186] ("EPR") aim to protect groundwater and surface waters from pollution by controlling the inputs of potentially harmful and polluting substances. The EPR implement the WFD and the Groundwater Daughter Directive 2006. The EPR replace those parts of the Water Resources Act (WRA) 1991 that relate to the regulation of discharges to controlled waters (including groundwater).

NATIONAL POLICY

14.2.8. The NPPF[187] sets out the Governments planning policies and how these are expected to be applied. In terms of land contamination, the NPPF aims to contribute to protecting and enhancing our environment, by (amongst other things) ‘remediating and mitigating despoiled, degraded, derelict, contaminated land and unstable land where appropriate’.

14.2.9. Section 15, sub section: Ground conditions and pollution, paragraph 183 of the revised NPPF states that planning policies and decisions should ensure that:

- The Site is suitable for its proposed used taking account of ground conditions and any risks arising from land instability and contamination. This includes risk arising from natural hazards or former activities such as mining, and any proposal for mitigation including land remediation (as well as potential impacts on the natural environment arising from the remediation);
- After remediation as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990;
- Adequate site investigation information, prepared by a competent person, is available to inform these assessments.

14.2.10. Local policy relevant to South Cambridgeshire can be found in South Cambridgeshire Local Plan[188] September 2018 under:

- Policy NH/3 (Protecting Agricultural Land)

[185] The Water Environment (Water Framework Directive) (England and Wales) Regulations, (2000/60/EC) (Statutory Instruments, 2017)
[186] The Environmental Permitting (England and Wales) Regulations (Statutory Instruments, 2016).
[187] Ministry of Housing Communities and Local Government (CLG) (2021).National Planning Policy Framework (NPPF).
[188] South Cambridgeshire District Council (2018). South Cambridgeshire Local Plan. Available at: South Cambridgeshire Adopted Local Plan 2018 (scambs.gov.uk) [Accessed 01 December 2021].

- Policy CC/6 (Construction Methods
- Policy SC/11 (Contaminated Land)

14.2.11. Local policy relevant to Cambridge can be found in the Cambridge City Local Plan[189] under:

- Policy 8 (Setting of the city); and
- Policy 33 (Contaminated Land)

GUIDANCE

14.2.12. In the guidance that accompanies the Environmental Protection Act 1990 there is advice on what constitutes significant harm and what constitutes a significant possibility. The following reports provide further guidance on the risk assessment process:

- Land Contamination: Risk Management (LCRM) (Environment Agency)[190]
- Guidance on the legal definition of contaminated land (Defra (2008) Guidance on the legal definition of contaminated land)[191]; and
- Guiding Principles on Land Contamination (Environment Agency)[192].

14.2.13. Guidance on the assessment of contaminated sites acknowledges the need for a tired risk-based approach, underpinned by a Conceptual Site Model:

- Development of the specific Conceptual Site Model (Stage 1);
- Assessment of site investigation results against Generic Assessment Criteria (GAC) (Stage 2) where available and appropriate as derived by Generic Quantitative Risk Assessment (GQRA); and
- Assessment of site investigation results against Site Specific Assessment Criteria (SSAC) (Stage 3)' as derived by Detailed Quantitative Risk Assessment (DQRA).

14.2.14. The impacts associated with contaminated land are generally assessed by means of a source/contaminant-pathway-receptor methodology in accordance with The Land Contamination: Risk Management (LCRM) document[193].

[189] Cambridge City Council (2018). Cambridge Local Plan October 2018. Available at: Cambridge Local Plan [Accessed 01 December 2021].

[190] Environment Agency. (2020). Land Contamination: Risk Management (LCRM). Available at: https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks [Accessed 19 November 2021].

[191] Defra (2008). Guidance on the legal definition of contaminated land.

[192] Environment Agency (2010). Guiding Principles on Land Contamination.

[193] Environment Agency. (2020). Land Contamination: Risk Management (LCRM). Available at: https://www.gov.uk/guidance/land-contamination-how-to-manage-the-risks [Accessed 10 November 2021].

14.2.15. LCRM introduced the concept of a conceptual site model (CSM) to identify and assess contaminant linkages along with the revised Part 2a Contaminated Land Statutory Guidance (2012)[194]. The following definitions apply:

- Contaminant: contamination that has the potential to cause unacceptable adverse impacts to a receptor. It may comprise chemical, biological or physical agents;
- Receptor: a target that may be affected by contamination; examples include human occupants or users of the site, water resources or structures; and
- Pathway: a route whereby a contaminant may come into contact with the receptor; examples include ingestion of contaminated soil and leaching of contaminants from soil into water resources.

Guidance for Generic Assessment Criteria

14.2.16. Generic Assessment Criteria for soils, water, ground gas and vapours have been derived for human health and controlled waters in the following guidance:

Human Health Receptors

- Human Health Toxicological Assessment of Contaminants in Soil[195];
- Updated Technical Background to the Contaminated Land Exposure Assessment (CLEA) Model[196];
- Construction Industry Research and Information Association (CIRIA) C665. Assessing risked posed by hazardous ground gases to buildings[197]; and
- The Society of Brownfield Risk Assessment (SOBRA). Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health and Volatile Contaminates in Groundwater[198].

Controlled Waters Receptors

- Environment Agency's approach to groundwater protection[199];
- Anti-Pollution Works Regulations 1999[200];

[194] HMSO (2012). Contaminated Land (England) (amendment) Regulations.

[195] Environment Agency (2008). Science Report – SC050021/SR2 - Human Health Toxicological Assessment of Contaminants in Soil.

[196] Environment Agency (2008). Science Report SC050021/SR3 - Updated Technical Background to the CLEA Model.

[197] CIRIA C665 (2007). Assessing risks posed by hazardous ground gases to buildings.

[198] The Society of Brownfield Risk Assessment (SOBRA) (2017). Development of Generic Assessment Criteria for Assessing Vapour Risks to Human health and Volatile Contaminants in Groundwater.

[199] Environment Agency (2018). Environment Agency's approach to groundwater protection.

[200] HMSO (1999). Anti-Pollution Works Regulations. Available at: http://www.legislation.gov.uk/uksi/1999/1006/contents/made [Accessed 21 September 2021]

- Water Framework Directive Directions 2017[201]; and
- The Water Supply (Water Quality) Regulations 2016[202].

Potable Water Supply Pipes and Buried Concrete

- UK Water Industry Research (UKWIR). Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites[203]; and
- Building Research Establishment ('BRE'). Special Digest 1. 3rd Edition (including February 2018 amendments), Concrete in aggressive ground[204].

14.2.17. The Environment Agency's (EA) Waste Classification Guidance on the calcification and assessment of waste 2015[205] document provides the criteria for classification of waste as 'hazardous', 'non-hazardous' and 'inert' and the assessment methodology for the determination of these classifications. This classification is required to allow for the disposal of waste and also determines whether a waste requires classification or is suitable for re-use.

14.3 STUDY AREA

14.3.1. The extent of the study area for the assessment of ground conditions encompasses information on current and historical anthropogenic activities for all options in the following areas:

- Within the red line boundary of the site;
- Within 500m of the site for human health receptors; and
- Within 500m of the site for controlled waters.

14.3.2. The extent of this zone has been developed using professional judgement on the basis that contamination migration beyond this distance is likely to be negligible.

SIGNIFICANCE CRITERIA

14.3.3. A number of criteria will be used to determine the significance of the potential effects of the C2C Scheme and whether or not they are 'significant'. The effects will be assessed quantitatively wherever possible.

- The significance rating for an effect will take account of the following criteria:
- Likelihood of occurrence;
- Geographical extent;
- Adherence of the proposals to legislation and planning policy;

[201] HMSO (2017). The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.
[202] (2016) The Water Supply (Water Quality) Regulations.
[203] UK Water Industry Research (UKWIR) (2010). Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites.
[204] Building Research Establishment (BRE) (2017). Special Digest 1. 3rd Edition (including February 2018 amendments), Concrete in aggressive ground.
[205] Environment Agency (2015). Classification – Guidance on the classification and assessment of waste.

- Adherence of the proposals to international, national and local standards / guidance;
- Sensitivity of the receiving environment or other receptor;
- Value of the affected resource;
- Whether the effect is temporary or permanent;
- Whether the effect is short, medium or long-term in duration;
- Whether the effect is reversible or irreversible; and
- Inter-relationship between effects (both cumulatively and in terms of potential effect interactions).

14.3.4. The proposed methodology for assessing significance takes into consideration relevant guidance/regulations including DMRB LA 109, Geology and Soils[206]:

Sensitivity of Receptors

14.3.5. The sensitivity of potential receptors has been described qualitatively using professional judgement and guidance within DMRB LA 109, as detailed in Table 14-1**.**

Table 14-1 - Sensitivity of receptors

Sensitivity	High	Medium	Low	Negligible
Human Health (construction / maintenance workers and Site users and adjacent Site users)	Residential properties with private gardens schools/care homes/ hospitals /playing fields Construction/ maintenance workers	Residential properties without plant uptake Retail and business parks (public and work places) Allotment and market gardens	Commercial/ industrial properties Public open spaces	N/A
Controlled Waters (groundwater and surface water)	EA defined Principal Aquifers EA defined Secondary Aquifers overlying Principal Aquifers EA groundwater SPZ1	EA defined Secondary A and B Aquifers (where not overlying Principal Aquifers) EA groundwater SPZ 2 and 3 Surface water bodies of Moderate quality	EA defined Unproductive Strata and Secondary Undifferentiated Aquifers Minor local drainage network	N/A

[206] Highways England (2019). Design Manual for Road and Bridges (DMRB) LA 109 – Geology and soils. Available at: https://www.standardsforhighways.co.uk/prod/attachments/adca4c7d-4037-4907-b633-76eaed30b9c0?inline=true. [Accessed: November 2021].

Sensitivity	High	Medium	Low	Negligible
	Surface water bodies of High quality			
Below Ground Services (potable water supply pipes and buried concrete)	N/A	Potable water supply pipes Buried concrete	N/A	N/A

Magnitude of Change

14.3.6. The magnitude of the change of the C2C Scheme on soils, geology and land contamination is assessed by comparing the difference in risk each contaminant linkage at baseline to those at construction and at operational phases. This provides a way of assessing both the adverse and beneficial effects during construction and the operational period. The magnitude impacts have been described qualitatively using professional judgement and guidance within DMRB LA 109, Geology and Soils[206] as detailed in Table 14-2.

Table 14-2 - Magnitude of Change Criteria

Magnitude of Change	Definition	Example
High	Total loss or major alteration to key elements/features of the baseline. Results in loss of attribute and/or likely to cause exceedance of statutory objectives and/or breach of legalisation.	Likely significant human health impact. Contamination of a Principal aquifer.
Medium	Partial loss or alteration to one or more key elements/features of the baseline. Results in effect on integrity of attribute/or loss of part of attribute, and/or possibly cause exceedance of statutory objectives and/or breach of legislation.	Reduction in the value of a feature, Moderate human health impact.
Low	Minor shift away from baseline. Results in minor effects on attribute.	Measurable change in attribute, but of limited size/proportion.
Negligible	Very slight change from baseline Results in a very slight change or effect on attribute.	No significant loss in quality of feature/attribute.

SIGNIFICANCE OF EFFECTS

14.3.7. The level of risk for each plausible contamination linkage will be determined through the contamination of severity and probability using the risk matrix presented in Table 14-3.

Table 14-3 - Matrix for classifying the significance of effect

		Sensitivity of receptor			
		High	Medium	Low	Negligible
Magnitude of Impact	High	Major	Moderate to Major	Minor to Moderate	Negligible
	Medium	Moderate to Major	Moderate	Minor	Negligible
	Low	Minor to Moderate	Minor	Negligible to Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

14.3.8. The following terms have been used to define the significance of the effects identified and apply to both beneficial and adverse effects:

- **Major effect**: where the C2C Scheme could be expected to have a large improvement or deterioration on receptors.
- **Moderate effect**: where the C2C Scheme could be expected to have a noticeable improvement or deterioration on receptors;
- **Minor effect**: where the C2C Scheme could be expected to result in a small improvement or deterioration on receptors; and
- **Negligible**: where no discernible improvement or deterioration is expected as a result of the C2C Scheme on receptors, including instances where no change is confirmed.

Effects that are classified as moderate or above are considered to be significant. Effects classified as below moderate are considered to be not significant.

14.4 BASELINE

14.4.1. An understanding of the likely existing baseline environmental settings has been established with reference to the following:

- Natural England Multi-Agency Geographic Information for the Countryside (MAGIC)[207].
- British Geological Survey (BGS), 1975, Huntingdon, England and Wales Sheet 187.
- British Geological Survey (BGS), 1981, Cambridge, England and Wales Sheet 188.

[207] Natural England Multi-Agency Geographic Information for the Countryside (MAGIC) (2022). Available at: https://magic.defra.gov.uk/MagicMap.aspx [Accessed 01 November 2021]

- Cambourne to Cambridge Geotechnical and Geo-environmental Preliminary Risk Assessment (PRA)[208].

HISTORICAL LAND USE

14.4.2. Historical maps indicate that the majority of the C2C Scheme has been used as agricultural land with the development of several villages (to include commercial/industrial properties), Bourn Airfield and roadways to include major roads (A428, M11) present adjacent to or bisecting the route.

14.4.3. Bourn Airfield was used as an operational airfield during the Second World War for bombing operations, between 1940 and 1945. The airfield was subject to at least six air raids/strategic bombing between 1941 and 1944 It was decommissioned in 1948 and returned to agricultural use from 1950. Parts of the site have been used for commercial activity such as storage of construction plant.

SOILS

Agricultural Land

14.4.4. The Government MAGIC website shows the soils in the area in the "SoilScape" layer, based on the work carried out by Cranfield University[209]. This shows only one suite of soil types is found along the route, which is described as lime rich loamy and clayey soils. These soils have a clayey surface texture, and slightly impeded drainage. Natural fertility is high.

14.4.5. The Agricultural Land Classification maps on MAGIC are divided into two data sets. A national dataset that is pre-1988 and a post 1988 data set that is more accurate and detailed, but which does not cover the whole of the UK.

14.4.6. The post 1988 ALC dataset shows land between Cambourne and the Scotland Farm Travel Hub is made up of Grade 2, 3a and 3b quality land. The Grade 2 areas are associated with slight topographic lows which align with drainage features in the area, and consequently the route only crosses short stretches of this higher quality land.

14.4.7. From Hardwick to the M11 the only available dataset on MAGIC is the pre-1988 dataset, which shows the land is all categorised as Grade 2. This could be overly conservative as all the Grade 3a and 3b land in the more accurate post 1988 dataset is categorised as Grade 2 in the earlier dataset.

Artificial Ground

[208] Mott MacDonald (2020). Cambourne to Cambridge Geotechnical and Geo-environmental Preliminary Risk Assessment (PRA)

[209] Cranfield University Soilscape website. Available at: http://www.landis.org.uk/soilscapes/index.cfm [Accessed 01 December 2021].

14.4.8. Artificial ground is not recorded on BGS mapping. It is considered that artificial ground may be present on or within areas surrounding the C2C Scheme associated with historic extraction and infilling, industrial infrastructure development associated with road construction and within the footprint of Bourn Airfield.

SUPERFICIAL DEPOSITS

14.4.9. The majority of the C2C Scheme is underlain by the Oadby Member (Diamicton Till).

14.4.10. Mapping indicates there are no superficial deposits present east of Cambridge Road at Coton, across the M11 and the West Cambridge site towards Grange Road.

BEDROCK FORMATIONS

14.4.11. The bedrock geology varies across the C2C Scheme from west to east. The Kimmeridge Clay Formation is shown as present at the very western extremity whilst the Woburn Sands Formation is recorded east of this within the area of the Bourn Airfield. The remaining areas of the C2C Scheme are predominantly noted to be underlain by the Gault Formation (typically up to 39m thick) with the exception of West Melbury Marly Chalk Formation (typically up to 12m in thickness) overlying the Gault Formation from Madingley Mulch to the Coton Orchard. The White Melbury Marly Chalk Formation is physically separate to the main body of the Chalk present beyond the western end of the C2C Scheme.

14.4.12. Extracts have been taken from the PRA completed by Mott MacDonald and show the geology described above in Figure 14-1 and Figure 14-2.

Figure 14-1 - Superficial geology

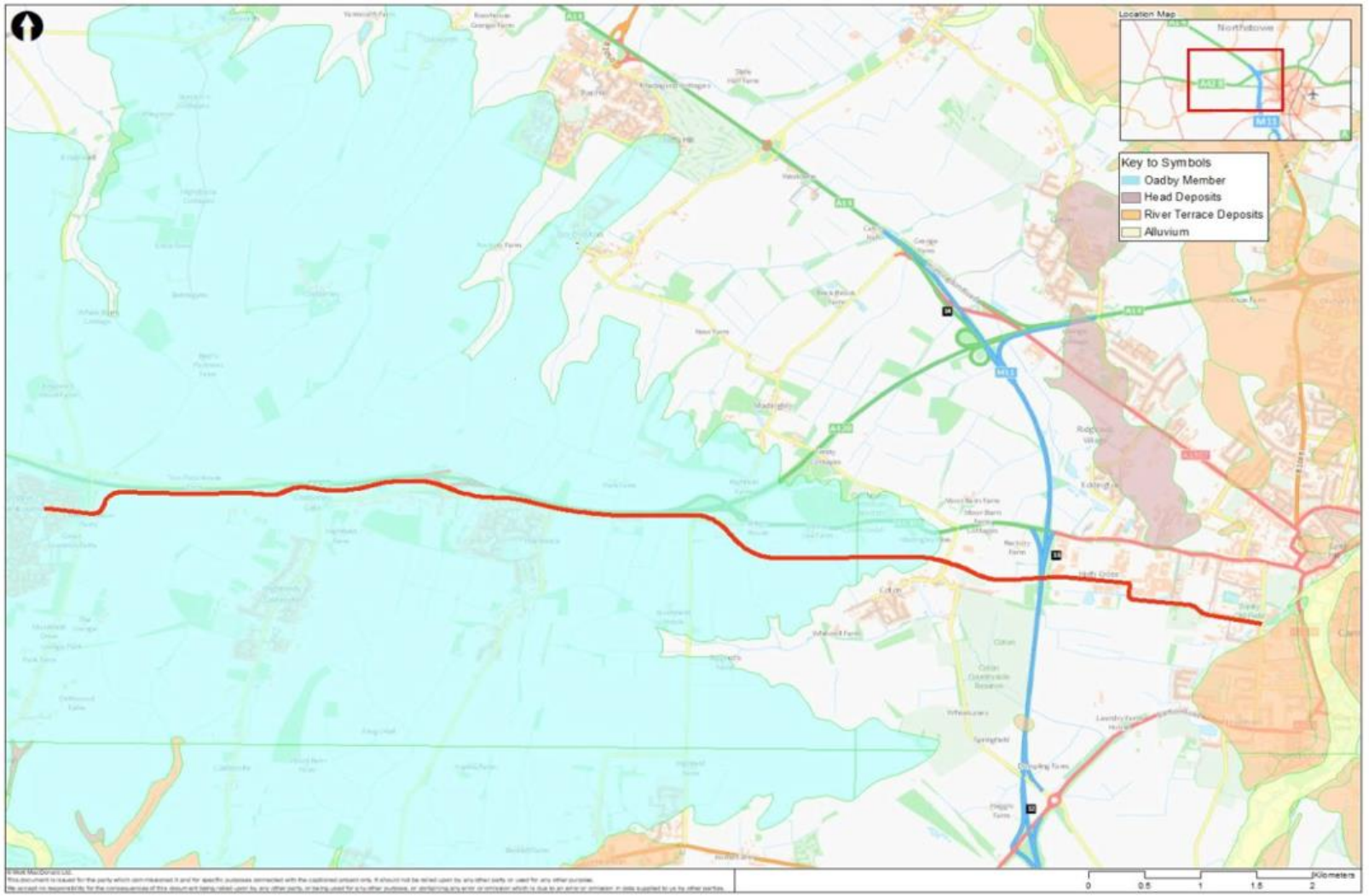
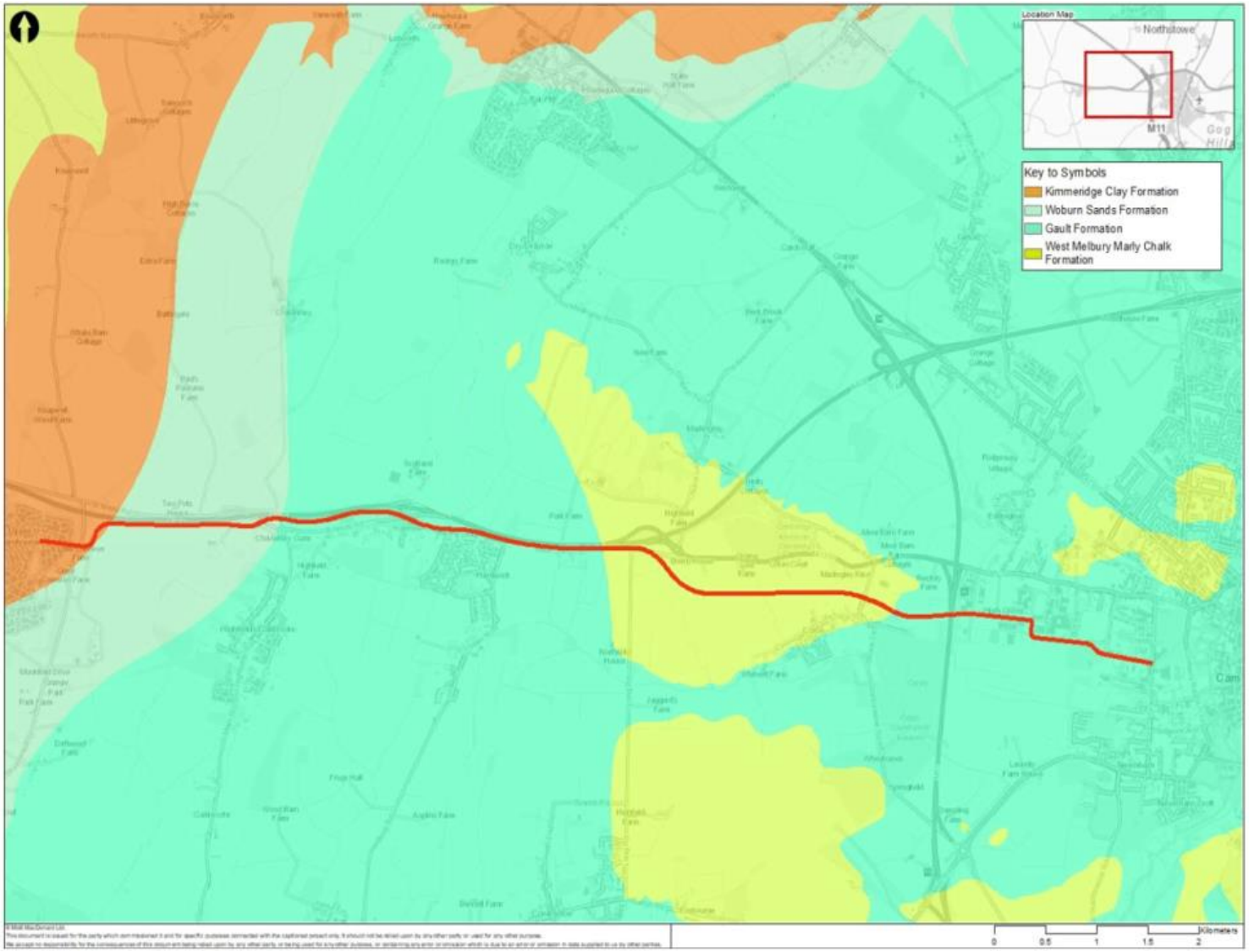


Figure 14-2 - Bedrock geology



GEOTECHNICAL HAZARDS

14.4.13. A summary of the geotechnical hazards associated with the geological units include the following:

- The Oadby Member is likely to be moisture sensitive leading to potential deterioration of ground conditions; variable conditions leading to long term consolidation settlement of embankments; potential to contain cobbles/boulders resulting in obstructions to structures; and periglacial features (shallow shear surfaces and perched water) leading to slope instability.
- The West Melbury Marly Chalk Formation is likely to be suspectable to frost; variable weathering zones, natural dissolution and man-made cavities (e.g. sink holes, cave systems and tapering pipes) leading to potential subsidence and potential presence of compressible material.
- The Gault Formation may have a variable strength / weathering which may lead to differential settlement and long-term consolidation settlement of embankments. The Formation may be susceptible to shrink/swell and may contain periglacial shallow shear surfaces leading to instability. Obstructions such as limestone bands may be present.
- Sulphate bearing minerals / nodules may be present within the above formations leading to potential risk of buried structural elements to be attacked by aggressive ground.

HYDROGEOLOGY AND HYDROLOGY

Hydrogeology

14.4.14. Information taken from Magic Mapping and the PRA completed by Mott MacDonald indicate the following aquifer classifications and groundwater vulnerabilities for the C2C Scheme (Table 14-4).

Table 14-4 – Summary of Hydrogeology

Strata	Location	Aquifer Classification	Groundwater Vulnerability
Oadby Member	• Across entire C2C Scheme with exception of the eastern area from east of Cambridge Road at Coton, across the M11 and the West Cambridge site towards Grange Road	• Secondary Undifferentiated	• Medium
Gault Formation	• Located across the majority of the site with exception of the far western area (underlain by Kimmeridge Clay and Woburn Sands Formation). Formation anticipated to outcrop in the far eastern extent of the C2C Scheme.	• Unproductive Strata	• Unproductive
West Melbury Marly Chalk Formation (Grey Chalk Subgroup)	• Overlying the Gault Formation and underlying the Oadby Member from Madingley Mulch to the Coton Orchard. Noted to outcrop in the eastern extent of the deposit (Coton Orchard)	• Principal Aquifer	• Medium to High
Kimmeridge Clay	• Located in the far western area of the C2C Scheme underlying the Oadby Member	• Unproductive Strata	• Low

Strata	Location	Aquifer Classification	Groundwater Vulnerability
Woburn Sands Formation	• Located in the west underlying the Oadby Member and the Kimmeridge Clay within the area of Bourn Airfield	• Principal Aquifer	• Medium

14.4.15. The Woburn Sands Formation has been identified as being part of the Cam and Ely Ouse Woburn Sands groundwater body. This is identified as being in poor chemical condition and good quantity condition. The poor chemical condition is attributed to diffuse pollution, mainly from agriculture. It is worth noting the groundwater body is a long narrow body that goes from south of Cambourne, across the Bourn Airfield and then north east to Downham Market (occupying an area of 95.3km^2).

14.4.16. The isolated outcrop of the West Melbury Marly Chalk is not included within any designated groundwater body (under the Water Framework Directive). This reinforces the interpretation that the outcrop is a small, isolated outcrop that is not likely to hold any significant quantity of groundwater. The nearest chalk groundwater body is the Cam and Ely Ouse Chalk groundwater body which commences to the east of the River Cam in Cambridge and which is not connected to the chalk underlying the C2C Scheme.

14.4.17. The site is not located within an Environment Agency Source Protection Zone (SPZ). The nearest SPZ to the site is indicated to be 630m south of the site boundary, to the west of Highfields Caldecote.

14.4.18. BGS borehole logs indicate groundwater was encountered within the Oadby Member from 0.35m to 17.7m below ground level (bgl); and the Gault Formation from 1.2m to 1.7m bgl. It is anticipated that the groundwater encountered within the Gault Formation is likely to be porewater and unlikely to be a continuous unit.

14.4.19. The BGS 1:100,000 Hydrogeological map (Cambridge to Maidenhead) indicates that groundwater levels within the Lower Greensand (Woburn Sands Formation) range from 30m Above ordnance datum (AOD) in the west to 10m AOD in the east near the village of Coton.

14.4.20. A series of springs are recorded within Coton, which appear to be located broadly at the boundary between the Oadby Member and the underlying Chalk. This may suggest the presence of groundwater within the Chalk, which has been confined by the Oadby Member overlying it to the west.

14.4.21. There are three recorded groundwater abstractions within 500m of the C2C Scheme located 200m north for general farming and domestic use; and 225m north and 260m north west for industrial processing.

Hydrology

14.4.22. Along the C2C Scheme, there are many land drains which appear to be associated with the existing road infrastructure. Several small valley streams are recorded, including Callow Brook which transects the site north of Hardwick and appears to run under the A428 through a culvert orientated north-east to south-west.

14.4.23. Bin Brook is present at its closest 200m south of the site orientated approximately north-west to south-east. Several land drains south of the site lead to this, forming a tributary to the River Cam 1.1km east of the site.

14.4.24. In the eastern area of the site between Charles Babbage Road and Adam's Road, several ponds and land drains are present. The site also crosses over the West Cambridge Canal, a water feature (non-navigational) which is orientated east to west within the West Cambridge Site (Cambridge University).

14.4.25. One surface water abstraction within 500m of the C2C Scheme located 25m south east for industrial/commercial uses and 500m east for general farming and domestic use.

WASTE MANAGEMENT / LANDFILL SITES

14.4.26. There are no known former/disused or existing landfill sites within the study area.

RECORDED MINERAL SITES

14.4.27. One BGS Recorded Mineral Site is present within 500m of the C2C Scheme. Coton Chalk Pit is situated 150m south, production within this pit is recorded as being ceased. There are three records of man-made mining cavities, situated 75m north, 360m south and 330m south the purpose of which was historical mining of coprolite.

SAFEGUARDED MINERAL RESOURCES

14.4.28. A review of the Cambridgeshire and Peterborough Minerals and Waste Plan indicate that part of the C2C Scheme between Coton and West Cambridge is situated within a Mineral Safeguard Area (MSA) for Chalk. Polices are in place to ensure that mineral resources are not built upon and to avoid detrimental impact of the mineral resource through development.

UXO

14.4.29. The Preliminary unexploded ordnance (UXO) Threat Assessment completed by 6 Alpha Associates recorded the potential for unexploded WWI and WWII ordnance to exist at the western quarter of the site, notably around Bourn Airfield, to be likely, with no further action required in the eastern area of the site).

LOCAL GEOLOGICAL SITE

14.4.30. There are no geological SSSI sites in the area of the route.

CONCEPTUAL SITE MODEL

14.4.31. The following potential sources of contamination have been identified:

Onsite:

- Potential for impacted Made Ground from historical and current land uses at Bourn Airfield; the construction and operation of the British Antarctic Survey and University of Cambridge campus buildings; construction of previous and current infrastructure (roads/highways)
- Fuel / oil spillages and airborne particulates migrating into the underlying ground with the current vehicle usage of the roads/highways.
- Agricultural land including the application of pesticides and sewage sludge to the ground (agricultural land), and localised fuel / oil spillages from agricultural machinery.

Offsite:

- Impacted Made Ground from adjacent previous and current infrastructure (roads/highways); and Born Airfield; and construction and operation of the British Antarctic Survey and University of Cambridge campus buildings.
- Mineral extraction activities and potential for subsequent infilling with unknown material.
- Fuel / oil spillages and airborne particulates migrating into the underlying ground with the current vehicle usage of the roads/highways.
- Potentially contaminative contemporary trade directory entries to include active petrol filling stations within 500m of the site.
- Agricultural land including the application of pesticides and sewage sludge to the ground (agricultural land), and localised fuel / oil spillages from agricultural machinery.

Contamination Pathways

14.4.32. The plausible contaminant pathways for the C2C Scheme include:

Human Health:

- Dermal Contact;
- Direct Ingestion;
- Direct exposure to impacted shallow groundwater and/or surface water;
- Inhalation of particulates/fibres and/or soil/water derived vapours; and,
- Asphyxiation by accumulation of ground gases in internal/confined spaces.

Groundwater / geology:

- Leaching of contaminants through the unsaturated zone and subsequent impact on groundwater and Mineral Safeguarding areas; and,
- Lateral migration of impacted groundwater.

Surface water features:

- Surface water runoff; and,
- Migration of immiscible contaminants.

Below Ground Services

- Direct contact with corrosive substances (e.g. sulphates and hydrocarbons) in the soils and shallow groundwater)

Agricultural Land

- Leaching of contaminants;
- Surface water runoff; and
- Lateral migration of impacted groundwater; and
- Migration of immiscible contaminants.

Sensitive Receptors

14.4.33. The following receptors may be impacted by potential sources of contamination within the Site. These have been separated into four categories.

Human Health:

- Construction / maintenance workers;
- Current / future users including road and pavement users; and
- Off-site users in the immediate vicinity including neighbouring residents.

Controlled Waters:

- Groundwater – Secondary Undifferentiated Aquifer (Oadby Member); and Principal Aquifers (Woburn Sands Formation and West Melbury Marly Chalk)
- Surface waters – On and off Site features including ponds and small streams bisecting the C2C Scheme and Bin Brook located 200m south.

Below Ground Services:

- Potable water supply pipes (if present);
- Buried concrete; and
- Foundations

14.5 POTENTIAL IMPACTS

14.5.1. The following issues will be considered within the ES:

- Agricultural land use with a potential of use of pesticides, sewage sludge and potential for fuel/oil/chemical spillages from machinery;
- Bourn Airfield in the west of the C2C Scheme including previous use as an airfield during WWII and current use for commercial / industrial works;
- Current and previous uses of roadway/highways including potential for fuels/oil spillage and release of airborne particulates;
- Presence of Made Ground from Bourn Airfield, infrastructure and surrounding commercial/industrial land use;
- Surrounding mineral extraction activities and potential for subsequent infilling with unknown materials; and
- Local industrial and commercial land use including active petrol filling stations within 500m of the Site.

CONSTRUCTION

14.5.2. During the Construction Stage of the C2C Scheme the principal human health receptors will be construction workers, current and neighbouring users. Controlled waters receptors including underlying aquifers and on-Site and nearby surface water features as well as agricultural land receptors will also be considered.

PERMANENT AND OPERATIONAL

14.5.3. During the Operational Stage of the C2C Scheme, the principal human health receptors will be future Site users and neighbouring Site users. Maintenance workers will be considered should the groundworks be required for the maintenance of the C2C Scheme. Controlled waters receptors including underlying aquifers and on-Site nearby surface water features as well as agricultural land receptors will also be considered

14.6 MITIGATION

14.6.1. Mitigation measures if required are anticipated to comprise:

- Requirement for a detailed UXO assessment prior to any intrusive works commencing within the former Bourn Airfield.
- Requirement for a ground investigation across the C2C Scheme to confirm ground conditions and any contamination within the soils or groundwater (if present). Works will include groundwater and ground gas monitoring.
- Complete a natural and man-made cavity search based on a number of man-made and (potential presence of natural cavities) recorded in close proximity to the site.
- Production of a Remediation Method Statement (RMS) which would specify the remediation measures required to reduce the risk to human health and controlled waters to an acceptable level. Measures would likely comprise, but not necessarily limited to:
  - Removal / treatment of contamination hotspots; and
  - Installation of clean cover in areas of soft landscaping.
- A verification report to confirm the successes of the remediation (if required);
- A Construction Phase Plan would be in place through all construction works to ensure the protection of workers and the general public. The CPP would specify safe working practices to protect workers and neighbouring Site users from contamination related risks. Measures would include provision of Personal Protective Equipment (PPE) and Respiratory Protective Equipment (RPE) for the proposed takes and identified contamination; and
- Implementation of best practice environment management techniques during construction such as the development and implementation of a CEMP and a Site Waste Management Plan. Measures would include, but are not limited to:
  - Diversion of surface water drainage;
  - Storage of contaminated spoil in bunded covered containers;
  - Storage of fuel and chemicals in bunded containers; and
  - The use of spill trays when refuelling.

14.7 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

14.7.1. Potential impacts for both construction and operational phases that have been scoped in for further assessment include human health (construction and maintenance users; neighbouring site users; and current and future site users); controlled waters (aquifers and surface water features); buried structures (services and buried concrete); agricultural land; and mineral safeguarding areas.

SCOPED OUT

14.7.2. The potential sterilisation of areas of geological importance have been scoped out as there are no areas of geological importance identified.

15 WATER RESOURCES AND FLOOD RISK

15.1 INTRODUCTION

15.1.1. This chapter considers the identification and assessment of likely significant effects of the C2C Scheme on the water environment receptors (surface water and groundwater) in the study area, including flood risk. The chapter concludes that it is not likely that the C2C Scheme will have a significant impact on the surface water and groundwater receptors and therefore it is proposed to scope the water environment receptors (surface water and groundwater) out of the EIA. However, the risks associated with flooding could be changed (positively or negatively) by the C2C Scheme and will be assessed with the approach to be taken to support the EIA and planning application set out in this chapter. The Flood Risk Assessment (FRA) will be appended to the Environment Statement.

15.2 ASSESSMENT METHODOLOGY

15.2.1. This section presents the applicable legislation, the methodology, study area and existing baseline and includes an initial assessment of the potential impacts on water resources and flood risk from the C2C Scheme.

15.3 LEGISLATION AND STANDARDS

LEGAL FRAMEWORK

The Water Environment (Water Framework Directive) (England and Wales) Regulations 20016

15.3.1. The Water Framework Directive (WFD) (2000/60/EC) established a framework for the management of water resources throughout the European Union. The WFD is translated into UK law through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

15.3.2. The key objectives of the WFD are to:

- Prevent deterioration of, enhance and restore bodies of surface water, achieve good chemical and ecological status of such water and reduce pollution from discharges and emissions of hazardous substances.
- Protect, enhance and restore all bodies of groundwater, achieve good chemical and quantitative status of groundwater, prevent the pollution and deterioration of groundwater, and ensure a balance between groundwater abstraction and replenishment.
- Preserve protected areas.

The Groundwater (England and Wales) Regulations 2009

15.3.3. The Groundwater (England and Wales) Regulations 2009 transposed the EU Groundwater Directive (2006/118/EEC) and provide for the protection of groundwater from pollution and deterioration. The main requirements in relation to transport projects concern the limitation or avoidance of the discharge of hazardous substances to groundwater.

Environmental Permitting (England and Wales) Regulations 2016

15.3.4. The Environmental Permitting (England and Wales) Regulations 2016 ("EPR") aim to protect groundwater and surface waters from pollution by controlling the inputs of potentially harmful and polluting substances. The EPR implement the WFD and the Groundwater Daughter Directive 2006.

The EPR replace those parts of the Water Resources Act (WRA) 1991 that relate to the regulation of discharges to controlled waters (including groundwater).

Water Resources Act 1991

15.3.5. Section 93 of the WRA 1991 provides for the establishment of groundwater protection zones. The requirements of Section 93 are implemented and set out in the Environment Agency's Groundwater Protection Guides covering: requirements, permissions, risk assessments and controls (previously covered in GP3). Source Protection Zones (SPZs) are defined for groundwater supplies used for human consumption. The Environment Agency's position statement relating to the use of Sustainable Drainage Systems (SuDS) can be found within these guides.

Land Drainage Act 1991

15.3.6. Local Authorities and Internal Drainage Boards have additional duties and powers associated with the management of flood risk under the Land Drainage Act 1991. As Land Drainage Authorities, consent must be given for any permanent or temporary works that could affect the flow within an ordinary watercourse under their jurisdiction to ensure that local flood risk is not increased.

15.3.7. The Land Drainage Act specifies that the following works will require formal consent from the appropriate authority:

- Construction, raising or alteration of any mill dam, weir or other like obstructions to the flow of a watercourse.
- Construction of a new culvert.
- Any alterations to an existing culvert that would affect the flow of water within a watercourse.

NATIONAL STANDARDS

National Planning Policy Framework 2019

15.3.8. The NPPF applies to the C2C Scheme under Chapter 15 ("Meeting the challenge of climate change, flooding and coastal change") and the supporting technical guidance, in relation to flood risk. A site-specific flood risk assessment will be required to assess the potential impacts of flooding on and as a result of the C2C Scheme and ensure that the C2C Scheme is sequentially appropriate which may involve passing the exception test if required. .

LOCAL POLICY

15.3.9. The current local planning policy and guidance relevant to the water environment is contained in the adopted (2018) South Cambridgeshire and Cambridge City Local Plans.

15.3.10. The South Cambridgeshire Local Plan contains three policies relevant to the C2C Scheme:

- Policy CC/7: Water Quality.
- Policy CC/8: Sustainable Drainage.
- Policy CC/9: Managing Flood.

15.3.11. Two policies from the Cambridge Local Plan are relevant to the water environment for the C2C Scheme:

- Policy 31: Integrated water management and the water.
- Policy 32: Flood Risk.

STUDY AREA

15.3.12. The study area encompasses the surface water features and groundwater resources up to 1km from the route alignment. The route alignment has been described in Section 2.

15.4 BASELINE

SURFACE WATER FEATURES

15.4.1. The C2C Scheme is located between watercourses that drain to the Bourn Brook and Bin Brook (to the south) and the Great Ouse (to the north). The low, flat ridge on which Cambourne, the A428 and the A1303 are located is orientated east-west and surface water features run north and south from this ridge. A number of field drainage features are shown on OS maps which also follow this north / south flow pattern. The C2C Scheme crosses the following watercourses:

- Unnamed tributaries of Bourn Brook
- Callow Brook
- Unnamed tributaries of Callow Brook
- Bin Brook
- Unnamed tributaries of Bin Brook

15.4.2. From Cambourne to Hardwick the route is located on the interfluve between the Great Ouse Lower catchment and the River Cam catchment. The route crosses in and out of the catchments but can be broadly defined as set out below in relation to specific surface water body catchments between Cambourne and Cambridge.

Cambourne and western part of Bourn Airfield

- On the extreme eastern limit of Ouse Upper and Bedford Management Catchment.
- Local water body identified as the Fen Dayton Drain which is heavily modified and classified as Moderate status under the WFD.

Easter Bourn Airfield to Grange Road

- Running from the western limit of Cam and Ely Ouse Management Catchment towards the Cam in Cambridge.
- Local water body which the Travel Hub site and the section of route alongside the St Neots road west of Madingley Mulch drains to (via Callow Brook) is the Old West River (heavily modified and classified as Moderate status).
- Local water body which remainder of route from Madingley Mulch to Grange Road drains to identified as Bin Brook (heavily modified and classified as Moderate WFD status).

15.4.3. The route itself does not cross any perennial streams but does cross a number of drainage ditches around the edges of fields. There are no natural surface water features in the potential Travel Hub site although the headwater of the Callow Brook is located within 100m of the proposed parking layout. This brook drains northwards to become the Old West River at Dry Drayton.

15.4.4. There are no surface water features crossed by the C2C Scheme between the Madingley Mulch area and the M11 crossing. Drainage off the higher land in this area (via ditches) would flow south downhill off Madingley Hill towards the Bin Brook. Runoff from nearer Coton and the Coton Orchard runs into ditches and drains to eventually enter Bin Brook between the M11 and Grange Road.

HYDROGEOLOGY

Superficial Deposits

15.4.5. The majority of the C2C Scheme, from the Cambridge Road crossroad on the A1303 at Coton, westwards beyond Cambourne, is underlain by the Secondary (Undifferentiated) Aquifer made up of the Diamicton Till. This is called the Oadby Member which is a low permeability formation that has limited groundwater present within it.

15.4.6. Approximately 300 metres east of Cambridge Road at Coton, across the M11 and the West Cambridge site towards Grange Road there are no superficial deposits present.

Bedrock Formations

15.4.7. Within the study area there are only two Principal Aquifer units present. Beneath Bourn Airfield are sandstones of the Woburn Sands Formation. This formation is identified as being part of the Cam and Ely Ouse Woburn Sands groundwater body. This is identified as being in poor chemical condition and good quantity condition. The poor chemical condition is attributed to diffuse pollution, mainly from agriculture. It is worth noting the groundwater body is a long narrow body that goes from south of Cambourne, across the Bourn Airfield and then north east to Downham Market (occupying an area of 95.3km^2).

15.4.8. From Madingley Mulch to the Coton Orchard the area has the West Melbury Marl Chalk Formation present. The chalk formation is an isolated outcrop on the north western limit of outcropping chalk in East Anglia. It is draped over the underlying Gault Formation and is likely to be relatively thin in the study area. There are no springs visible in the area around the edge of the chalk formation which indicates the chalk is likely to have limited water within it.

15.4.9. It is worthy of note that the Environment Agency has not included this outcrop within any designated groundwater body (under the Water Framework Directive). This reinforces the interpretation that the outcrop is a small, isolated outcrop that is not likely to hold any significant groundwater.

15.4.10. The nearest chalk groundwater body is the very large Cam and Ely Ouse Chalk groundwater body which commences to the east of the River Cam in Cambridge and which is not connected to the chalk underlying the C2C Scheme.

15.4.11. Cam and Ely Ouse Woburn Sands groundwater body has been identified as having a medium groundwater vulnerability by the Environment Agency. The West Melbury Marl Chalk Formation outcrop between Madingley Mulch and Coton Orchard is mostly situated within a medium groundwater vulnerability zone, where the Till superficial deposits are present. Where the Till superficial deposits are not present towards the east, the C2C Scheme over the chalk is situated within a medium to high groundwater vulnerability zone.

15.4.12. Where the chalk is absent between Childerley Gate and Grange Road the C2C Scheme is underlain by Gault Formation (low permeability mudstone). Kimmeridge Clay and undifferentiated West Walton and Ampthill Clay Formations are beneath the C2C Scheme in Cambourne. None of these clay formations are designated as aquifers (i.e. they have no significant groundwater present within them) and are not included as groundwater bodies in the Anglian Region Management Plan.

15.4.13. The Travel Hub site is entirely on the low permeability Oadby Member which overlies the Gault Formation. The geology described above is shown in Figures 14-1 and 14-2.

Source Protection Zones

15.4.14. Review of the Environment Agency's groundwater data indicates that there is a Zone 3 Source Protection Zone (SPZ) located approximately 650m to the south of the western end of the C2C Scheme area. Zone 3 is defined as the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where water is taken.

FLOOD RISK

15.4.15. Review of the Environment Agency Flood Map for Planning (Rivers and Sea) indicates that the majority of the C2C Scheme is located within the low-risk Flood Zone 1 where the risk of flooding from fluvial sources is less than 1 in 1000 (0.1%) in any year. However, there is a small area located within Flood Zone 3 located to the eastern end of the C2C Scheme where the risk of flooding from fluvial sources is greater than 1 in 100 (1%) in any year. The identified fluvial flood risk is located along the Bin Brook and is associated with the floodplain of the River Cam located to the east.

15.4.16. Review of the Environment Agency's Flood Risk from Surface Water Map indicates that sections of the C2C Scheme are at high, medium and low risk of flooding from surface water sources. Flooding from surface water is typically associated with natural overland flow paths and local depressions in topography where surface water runoff can accumulate during or following heavy rainfall events. The Flood Risk from Surface Water Map can also indicate fluvial flood from watercourses with a catchment less than c.3km² that are too small to be mapped on the Environment Agency's Flood Map for Planning.

15.5 POTENTIAL IMPACTS AND EFFECTS

TEMPORARY CONSTRUCTION EFFECTS

15.5.1. During construction there are not likely to be significant below ground works except in the vicinity of the main structural elements at the M11 bridge crossing and the section closest to the A428 near the Waterworks site. At the M11 crossing the foundations would be based in the Gault clay formation. Along the A428 the route is largely on Gault clay – but closest to the Waterworks site the route encroaches onto the western extremity of the chalk outcrop. In these areas some form of below ground piling for foundations may be required. Piling creates an opportunity for pollutants to move more rapidly from the surface to any groundwater encountered by the piling but as the geology is of low permeability clays, or a dry area of chalk any piling is not likely to cause any significant effects on groundwater.

15.5.2. Issues to note during construction with respect to surface water resources are as follows:

- There will be construction of a surface water drainage network which will include various drainage facilities including ponds or drains, which will discharge into existing surface water features.
- Leaks and spills of chemicals and other potentially polluting substances used or stored on the site (e.g. fuel, cement).
- Suspended materials from working areas running off in rainfall and causing high turbidity water to enter existing surface water features.
- Impacts to the hydromorphological, chemical and ecological quality of watercourses associated with works within or in close proximity to watercourses such as the installation and alteration of

culverts, bridges and outfalls as well as realignment of watercourses, including longer-term changes associated with sediment deposition.

- Increased flood risk associated with temporary works within areas of fluvial flood storage, works to existing watercourse alignments and culverts, and associated with changes to catchment permeability and hydrology.

15.5.3. Adherence to standard pollution control measures that will be set out in the CoCP will ensure risks to water resources are controlled and limited. As there would be no direct discharge to surface water bodies from the site, and as the surface geology is of low permeability superficial deposits or low permeability bedrock it is concluded that any incidents on site would not be likely to result in significant effects on water resources from these sources of pollution.

PERMANENT AND OPERATION EFFECTS

15.5.4. The drainage strategy for this C2C Scheme will detail how the surface water drainage along the route will be designed to minimise risks to flooding and water quality.

15.5.5. The potential impacts from operations on the water environment will arise from:

- Contaminants arising from the C2C Scheme entering groundwater or surface water features;
- Change in recharge to groundwater resources;
- Changes in flow of groundwater;
- Changes to flow of surface water (either increased or reduced);
- Changes to the geomorphology of surface water features; and
- Impacts on water dependant ecosystems.

15.5.6. There are two means to assess the potential for contaminants from the C2C Scheme entering surface or groundwater features. One is to follow the guidance published by Highways England[210] and the other is the CIRIA SUDS Manual[211] which includes a tool for carrying out an assessment of the potential for controlling runoff quality with a SUDS scheme.

DMRB Assessment

15.5.7. LA113 references the Highways England Excel tool that models impacts on water resources, this is the HEWRAT tool that enables an assessment of the risk to groundwater, and assesses the potential quality of discharges into the surface water environment.

[210] Highways England (2019). LA113 Rev 0. Road Drainage and the water environment. Available at: file:///C:/Users/mon11362/OneDrive%20-%20Mott%20MacDonald/_information/DMRB%20&%20Webtag%20&%20Highways%20Act/V11%20EIA%20Process/Section%203/LA%20113%20Road%20drainage%20and%20the%20water%20environment-web%202019.pdf [Accessed 01 December 2021].

[211] Woods Ballard, B, Wilson, S, Udale-Clarke, H, Illman, S, Scott, T, Ashley, R, Kellagher, R (2007). CIRIA C753 The SuDS Manual. Available at: https://www.ciria.org/ItemDetail?iProductCode=C753F&Category=FREEPUBS [Accessed 01 December 2021].

15.5.8. During operations the vehicles using the C2C Scheme would be a relatively small number – generally around 250 to 300 a day. In order to maintain environmental standards vehicles would need to be relatively new and well maintained. This number of vehicles (albeit they are all large vehicles) is not likely to generate sufficient contaminant load from any leakages of hydraulic and brake fluids and fuel, or particles from wear and tear of brakes and tyres to create a risk of contamination from road runoff to surface water and groundwater.

15.5.9. Using Highways England's HEWRAT tool to assess groundwater risk, and assuming there is some infiltration through swales and ditches to ground, the risk to groundwater receptors is identified as Low or Moderate – depending on the depth to groundwater which is not well known in the area. Given the very low number of vehicles using the C2C Scheme it is considered reasonable to assume a low risk to groundwater, which means that no further assessment of quality of groundwater is required.

15.5.10. The guidance manual for HEWRAT notes that the model is not likely to be reliable for AADT values much below 11,000 and is likely to be overly conservative. If AADT is much below 11,000 the assumption is that risks of pollution to surface water are low and could be managed by standard drainage design practice. As discussed, the number of vehicles using the route will be two orders of magnitudes lower than the AADT required to enable reliable use of the HEWRAT model.

15.5.11. Therefore it is concluded use of HEWRAT is not likely to benefit the C2C Scheme and that risks to surface water should be very low.

SUDS Manual Assessment

15.5.12. The SUDS Manual[212] was used to carry out an assessment of the potential risks to water resources using the simple assessment tool that is part of the SUDS manual. The tool considers the risks associated with the proposed SUDS design and was used to assess the pollutant risks from the segregated busway and from the travel hub.

15.5.13. With respect to the busway, if the route is identified as a road (which is conservative as this category excludes low traffic roads which the route is more similar to) then the route would be identified as presenting a medium hazard from suspended solids, metals and hydrocarbons. The proposed drainage design elements (e.g. Vegetated swales, filter strips and filter drains) reduced the hazard risk to "acceptable" for hydrocarbons and metals and to just below acceptable for suspended solids. Where suspended solids could enter water courses then additional treatment in the form of stop traps would reduce the hazard risks to "acceptable". The final surface water drainage strategy will present more detailed information on the risks to water quality to confirm the hazards are not likely to have any impact on surface and groundwater resources from this low traffic route.

[212] CIRIA (2015). The SUDS Manual, CIRIA C753.

15.5.14. With respect to the Travel Hub, the land use type assigned to the assessment was a "Non-residential car parking with frequent change (e.g. hospitals, retail)" which presents a medium hazard from suspended solids, metals and hydrocarbons.[213]. Assuming permeable paving under the car parking (as proposed for the Cambridge South West Travel Hub currently the subject of a planning application to South Cambridge District Council), swales and vegetated ditches and a detention pond and wetland/pond prior to discharge the hazard risks are reduced to acceptable levels. Even if the wetland/pond was not included the overall hazard risk is still acceptable.

15.5.15. Therefore it is concluded the potential impacts on surface water quality from the C2C Scheme would not be significant and do not warrant inclusion in the EIA.

Change in recharge to groundwater

15.5.16. As described above the C2C Scheme is largely routed over low permeability formations with limited groundwater potential. The area of the C2C Scheme is relatively small in comparison with the catchments of the formations crossed by the C2C Scheme. As there will be swales with some opportunity for infiltration along the C2C Scheme some recharge will occur close to where it would have occurred. The overall effect therefore of the C2C Scheme on groundwater recharge is likely to be a very slight reduction in recharge but not significant in terms of the groundwater resources of the area.

Changes in groundwater flow

15.5.17. Groundwater flow is affected if a scheme introduces structures that can block groundwater flow or can divert groundwater flow. The C2C Scheme is almost entirely constructed on existing ground level, and there are not likely to be any significant below ground structures that could interfere with groundwater flow.

Changes to flow in surface water

15.5.18. The C2C Scheme creates a significant increase in hard surface which will be drained by a positive surface water drainage system. Whilst opportunities for some infiltration through swales will be included in the design where possible it is anticipated that the C2C Scheme's drainage system will discharge to the local surface water network. Without appropriate design the C2C Scheme has the potential to increase the rate of flow from the hard surfaced areas to the final point of discharge, increasing flows in receiving water bodies.

15.5.19. However, the design will have to meet the Lead Local Flood Authority (LLFA), which for the C2C Scheme is Cambridgeshire County Council, requirements to ensure no increase in flood risk arises from the C2C Scheme – taking appropriate account of climate change increases. Discharges will be

[213] The tool does not permit a well-used non-residential car park to be selected, but this is a category identified in the CIRIA SuDS Manual (Table 26.2) which allocates the same risk indices as the road category chosen in the simple assessment tool used for this assessment.

at rates agreed with the LLFA and are likely to be similar to existing green field runoff rates plus a climate change allowance. Therefore it is concluded the potential for the C2C Scheme to increase flows in surface water is considered to be insignificant.

15.5.20. As part of the C2C Scheme is located in an interfluve there is a small potential for the drainage design to divert flows from one catchment to another. However the area where potential runoff would be diverted is considered marginal as the C2C Scheme's drainage will be gravity drained, thereby requiring flow to follow the broad fall of the existing topography. Thus it is concluded the opportunity for impacts that reduce surface water flow in any catchment is not significant.

Changes to the geomorphology of surface water bodies

15.5.21. Any drainage feature that discharges directly into a receiving water course will have to be designed to minimise scour and prevent changes to the geomorphology of the receiving river or stream.

15.5.22. There may be permanent impacts to the hydromorphological and ecological quality of water features associated with works within or in close proximity to water features such as the installation and alteration of culverts, bridges and outfalls as well as realignment of watercourses if required. Any widening of existing highway culverts and bridge crossings and any watercourse diversions will maintain hydraulic capacity and, where possible, explore opportunities to provide betterment. Any new crossings of watercourses and any new watercourse channels will maintain the capacity of the channel, ensure no increased flood risk up to the 1 in 100-year event considering the potential effects of climate change, be designed in accordance with DMRB guidance, and be sensitive to ecological requirements.

15.5.23. It is therefore concluded there is not likely to be any significant impact on the geomorphology of any perennial streams or rivers in the area. A WFD Screening and Scoping Report will be undertaken to support the EIA and planning application to determine if a detailed WFD assessment will be required.

Water dependant ecosystems

15.5.24. These are addressed under biodiversity (Section 6).

15.6 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

15.6.1. As the C2C Scheme will increase the area of hardstanding along the route and the route crosses Flood Zone 3 along the Bin Brook, a robust Flood Risk Assessment will be undertaken to demonstrate the surface water drainage design of the C2C Scheme meets the requirements of the LLFA. The FRA will assess the potential implications of the C2C Scheme on flood risk to people and property, as well as assess the potential risk of flooding to the C2C Scheme. The FRA will also assess the impacts to the quantity of groundwater.

15.6.2. The standalone FRA will be prepared to support the EIA in accordance with the NPPF, PPG and the National Policy Statement for National Networks (NPSNN) (December 2014). This will be carried out following consultation with the EA and LLFA as part of the EIA and included as an appendix to the ES.

15.6.3. The FRA will include the surface water drainage strategy for the C2C Scheme (with associated design layouts and calculations) which will also be included in the ES as an appendix. The surface water drainage design and strategy will include a section that assesses potential pollution hazard risks to receiving surface waters.

A WFD Screening and Scoping Report will be undertaken to support the EIA and planning application to determine if a detailed WFD assessment will be required.

SCOPED OUT

15.6.4. As the potential impacts on the quality of groundwater and surface water receptors from the C2C Scheme design are considered highly unlikely to be significant, the EIA will not include a detailed evaluation of these impacts.

15.6.5. However, the CoCP and the CEMP that is informed by it will include measures to be complied with that will control the impacts during construction on both surface water and groundwater resources. The draft CoCP will be included as part of the ES.

16 MAJOR ACCIDENTS AND DISASTERS

16.1 INTRODUCTION

16.1.1. This section provides consideration and high-level assessment of likely significant adverse effects of the C2C Scheme on the environment deriving from the vulnerability of the C2C Scheme to risks of major accidents and/or disasters.

16.1.2. Major accidents or disasters are events or situations that have the potential to affect the C2C Scheme causing immediate or delayed serious damage to human health, welfare and the environment. The assessment considers the risks of major accidents and disasters (referred to as major events) during construction and operation of the C2C Scheme caused by natural hazards or manmade hazards (including operational failure).

16.1.3. The starting list of potential major event categories and types to which the C2C Scheme may be at risk of vulnerability during construction and operation phases considered in this section are listed in Table 16-1.

Table 16-1 – Major event categories and types

Category	Type
Natural	Geophysical
	Hydrological
	Climatological and meteorological
	Space
	Biological
Technological or manmade hazards	Societal
	Industrial and urban accidents
	Transport accidents
	Pollution accidents
	Utility failures
	Malicious attacks
	Engineering accidents and failures

16.1.4. This section should be read in the context of the other environmental assessment consideration to provide an appreciation of the risks associated with these major event types, as well as the general mitigation to limit these risks.

16.1.5. The definition of key terms used in this chapter are given in Table 16-2. These definitions have been developed by reference to the definitions used in EU and UK legislation and guidance relevant to

major accidents and/or disasters[214] as well as professional judgement in the context of the C2C Scheme.

Table 16-2 – Key terms and definitions relevant to this chapter

Term	Definition
(Major) Accident	In the context of the C2C Scheme, an event that threatens immediate or delayed serious damage to human health, welfare and/or the environment and requires the use of resources beyond those of the Applicant or its contractors to respond to the event. Serious damage includes the loss of life or permanent injury and/or permanent or long-lasting damage to an environmental receptor that cannot be restored through minor clean-up and restoration efforts. The significance of this effect will take into account the extent, severity and duration of harm and the sensitivity of the receptor.
Consultation Zone	The Health & Safety Executive (HSE) sets a Consultation Distance (CD) around major hazard sites and major accident hazard pipelines after assessing the risks and likely effects of major accidents at the major hazard site/pipeline. The area enclosed within the CD is referred to as the consultation zone. The Local Planning Authority is notified of this CD and has a statutory duty to consult HSE on certain proposed developments within the zone the CD forms.
Disaster	In the context of the C2C Scheme, a naturally occurring phenomenon such as an extreme weather event (for example storm, flood, temperature) or ground-related hazard events (for example subsidence, landslide, earthquake) with the potential to cause an event or situation that meets the definition of a Major Accident as defined above.

[214] The Seveso III Directive (Directive 2012/18/EU).

International Federation of Red Cross and Red Crescent Societies. What is a Disaster? Available at:http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/what-is-a-disaster/ [Accessed 24 March 2021].

Department of Environment, Food and Rural Affairs (2011). Guidance: Major Accident Off-Site Emergency Plan (Management of Waste from Extractive Industries) (England and Wales) Regulations 2009. Mining Waste Directive: Article 6 Category “A” Waste Facilities. Department of Environment, Food and Rural Affairs, August 2011.

Control of Major Accident Hazards Regulations (2015). (SI 2015 No. 483) (COMAH).

Major Accident Off-Site Emergency Plan (Management of Waste from Extractive Industries) (England and Wales) Regulations 2009 (SI 2009 No. 1927).

Health and Safety Executive (2015) The Control of Major Accident Hazards Regulations 2015: Guidance on Regulations, L111, Third Edition, June 2015.

The Pipelines Safety Regulations 1996 (SI 1996 No. 825).

Health and Safety Executive (2021). COMAH 2015 Public Information Search. Available at: https://notifications.hse.gov.uk/COMAH2015/Search.aspx [Accessed 05 May 2021].

Term	Definition
External Influencing Factor	A factor which occurs beyond the limits of the C2C Scheme that may present a risk to the C2C Scheme, e.g. if an external disaster occurred (e.g. earthquake, COMAH site major accident) it would increase the risk of serious damage to an environmental receptor associated with the C2C Scheme.
Hazard	Anything with the potential to cause harm, including ill-health and injury, damage to property or the environment; or a combination of these.
Internal Influencing Factor	A factor which occurs within the limits of the C2C Scheme that may present a risk to the C2C Scheme.
Risk	The likelihood of an impact occurring combined with effect or consequence(s) of the impact on a receptor if it does occur.
Risk Event	An identified, unplanned event, which is considered relevant to the C2C Scheme and has the potential to be a Major Accident and/or Disaster subject to assessment of its potential to result in a significant adverse effect on an environmental receptor.
Vulnerability	In the context of the 2014 EU Directive, the term refers to the 'exposure and resilience' of the C2C Scheme to the risk of a major accident and/or disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.

16.2 RELEVANT GUIDANCE

16.2.1. There is no published guidance for the application of the legal requirements to the assessment of MA&D. However, selected relevant guidance for risk assessment methodologies is summarised as follows:

- Defra (2011) 'Guidelines for Environmental Risk Assessment and Management[215];
- Chemical and Downstream Oil Industries Forum, (2013), Guideline - Environmental Risk Tolerability for COMAH Establishments[216]; and
- The International Standards Organization's ISO 31000: 2018 Risk Management - principles and guidelines[217].

16.2.2. Additionally, the following have been consulted to support the identification of potential MA&D:

[215] Department for Environment Food and Rural Affairs (Defra) (2011). Guidelines for Environmental Risk Assessment and Management: Green Leaves III, Cranfield University and Department for Environment, Food and Rural Affairs, November 2011.

[216] Chemical and Downstream Oil Industries Forum (CDOIF). Environmental Risk Tolerability for COMAH Establishments v2.0. Available at: http://www.sepa.org.uk/media/219154/cdoif_guideline__environmental_risk_assessment_v2.pdf [Accessed 03 March 2018].

[217] The International Standards Organization's ISO 31000: 2018 Risk Management – principles and guidelines.

- The Cabinet Office National Risk Register of Civil Emergencies[218]. This document is the unclassified version of the National Risk Register and it identifies the main types of civil emergencies that could affect the UK in the next five years. It is recognised, however, that this document does not provide an all-encompassing list of all potential accidents and disasters and its timescales are short term.
- The International Federation of Red Cross & Red Crescent Societies Early Warning, Early Action (2008)[219]. This guidance looks to other countries including those in warmer climates, thereby identifying risks that the UK may encounter in the future in light of climate change and global warming.
- The International Disaster Database[220]. This online source (http://www.emdat.be/) contains data covering over 22,000 mass disasters in the world since 1900 to the present day and aims to "rationalise decision making for disaster preparedness, as well as provide an objective base for vulnerability assessment and priority setting".

16.3 STUDY AREA

16.3.1. The study area for Major Events has been developed based on professional judgement as there is no specific regulatory guidance nor significant precedent or standardised methodology. The following factors and associated distances were adopted for setting the study area in order to capture internal and external influencing factors which may have high adverse consequences on the C2C Scheme:

- Manmade features:
  - Airports and airfields within 13km;
  - Control of Major Accident Hazard facilities within 5km;
  - Major accident hazard pipelines within 1km;
  - Fuel retail sites (including Liquified Natural Gas, Liquified Petroleum Gas) within 1km;
  - Rail infrastructure within 500m; and
  - Transmission (gas, electrical, oil/fuels) crossing the development limits C2C Scheme boundary.
- Natural features with the potential to create risks within:

[218] HM Government (2020). National Risk Register. Available at: https://www.gov.uk/government/publications/national-risk-register-2020 [Accessed 24 March 2021].

[219] International Federation of Red Cross and Red Crescent Societies (IFRC). What is a Disaster? Available at: http://www.ifrc.org/en/what-we-do/disaster-management/about-disasters/what-is-a-disaster/ [Accessed 24 March 2021].

[220] The International Disaster Database (2009). Available at: http://www.emdat.be/ [Accessed 24 March 2021].

- 3km (chiefly hydrological and geological, for example dam failure and seismic activity respectively); and
- 1km (chiefly hydrological and geological, for example flood risk and unstable ground conditions respectively).

16.4 BASELINE

16.4.1. The baseline conditions described for Major Events are derived from the following desk study sources:

- National Risk Register of Civil Emergencies (HM Government, 2020)[221];
- British Geological Survey 'Onshore GeoIndex' (British Geological Survey, 2020)[222];
- Tsunamis Hazard Map (PreventionWeb, 2005)[223];
- The International Disaster Database (Centre for Research on the Epidemiology of Disasters, 2009)[224];
- Health and Safety Executive's Planning Advice Web App (Health and Safety Executive, 2021)[225];
- Health and Safety Executive's COMAH 2015 Public Information Search (Health and Safety Executive, 2015)[226];
- Google aerial and street view maps covering Study Area (Google, 2021)[227]; and
- Technical chapters (Chapters 6 to 15 and 17 to 18).

16.5 RECEPTORS

16.5.1. The EIA Requirements state the information to be included in an ES. As such, the scoping study has considered the following receptors:

- Members of the public and local communities;
- Infrastructure and the built environment;
- The natural environment, including ecosystems, land and soil quality, air quality, surface and groundwater resources and landscape;

[221] HM Government (2020). National Risk Register. Available at: https://www.gov.uk/government/publications/national-risk-register-2020 [Accessed 24 March 2021].

[222] British Geological Survey (2020). Geo Index Onshore. Available at: http://mapapps2.bgs.ac.uk/geoindex/home.html [Accessed 24 March 2021].

[223] Prevention Web Europe (2005). Tsunamis Hazard Map. Available at https://www.preventionweb.net/english/professional/maps/v.php?id=3831 [Accessed 24 March 2021].

[224] The International Disaster Database (2009). Available at: http://www.emdat.be/ [Accessed 24 March 2021].

[225] Health and Safety Executive (2021). Planning Advice Web App. Available at: https://pa.hsl.gov.uk/ [Accessed 02 December 2021].

[226] Health and Safety Executive (2021). COMAH 2015 Public Information Search. Available at: https://notifications.hse.gov.uk/COMAH2015/Search.aspx [Accessed 5th May 2021].

[227] Google (2021). Aerial and street view maps covering Study Area. Available at: https://www.google.com/maps/ [Accessed 02 December 2021].

- The historic environment, including archaeology and built heritage; and
- The interaction between the factors above.

16.6 DESIGN AND MITIGATION MEASURES

16.6.1. The Applicant will commit to constructing and managing the C2C Scheme in accordance with:

- Environmental, Health & Safety Management systems;
- Supplier management environmental health & safety standards (e.g. Construction Skills Certification Scheme);
- Risk management systems; and
- Construction and Environmental Management systems (including a CEMP).

16.7 POTENTIAL VULNERABILITY TO MAJOR ACCIDENT AND DISASTER RISKS

16.7.1. An initial review of the MA&D event categories (Table 16-1) identified in the Study Area has been undertaken to inform the scoping process. For potential Major Event categories/types that have been screened out (stage 2), justification has been provided to support this decision (Appendix A - MA&D Scoping and Assessment Workbook).

16.7.2. The Major Events considered during the construction and operational phases of the C2C Scheme are given in Table 16-3 below. The phases are indicated in the table as "C" for Construction phase and "O" for Operational phase.

Table 16-3 – Screening and scoping major events relevant to the C2C Scheme

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In/Out
Natural Hazards	Biological	Animal Diseases: - zoonotic: • avian influenza • West Nile virus • Rabies - non-zoonotic: • foot and mouth • swine fever	Low and highly pathogenic avian influenza has been recorded in poultry in the UK several times in the last 10 years, most recently in the winter of 2016/17, although with no human cases reported. There was a devastating foot and mouth outbreak in 2001. It is likely the major event will be scoped out as the use of the C2C Scheme (highway) is not going to be the source of any disease epidemics and spread would be controlled through containment of infected animals including prohibition of transportation. However, more information is required to understand if there are any Foot and mouth burial pits within the C2C Scheme area to confirm this.
Technological or Manmade Hazards	Industrial and Urban Accidents	Major Accident Hazard Pipelines	One local high pressure National Grid gas pipeline under sections of the C2C Scheme and through the scheme's boundary. If the high-pressure gas pipeline needs to be diverted (new sections of pipeline to be constructed) to meet current engineering and safety standards, there will be an increased risk of a major accident and disaster during the construction phase due to the nature of the work required on the pipeline. However, any work within the consultation zone of the pipeline must be undertaken with the agreement of the pipeline operator, which will include risk assessment and method statements covering the works to be carried out before they can commence, under existing legal requirements, namely The Pipelines Safety Regulations 1996. Risks during maintenance and operation of the scheme should not be significantly different than the baseline situation. On this basis, the local high pressure National Grid gas pipeline has been scoped out of the MA&D assessment. The previous scoping report notes the presence of a pipeline between Coton to Bourn which lies to the north of the adjacent A428, opposite Bourn Airfield, and further east, from Scotland Farm to the A1303/ A428 slip road, south of Park Farm before continuing south of the A428 to Coton. Based on its location and information in the public domain it is likely this pipeline was used to transport aviation fuel to Bourne Airfield. However, it is unknown whether this pipeline is currently operational. This will be further assessed by the EIA.

Major Event Group	Major Event Category	Major Event Type	Basis of Decision to Scope In/Out
Technological or Manmade Hazards	Malicious Attacks	Unexploded Ordnance	Historically an RAF airfield was located at Bourn airfield, as a result the potential for UXO risk cannot be discounted. It should be noted that this topic will be covered by the Geology and Soils Chapter of the Scoping Report. Measures would be undertaken during construction to brief operatives to raise awareness of this issue, and to define appropriate response strategies such this be discovered during the works. There would be a limited risk of unexploded ordnance affecting the C2C Scheme, once operational but no greater than similar schemes.

16.8 PROPOSED ASSESSMENT METHODOLOGY

16.8.1. For those Major Event types which have been scoped in for detailed assessment in the ES, the proposed assessment process will include the following:

- Identifying potential risk events related to the scoped in Major Event types;
- Screening these risk events, e.g. to remove unrealistic worst-case scenarios;
- Defining the likely worst-case consequences (impact);
- Assessing the likelihood; and then
- Determining whether the risk event could result in a MA&D and if relevant, whether the risk is ALARP with the proposed mitigation measures.

16.9 LIMITATIONS AND ASSUMPTIONS

16.9.1. To ensure transparency within the EIA process, the following limitations and assumptions have been identified:

- The design of structures and infrastructure will be subject to relevant Hazard Identification (HAZID) studies and actions identified integrated into the final design to reduce risks to as low as reasonably practicable (ALARP).
- The construction stage(s) of the C2C Scheme will be managed through the implementation of the Construction Phase Plan (required under the CDM Regulations 2015) and CEMP.
- The C2C Scheme is being designed and its implementation guided by other industry standards and codes, many of which are mandatory. These require infrastructure and systems to be designed so that risks to people and the environment are either eliminated or reduced to levels that are ALARP.
- It is considered highly unlikely that the C2C Scheme would be demolished after its design life as it is likely to have become an integral part of the infrastructure in the area, therefore the demolition of the C2C Scheme is scoped out.

16.9.2. Environmental effects associated with unplanned events that do not meet the definition of a major accident and/or disaster (e.g. minor leaks and spills that may be contained within the construction sites are addressed in other topic chapters as appropriate and not in this section). It is also recognised that the management framework for the C2C Scheme is not fully defined at this stage; however a presumption of standard practice and regulatory compliance within the adopted management framework has been assumed and will be developed following the appointment of the Principal Contractor.

17 TRAFFIC AND TRANSPORT

17.1 INTRODUCTION

17.1.1. This chapter of the ES Scoping report presents the methodology and scope for identifying and assessing the likely significant impacts and associated effects of the construction and operational phases of proposed C2C Scheme. It provides a summary of transport legislation and policy that is relevant to the C2C Scheme and the wider study area for the purposes of the ES. It details the proposed methodology for assessing the transport impacts (initially through a Transport Assessment) and identifies those impacts which can be scoped out of the EIA.

17.2 LEGISLATION AND STANDARDS

17.2.1. The methodology and the significance criteria to be used in the EIA will be based on the following guidance and best practice in accordance with industry standards, with particular reference to:

- Guidelines for the Environmental Assessment of Road Traffic, 'Guidance Note 1' (1993) 'Institute of Environmental Assessment' (IEMA)
- LA 101 'Introduction to environmental assessment' (2019) 'Design Manual for Roads and Bridges'
- LA 103 'Scoping projects for environmental assessment' (2020) 'Design Manual for Roads and Bridges'
- LA 104 'Environmental assessment and monitoring' (2020') 'Design Manual for Roads and Bridges'
- LA 112 'Population and Human Health' (2020) 'Design Manual for Roads and Bridges'
- National Planning Policy Framework (2021)
- National Planning Practice Guidance – Travel Plans, Transport Assessments and Statements (2014)
- Cambridgeshire County Council's Transport Assessment Guidance (2019)

17.2.2. The Traffic and Transport assessment will address the existing and future baseline conditions based on the local transport network associated with the site. It will provide an overview of the proposed Travel Hub and the largely segregated roadway for bus use and how these, together with local committed developments and growth in the corridor, are expected to impact on the surrounding highway network (compared to the 'without' C2C Scheme future baseline). This assessment will be drawn from the Transport Assessment which will be submitted as part of the application documents.

17.2.3. The scope of the Transport Assessment will be established with both Cambridgeshire County Council and National Highways (formerly Highways England) as a separate exercise to the EIA scoping process. It is intended that a TA Scoping Note will be submitted to CCC and Highways England to inform the scope of the TA and the associated methodology through pre-application discussions.

17.2.4. The ES Traffic and Transport assessment will consider the outcomes of the Transport Assessment as part of the process of identifying environmental impact of traffic and transport. The methodology to be employed for the EIA is set out below.

17.3 STUDY AREA

17.3.1. The study area will be determined in accordance with the IEMA document "Guidelines for the Environmental Assessment of Road Traffic Guidance Note 1)" 1993 (GEART). The GEART document recommends the following rules-of-thumb should be applied to determine the scale and extent of the assessment:

- Rule 1: include highways links where traffic flows will increase by more than 30% (or the number of HGVs will increase by more than 30%)
- Rule 2: include any other sensitive areas where traffic flows have increased by 10% or more.

17.3.2. The 30% threshold provides a level for development flows to be assessed against to establish whether additional assessment is needed to establish the significance of the impact. Development flows above the 30% level do not automatically indicate the impacts as significant, therefore professional judgement will also be applied.

17.3.3. Once the traffic flow changes and Travel Hub demand are known through the TA process the study area for the purpose of the ES can be defined. If the changes in flow resulting from the proposals do not meet the thresholds detailed above during construction or operation, the study area for the impacts related to traffic and transport will be defined based on professional judgement and through discussion and agreement with Cambridgeshire County Council and National Highways.

17.4 CURRENT BASELINE

17.4.1. The A428/ A1303 is an important radial route into Cambridge which currently experiences high levels of demand and is prone to delays and congestion at peak times. These lead to queues back to the Madingley Mulch roundabout from Cambridge during the AM peak.

17.4.2. Congestion on the route means that current public transport services are unable to offer an attractive alternative to the private car. In addition, the existing A428/A1303 is inadequate for walking and cycling as a mode of transport into Cambridge. This has led to high levels of car ownership in the corridor, with 85% of households having access to a car compared to the national average of 74%.

17.4.3. The corridor will experience additional demand resulting from both allocated development sites and development already permitted. Cambourne West and Bourn Airfield developments will both produce a significant amount of new housing (both sites are situated to the west of Cambridge). Employment growth is expected at West Cambridge to the south at the Cambridge Biomedical Campus.

17.4.4. The developments described above will form part of the baseline against which the traffic and transport impact of C2C will be assessed.

17.4.5. The C2C Scheme aims to improve accessibility into Cambridge to support economic growth, deliver a sustainable transport network system between Cambourne and Cambridge and improve quality of life by relieving congestion and improving air quality.

17.4.6. Without intervention, those living and working in the new developments and elsewhere in the corridor would become yet more car-dependent, with low use of other non-car modes, exacerbating capacity issues along the route.

17.5 ASSESSMENT METHODOLOGY

GROWTH SCENARIOS

17.5.1. The Cambridge to Cambourne (C2C) assessment includes the development schemes described above. Their details are;

- Cambourne West – 850 dwellings (out of 2,350 dwellings)
- Bourn Airfield – 3,500 dwellings
- Total dependency – 4,350 dwellings

17.5.2. It is anticipated that the C2C impact assessment will include consideration of two baseline conditions; the highway network without the development outlined above and the highway network with the development outlined above. These scenarios are subsequently referred to as Core Minus and C2C Core respectively.

17.5.3. It is anticipated that the C2C assessment will model the following future years scenarios:

- 2026 & 2036 Do-Minimum “without C2C” (Core Minus)
- 2026 & 2036 Do-Minimum “without C2C” (C2C Core)
- 2026 & 2036 Do-Something “with C2C” (C2C Core)

17.5.4. The years to be tested by the C2C assessment will be agreed with both Cambridgeshire County Council and National Highways. The choice of assessment years will be guided by the output years which are available from the County Council’s CSRM transport model.

17.5.5. The assessment approach outlined above will identify the environmental impacts associated with the proposed developments referred to above. It will also determine the scale of environmental impact associated with the C2C Scheme.

SURVEYS

17.5.6. The suitability of existing traffic survey data, and the requirement to commission additional traffic surveys, will be established with both Cambridgeshire County Council and National Highways as part of the Transport Assessment scoping process. Cycling and pedestrian movement will be included as part of any future surveys.

SIGNIFICANCE CRITERIA

17.5.7. The IEMA document “Guidelines for the Environmental Assessment of Road Traffic (Guidance Note 1)” referenced above lists the environmental criteria that should be considered as part of an environmental impact assessment.

17.5.8. It is proposed that the following items should be considered as the potential impacts that may arise in both the construction and operational phases of the C2C Scheme:

- Driver severance;
- Driver delay;
- Pedestrian severance;
- Pedestrian delay;
- Pedestrian amenity;
- Fear and intimidation;
- Accidents and safety; and

- Hazardous loads.

17.5.9. These impacts will be described within the Traffic and Transport chapter within the Environmental Assessment. The significance of an effect is a function of the magnitude of change due to the proposed project and the sensitivity of the affected receptor or receiving environment to change (as detailed in chapter 3 of DMRB LA104 guidelines[228]). The magnitude of change and the sensitivity of the affected receptor or receiving environment will both be assessed on a scale of high, medium, low and negligible, as detailed in DMRB LA104 Table 3.8.1 and presented in Table 17-1 below.

17.5.10. The significance of changes in traffic flow volumes on receptors for each of the environmental effects listed previously will be considered in relation to the significance matrix summarized in Table 17-1 below.

Table 17-1 – Environmental value

		Sensitivity of Receptor/ Receiving Environment to change/ effect			
Magnitude of change		High	Medium	Low	Negligible
	High	Major	Moderate to major	Minor to moderate	Negligible
	Medium	Moderate to Major	Moderate	Minor	Negligible
	Low	Minor to Moderate	Minor	Negligible to Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

Source: DMRB Volume 11

17.5.11. The IEMA guidance details potential receptors that are expected to be sensitive to changes in traffic conditions.

17.5.12. The significance of changes in traffic flow volume on receptors for each of the environmental effects will be considered in relation to the significance matrix outlined above at Table 17-1. The impact of the proposed C2C development will be evaluated by combining the assessment of impact magnitude and receptor sensitivity, with significant effects generally attributed to those deemed to be moderate or major. The effects will be classified as beneficial or adverse and temporary or permanent.

[228] DMRB Volume LA104 Section 3 (LA 112).

17.6 POTENTIAL IMPACTS

CONSTRUCTION

17.6.1. The construction activity associated with the proposed C2C Scheme (which comprises a largely segregated roadway for buses use and a travel hub located off the A428 at Scotland Farm) is likely to bring changes to traffic flows on the local highway network during construction.

17.6.2. A temporary increase in traffic flows associated with the construction of the C2C Scheme is likely to include an increase in HGV movements and construction worker trips during the day. The severity of the environmental impacts of construction traffic activity will be assessed once construction vehicle trip generation figures have been determined.

17.6.3. Temporary disruption to pedestrians, cyclists and road vehicle users arising from construction may also occur, potentially causing severance, fear and intimidation, and amenity impacts. Construction activity may cause increased journey times of pedestrians, cyclists and road users. The Traffic and Transport chapter will also consider the impact of construction activity on public transport services, particularly with respect to the effect on journey times and bus routes.

OPERATION

17.6.4. The provision of a largely segregated roadway for HQPT and a Travel Hub is anticipated to bring changes to traffic flows on the local highway network during its operation.

Travel Hub

17.6.5. Forecast trip generation figures and redistribution of traffic resulting from the introduction of the C2C Scheme will be required to assess the potential operational phase impacts. This will be informed by the outputs from the Transport Assessment.

17.6.6. During the operational phase, there is expected to be a redistribution of traffic on the local road network due to private vehicles rerouting and parking at the proposed Travel Hub site and transferring to sustainable modes for the remainder of their journey. This is likely to result in some localised increase in traffic flows on approaches to and from the proposed Travel Hub site and reductions in traffic flows on routes into Cambridge. There will also be some reductions in traffic flow due to general mode switching to the new busway.

17.6.7. The Travel Hub site will require infrastructure change local to the site, including a new junction on Scotland Road to allow Travel Hub users and buses to access and egress the Travel Hub site before continuing their journey via the proposed busway route. The preliminary design of the proposed junction on Scotland Road will be produced as part of the TA process.

17.6.8. The severity of the environmental effects of operational traffic activity will be determined and assessed once vehicle trip generation figures have been determined from the TA process.

Route for the busway

17.6.9. The proposed busway route from Cambourne to Cambridge will need to cross or interact with the existing highways at a number of locations. The C2C Scheme includes the provision of new pedestrian and cycle links through the Travel Hub site and onwards towards Cambridge via the proposed Public Transport Route.

17.6.10. The C2C Scheme is expected to affect the following junctions and it is anticipated that they will need to be assessed as part of the TA:

- Highfields Caldecote Roundabout
- A428 / St Neots Road/ Scotland Road Junction
- Scotland Farm Travel Hub Site Access
- Long Road/ St Neots Road Junction
- M11 Junction 13/ Madingley Road
- Grange Road

17.6.11. Measures to accommodate the busway within the local highway network will be identified within the TA. Any environmental impacts arising from those accommodation works will be described within the ES Traffic and Transport chapter.

17.7 DESIGN AND MITIGATION

17.7.1. Any mitigation required to alleviate the environmental impact of the C2C Scheme will be provided in accordance with the mitigation hierarchy. This hierarchy involves the following step-by-step approach to first avoid and prevent, then to reduce effects, and finally to remediate effects. If mitigation is proposed in respect of likely significant effects then consideration will be given to the appropriateness of monitoring measures.

18 MATERIAL RESOURCES AND WASTE

18.1 INTRODUCTION

18.1.1. This chapter address the approach to identifying and assessing the likely significant effects of the proposed C2C Scheme on material resources (or material assets) and the generation and management of waste.

18.1.2. The EIA process provides an opportunity to assess and manage the effects associated with the use of resources and disposal / recovery of waste of any scheme. The management of impacts is largely achieved by encouraging sustainable design to:

- reduce overall material use
- prevent and / or reduce the generation of waste
- identifying appropriate management measures to control waste.

18.1.3. For the purposes of this report resources / material assets are defined as comprising the provision and use of material resources, including primary, secondary, recycled and manufactured materials.

18.2 LEGISLATION AND STANDARDS

18.2.1. The principal legislative and planning context for the assessment of the environmental effects of the C2C Scheme on material assets is presented below.

NATIONAL LEGISLATION

Environmental Protection Act 1990 (as amended)

18.2.2. The Environmental Protection Act[229] defines the fundamental structure and authority for waste management and control of emissions into the environment. It outlines:

- the definition of controlled waste
- the requirements of the duty of care in respect of waste and transferral of waste
- the requirements for permits and authorisations
- waste collection and waste disposal authorities and their roles

The Waste (England and Wales) Regulations 2011 (as amended)

18.2.3. The Waste (England and Wales) Regulations 2011[230], implement parts of the revised Waste Framework Directive 2008, particularly the principles of Waste Hierarchy, which is a 5-step waste

[229] UK Government (1990). The Environment Protection Act 1990. Available at: http://www.legislation.gov.uk/ukpga/1990/43/contents [Accessed 01 December 2021].

[230] Statutory Instrument (2011). The Waste (England and Wales) Regulations. No.988

hierarchy for waste management that applies to any person who produces or manages waste. The waste hierarchy ensures that waste is dealt with in the following order or priority:

- Prevention
- Preparing for re-use
- Recycling
- Other recovery (for example energy recovery)
- Disposal as a last resort

18.2.4. The following considerations must be taken into account: the general environmental protection principles of precaution and sustainability; technical feasibility and economic viability; protection of resources; the overall environmental, human health, economic and social impacts.

18.2.5. Site Waste Management Plans[231] (SWMPs) are no longer mandatory for projects commencing after 1 December 2013. They are, however, recommended, and the principles behind the Regulations remain best practice.

Hazardous Waste (England and Wales) Regulations 2005 (as amended)[232]

18.2.6. The Hazardous Waste (England and Wales) Regulations 2005 (as amended) aim to track and control hazardous waste movements. A consignment note is required prior to the removal of any hazardous waste. Hazardous wastes are wastes that exhibit certain properties (for example, they are potentially flammable, toxic or carcinogenic) such that they are or may (at or above certain concentrations) be detrimental to human health or the environment. Strict regulatory controls have been placed over the handling, storage, transportation, and disposal of hazardous wastes on account of the considerable risks they pose to human health and the environment.

Environmental Permitting (England and Wales) Regulations 2016 (as amended)[233]

18.2.7. The Environmental Permitting (England and Wales) Regulations 2016 consolidated and replaced the Environmental Permitting (England and Wales) Regulations 2010. These regulations introduce a streamlined system of environmental permitting in England and Wales for certain installations, waste operations and mobile plants. They transposed the provisions of fifteen EU Directives that imposed

[231] Department for Transport (2004). Guidance for Construction Contractors and Climate Voluntary Code of Practice 6 Chapter 43. Available at: http://www.legislation.gov.uk/ukpga/1990/43/introduction accessed 08/09/2016 [Accessed 01 December 2021].

[232] UK Statutory Instruments (2005). The Hazardous Waste (England and Wales) Regulations 2005. Available at: The Hazardous Waste (England and Wales)Regulations 2005 (legislation.gov.uk) [Accessed 01 December 2021].

[233] UK Statutory Instruments (2016). The Environmental Permitting (England and Wales) Regulations 2016. Available at: The Environmental Permitting (England and Wales) Regulations 2016 (legislation.gov.uk) [Accessed 01 December 2021].

obligations requiring delivery through permits or which are capable of being delivered through permits.

18.2.8. Activities under these regimes is covered by a single form of environmental permit governed by one set of regulations. This provides a system for environmental permits and exemptions for industrial activities, mobile plant, waste operations, mining waste operations, water discharge activities, groundwater activities and radioactive substances. It also sets out the powers, functions and duties of the regulators. The requirements of the Landfill Directive (1999/31/EC) (Ref 1.2) that aimed to reduce the disposal of controlled wastes in landfill were also transposed by these regulations.

NATIONAL POLICY

National Planning Policy Framework 2019

18.2.9. The NPPF sets out policies for development and how these should be implemented but makes specific reference to the Government's policy for waste which should be read in conjunction with the NPPF.

National Planning Policy for Waste 2014

18.2.10. The National Planning Policy for Waste[234] sets out detailed waste planning policies. It maintains the core principles of the 'plan led' approach with a continued focus of moving waste up the waste hierarchy. The document sets out detailed waste planning policies to facilitate a more sustainable and efficient approach to resource use and management.

The Waste Management Plan for England, 2013

18.2.11. Defra published the National Waste Management Plan for England in July 2013[235]. The plan outlines the waste hierarchy as a guide to sustainable waste management and sets out the Government's ambition to work towards a more sustainable and efficient approach to resource use and management. Positive planning plays a pivotal role in delivering England's waste ambitions through ensuring the re-use, recovery or disposal of waste is undertaken without endangering human health or harming the environment and delivering sustainable development and resource efficiency through all schemes.

[234] Department for Communities and Local Government (2014). National Planning Policy for Waste [online] available at: https://www.gov.uk/government/publications/national-planning-policy-for-waste [Accessed 01 December 2021].

[235] Department for Food and Rural Affairs (2013) National Waste Management Plan for England (2013) available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/265810/pb14100-waste-management-plan-20131213.pdf

LOCAL POLICY

The Cambridgeshire and Peterborough Minerals and Waste Plan[236]

18.2.12. The Cambridgeshire and Peterborough Minerals and Waste Local Plan sets the framework for all minerals and waste developments until 2036. It sets out policies to guide mineral and waste management development and will, amongst other things, ensure the management of waste is carried out in a much better way than landfill

18.2.13. The Adopted Policies Maps for Minerals include Mineral Allocation and Development areas, Waste Management areas, Transport Infrastructure areas and Water Recycling areas in addition to Mineral Safeguarding Areas. These maps identify the boundary and number of Inset Maps which can be found in the CPMWLP.

South Cambridgeshire Local Plan, 2018

18.2.14. The policy on mitigating climate change (CC/1) references the need for development proposals to demonstrate waste reduction during construction and operation which is specifically set out in Policy CC/6 which covers construction methods.

18.2.15. Policy CC/7 requires proposals to demonstrate adequate waste water collection, management and treatment systems are included in the proposal designs.

18.2.16. Policy HQ/1 sets out Design Principles including the need to include provision for facilities for waste management, recycling and collection in a manner that is appropriately integrated within the overall development.

Cambridge City Local Plan, 2018.

18.2.17. Policy 28 requires developers to demonstrate within a Sustainability Appraisal how site waste management and materials use will be carried out.

18.3 STUDY AREA

18.3.1. The DMRB provides definitions for two geographically different study areas to examine and assess the use of material assets (and resource use) and waste generation.

18.3.2. The primary study area defined by the extent of works within each C2C Scheme boundary. This comprises each C2C Scheme footprint and any areas required for temporary access, site compounds, working platforms and other enabling activities.

[236] Cambridgeshire and Peterborough Minerals and Waste Local Plan (Adopted July 2021)

18.3.3. The secondary study area is represented by the geographical extent to which infrastructure is suitable and could accept arisings and waste generated by the C2C Scheme. Accordingly, the secondary study area for waste is determined to comprise England and the East of England region based on Environment Agency data being set out against former planning regions and sub-regions, including Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk and Suffolk. This is based on professional judgement to take into account the balance between the Proximity Principle and value for money (re materials and waste logistics), and considering the extent of available data to compile a baseline assessment.

18.3.4. In addition to the above, a regional (and where necessary, national) study area for resource availability has been applied, for construction materials typically required for a scheme of this scale and nature.

18.4 ASSESSMENT METHODOLOGY

ASSESSMENT APPROACH

18.4.1. The assessment will follow the approach set out in DMRB LA110 August 2019. This guidance identifies that the construction and maintenance of motorway and trunk roads can have environmental effects associated with the consumption and use of material assets, and the disposal and recovery of waste. It is assumed that the C2C Scheme will result in the construction and operation of infrastructure of a similar nature and scale as a trunk road scheme in terms of the resources and waste it could require/generate.

18.4.2. Where the need for further assessment has been established, the assessment will describe the current and likely future requirements including information on availability, types and quantities of key construction materials. For the assessment of material resource use, an assessment against the UK national demand will also be undertaken. The assessment for waste will be based on the availability of suitable waste management infrastructure and capacity in Cambridge.

18.4.3. C2C Scheme specific information for the EIA will be obtained from the design team to identify the nature of the materials and quantities required for construction of the C2C Scheme.

SIGNIFICANCE CRITERIA

18.4.4. The DMRB LA110 document provides an approach to determining the significance of the potential effects that may arise from the use of material resources and the generation of waste.

18.4.5. Materials required for the construction of the C2C Scheme are likely to be procured from a range of different sources (which are not likely to be known during the ES preparation), all of which will have their own specific environmental effects, which may or may not have been subject to an environmental assessment. Therefore, there are no obvious environmental receptors or resources for materials in the way that there are for other topic areas. Consequently, this precludes the application of a methodology to derive a measure of significance of the use and consumption of materials based on the value or sensitivity of a resource or receptor and the magnitude of an identified effect.

18.4.6. Therefore, the significance of effect will be assigned in accordance with the criteria outlined below.

Table 18-1 – Effect categories and typical descriptors

Effect Category	Description
Neutral	Material assets: project achieves >99% overall material recovery / recycling (by weight) of non-hazardous Construction Demolition Waste (CDW) to substitute use of primary materials; and aggregates required to be imported to site comprise >99% re-used /recycled content. Waste: no reduction or alteration in the capacity of waste infrastructure within the region.
Slight	Material assets: project achieves 70-99% overall material recovery / recycling (by weight) of non-hazardous CDW to substitute use of primary materials; and aggregates required to be imported to site comprise re-used/recycled content in line with the relevant regional percentage target. Waste: ≤1% reduction or alteration in the regional capacity of landfill; and waste infrastructure has sufficient capacity to accommodate waste from a project, without compromising integrity of the receiving infrastructure (design life or capacity) within the region.
Moderate	Material assets: project achieves less than 70% overall material recovery / recycling (by weight) of non-hazardous CDW to substitute use of primary materials; and aggregates required to be imported to site comprise re-used/recycled content below the relevant regional percentage target. Waste: >1% reduction or alteration in the regional capacity of landfill as a result of accommodating waste from a project; and 1-50% of project waste for disposal outside of the region
Large	Material assets: project achieves <70% overall material recovery / recycling (by weight) of non-hazardous Construction and Demolition Waste (CDW) to substitute use of primary materials; and aggregates required to be imported to site comprise <1% re-used / recycled content; and project sterilises ≥1 mineral safeguarding site and/or peat resource. Waste: >1% reduction in the regional capacity of landfill as a result of accommodating waste from a project; and >50% of project waste for disposal outside of the region.
Very Large	Material assets: No criteria: as criteria for Large category above. Waste generation: >1% reduction or alteration in national capacity of waste infrastructure as a result of accommodating waste from a project. The project would require new (permanent) waste infrastructure to be constructed to accommodate waste
Notes:	'Primary materials' describes materials that are from a non-renewable source.

Table 18-2 – Significant criteria for material assets and waste generation

Significance	Description
Not significant	Material assets: Category description met for Neutral or Slight effect Waste generation: Category met for Neutral or Slight effect
Significant	Material assets: Category description met for Moderate or Large effect

Significance	Description
	Waste generation: Category met for Moderate, Large or Very Large effect
Notes	See Table 18-1 for definitions of scale of effect.

18.5 BASELINE

18.5.1. This section describes the material consumption and waste disposal for the current land use (the baseline); information provides the context in which the assessment of environmental impacts and significant effects can be undertaken. The following structure for this part of the chapter has been applied:

Materials

- baseline materials consumption, as determined by the materials currently required for the existing land use and assets;
- regional and national information and data for material resource availability, specifically in relation to construction materials typically required for highways schemes and improvement works; and
- location of mineral site and peat resources in relation to the C2C Scheme.

Site arisings

- baseline site arisings as determined by any resources generated by construction, excavation or demolition activities on the existing land use and assets; and
- regional and national information and data for existing transfer, recovery and recycling waste management facilities.

Waste generation and disposal

- baseline data for the type and volume of waste generated and disposed of by the existing land use and current assets; and
- regional / national information and data describing current landfill capacity.

18.5.2. The baseline data collected and presented in this section were obtained by desk study, from publicly available sources. The most up to date sources of information have been used. Indication of the most recent year from which data has been acquired is provided throughout. The following data sources have been consulted to inform the baseline review:

- Mineral Products Association, Profile of the UK Mineral Products Industry, 2020 Edition[237]

[237] Mineral Products Association (2020). Profile of the UK Mineral Products Industry 2020 Edition. Available at: https://www.mineralproducts.org/MPA/media/root/Publications/2021/Profile_of_the_UK_Mineral_Products_Industry_2020_Statistical_Background.xlsx [Accessed 01 December 2021].

- Department for Business, Energy & Industrial Strategy (2020), Monthly Bulletin of Building Materials and Components[238]
- East of England Aggregates Working Party Annual Monitoring Report (2017) [239]
- United Kingdom Steel Production I 1969-2020 Data I 2021-2022 Forecast I Historical (Online)[240]
- Natural England MAGIC mapping website[241]
- Defra Basis of the UK BAP target for the reduction in use of peat in horticulture SP0573 (2009)[242]
- Defra (2020) UK Statistics on Waste [243]
- Department for Communities and Local Government (2009). National and regional guidelines for aggregates provision in England 2005-2020[244]
- Environment Agency, Waste Data Interrogator (2021) 2020 Waste Summary Tables for England – Version 3: East of England and England [245]
- Environment Agency, Remaining landfill capacity – Version 2, England (2019)[246]

MATERIAL RESOURCES

Materials currently required

18.5.3. The operation and maintenance of the current assets within the C2C Scheme areas require a small number of specialist components (for example, light bulbs, signage, metal fencing, barriers) as well as some bulk products (asphalt for minor re-surfacing) for routine works and repairs of the roads and ancillary infrastructure.

18.5.4. Although no quantified data exists for the current land use, it is anticipated that material consumption is limited to nominal quantities of resource required for routine maintenance and repairs of the existing roads and any ancillary infrastructure. Therefore, the current requirement to

[238] Department for Business, Energy & Industrial Strategy (2020). Monthly Bulletin of Building Materials and Components. Available at: Monthly Statistics of Building Materials and Components - data.gov.uk [Accessed 01 December 2021].

[239] UK Government (2017). East of England Aggregates Working Party Annual Monitoring Report (2017). Available at: 2017 Annual Monitoring Report: East of England Aggregates Working Party (centralbedfordshire.gov.uk) [Accessed 01 December 2021].

[240] World Steel Association (2020). United Kingdom Steel Production I 1969-2020 Data I 2021-2022 Forecast I Historical. Available at: https://tradingeconomics.com/united-kingdom/steel-production [Accessed 01 December 2021].

[241] Natural England MAGIC mapping website (2021). Available at: MAGIC (defra.gov.uk).

[242] Department for Environment Food and Rural Affairs (DEFRA) (2009). Basis of the UK BAP target for the reduction in use of peat in horticulture – SP0573 (2009). Available at: Defra, UK - Science Search [Accessed 01 December 2021].

[243] Defra (2020). UK Statistics on Waste. Available at: UK Statistics on Waste (publishing.service.gov.uk) [Accessed 01 December 2021].

[244] Department for Communities and Local Government (2009). National and regional guidelines for aggregates provision in England 2005-2020. Available at: National and regional guidelines for aggregates provision in England 2005 to 2020 - GOV.UK (www.gov.uk) [Accessed 01 December 2021].

[245] Environment Agency (2021). Waste Data Interrogator (2021) 2020 Waste Summary Tables for England – Version 3. Available at: 2020 Waste Data Interrogator data.gov.uk [Accessed 01 December 2021].

[246] Environment Agency (2021). Remaining landfill capacity – England, Version 1 (2020). Available at: Remaining Landfill Capacity - data.gov.uk [Accessed 01 December 2021].

use resources within the C2C Scheme areas is determined - using professional judgement – to be negligible in the context of regional supply.

Availability of construction materials

18.5.5. Table 18-3 provides a summary of the availability of the main construction materials required to deliver typical highways schemes in East of England and the UK. The overview provides a context in which the assessment of environmental impacts and significant effects from material consumption from the C2C Scheme can be undertaken.

Table 18-3 - Construction materials availability in the East of England and the UK

Material Type	East of England	UK
Sand and gravel *[237]	13.7 million tonnes (Mt)	59.1 million tonnes (Mt) (**GB**)
Permitted crushed rock *[237]	0.0 Mt	116.5 million tonnes (Mt) (**GB**)
Primary aggregate (comprises sand and gravel and crushed rock) *[237]	13.7 Mt	198.8Mt
Concrete blocks #[238]	1.9 million square meters (Mm^2) (Southern) (2020)	6.0 Mm^2 (**GB**) (2020)
Recycled and secondary aggregate + | *	No data available [239]	71.0 Mt [237] (**GB**)
Ready-mix concrete *[237]	1.5 million cubic meters (Mm^3)	24.7 Mm^3
Steel + [240]	(no data)	7.1 Mt (2020)
Asphalt *[237]	2.5 Mt	27.4 Mt
# stocks + production * sales	Data availability: 2019 unless otherwise stated **GB**: Great Britain (England, Wales and Scotland) figures used where UK figures (including Northern Ireland) are unavailable	

18.5.6. The Cambridgeshire and Peterborough Minerals and Waste Local Plan indicates that there are Mineral Safeguarding Areas (MSA) located within the C2C Scheme boundary areas:

- Sand and Gravel MSA located beneath the eastern end of the C2C Scheme (between Bin Brook and Grange Road); and
- Chalk MSA located between an area to the east of the Waterworks site and to the west of the M11 (along the route parallel to the A1303).

18.5.7. There are no known peat resources[241] or active peat extractions[242] within the development study area.

18.5.8. Across the UK, the availability of construction materials typically required for highways construction schemes, indicates that supply and demand remain buoyant. Although it is recognised that COVID-

19 continues to adversely impact construction supply chain security, no definitive data in this context is available for this report.

18.5.9. Where data are available, the average availability of construction materials in East of England is commensurate with other UK regions. For example, stocks of concrete blocks, and sales of primary aggregate, ready-mix concrete and asphalt are comparable. However, sales of sand and gravel are higher than the average, whilst permitted crushed rock is considerably lower.

18.5.10. However, it should be noted that East of England has a higher recycled content target for aggregate (31%) by comparison with the average for England (25%)[244].

SITE ARISINGS

Site arisings currently generated

18.5.11. The current land use within the primary study area is expected to generate minimal volumes of site arisings, limited to potential earthworks on agricultural land, and surplus materials generated during minor repair works on roads – some of which is expected to be diverted from landfill. Although no data exist, it is anticipated that the current generation of site arisings is currently minimal in the context of material recovery facilities and regional waste management infrastructure; professional judgement indicates that the volumes of such arisings would be limited.

UK and regional perspective: transfer, recovery and recycling

18.5.12. Waste recovery facilities within the region have been assessed to identify the availability of infrastructure and capacity for the transfer and recovery of Construction, Demolition and Excavation (CDE) wastes from the C2C Scheme. The availability of such infrastructure encourages practices that will divert waste from landfill.

18.5.13. Defra data (Table 18-4) show that within England, the recovery rate for non-hazardous construction and demolition wastes has remained above 90% between 2010 and 2016. This exceeds the EU target of 70% (by weight), which the UK must meet by 2020[243]. Note that the 70% target *excludes* naturally occurring materials (specifically, category 17 05 04 in the List of Wastes, which is defined as non-hazardous soils and stones)[247].

Table 18-4 - Non-hazardous construction and demolition waste recovery in England

Year	Generation (Mt)	Recovery (Mt)	Recovery rate (%)
2010	53.6	49.4	92.2%

[247] The European Parliament and the Council of the European Union (2008). Directive 2008/98/EC of the European parliament and of the council of 19 November 2008 on waste and repealing certain directives. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008L0098 [Accessed 01 December 2021].

Year	Generation (Mt)	Recovery (Mt)	Recovery rate (%)
2011	54.9	50.8	92.5%
2012	50.5	46.4	92.0%
2013	51.7	47.6	92.0%
2014	55.9	51.7	92.4%
2015	57.7	53.3	92.3%
2016	59.6	55.0	92.1%
2017	62.2	57.9	93.1%
2018	61.4	57.5	93.8%
Note: Defra's 2021 update of this table does not extend the data range beyond 2018			

18.5.14. Data in Figure 18-1 has been collated to show that trends for waste recovery in the region have risen steadily over the past 20 years[245]. Data are provided for all waste types in the East of England and hence will include, but are not specific to, CDE wastes.

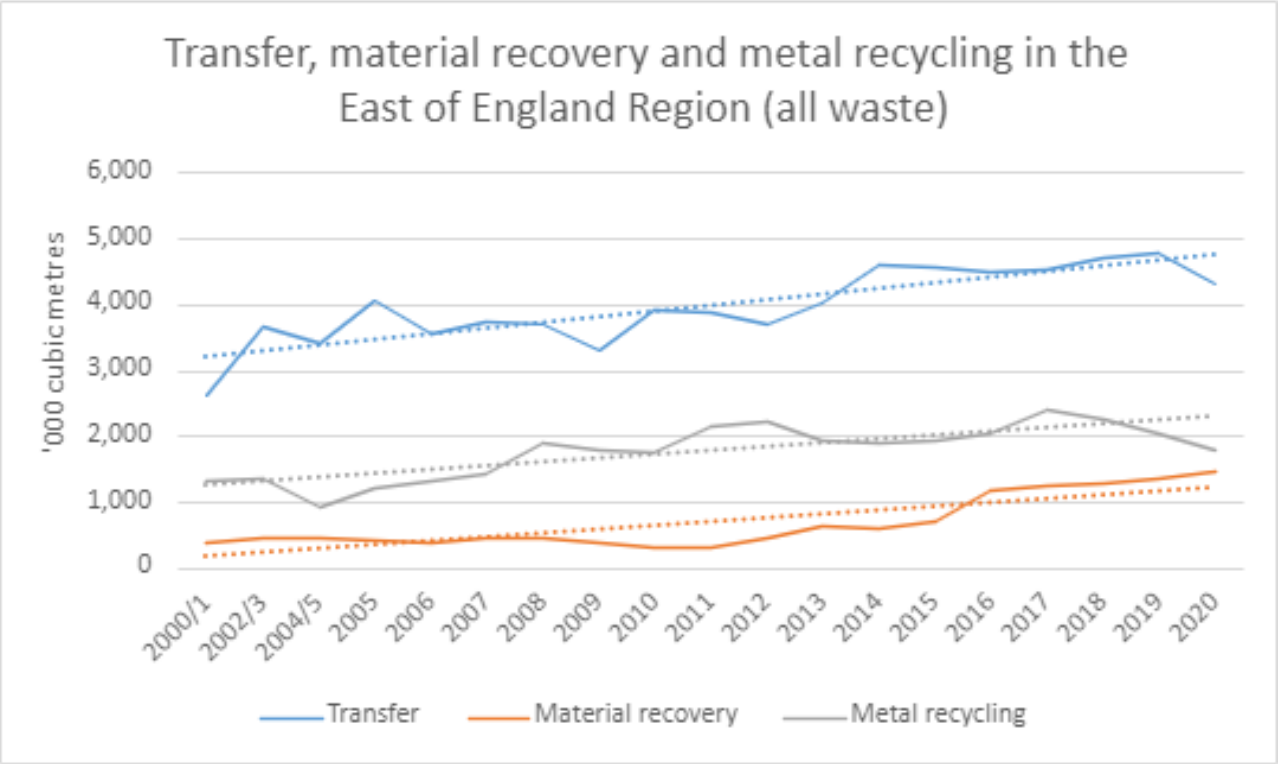


Figure 18-1 – Transfer, materials recovery and recycling in the East of England region (2000/1 – 2020)

18.5.15. Trends for transfer, recovery and metal recycling in the East of England indicate that there is likely to be regional infrastructure and capacity for managing CDE wastes from the C2C Scheme.

Construction and demolition recovery trends across England (Figure 18-1) and the data in Table 18-5 confirm this assertion[245].

Table 18-5 – Permitted waste recovery sites in the East of England region (2020)

Waste recovery facility type	Number of sites
Incineration	17
Transfer	338
Treatment	346
Metal recovery	270
Use of waste	2
Total	**973**

18.5.16. Regional data for construction and demolition waste is presented in the graph (Figure 18-2) based on analysis of publicly available information in the Waste Data Interrogator[245].

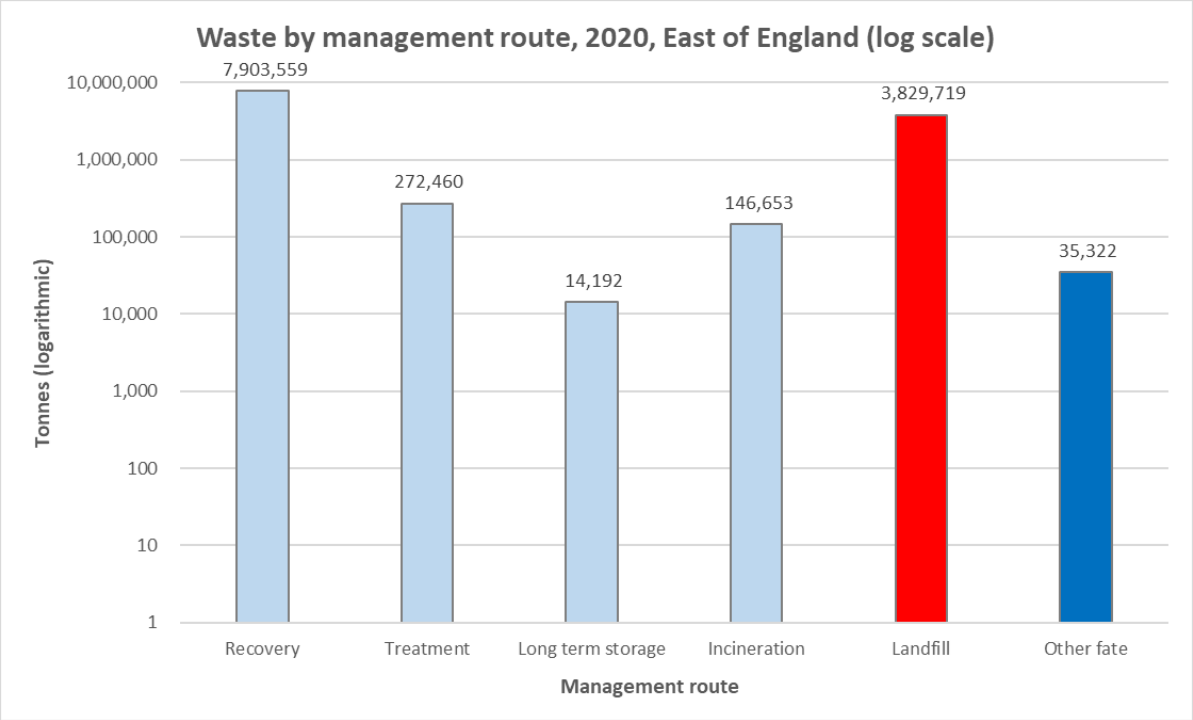


Figure 18-2 – Construction and demolition waste management by route for the region

18.5.17. Data in Figure 18-2 shows that, in 2020, the volume of waste recovered, including treatment and incineration, was more than double the volume of waste sent to landfill in the region. This is confirmed by data in Table 18-6 which show that 68% of waste received in the region was diverted from landfill through waste management and recovery methods. Data include the total waste received by the East of England, both within region and from other regions in the UK.

Table 18-6 – Waste management routes for waste received in the East of England region (2019)

Waste Management Route	Inert and non-hazardous waste (tonnes)	Hazardous waste (tonnes)	Total waste (tonnes)	Percentage
Recovery	8,211,161	125,704	8,336,865	68%
Landfill	3,761,771	67,948	3,829,719	31%
Other fate	24,235	11,087	35,322	0%
Totals	**11,997,167**	**204,738**	**12,201,905**	**100%**

18.5.18. The charts and data presented in this section of the Materials and Waste chapter confirm the availability of waste management facilities in the region to enable suitable recovery of site arisings generated by the C2C Scheme.

18.5.19. The CPMWLP[236] estimates that in 2017 waste arisings within the plan area totalled approximately 2.8 million tonnes per annum (Mtpa), of which 59% comprised CDE waste and 2% hazardous waste.

18.5.20. The availability of materials recovery infrastructure in the East of, and across, England suggests that there is strong potential to divert from landfill site arisings generated by the C2C Scheme. The importance of this infrastructure indicates there is a strong potential to maximise the reuse / recycling value of site arisings. Recovering arisings and diverting them from landfill has the potential to materially influence the findings of the assessment of impacts and effects from materials and waste.

WASTE GENERATION AND DISPOSAL

Waste currently generated and disposed of

18.5.21. Waste generated for disposal to landfill from activities undertaken on the current land use is expected to comprise non-recoverable wastes from farming practices, routine maintenance and infrequent repair of the roads and ancillary infrastructure. Although no waste data exists, it is anticipated (using professional judgement) that even in the worst-case scenario, the current waste generation and disposal is minimal in the context of available regional capacity.

Regional Perspective: Remaining Landfill Capacity

18.5.22. Environment Agency data[246] confirm that at the end of 2020, 55 landfill sites in the East of England region were recorded as having 52.5 million cubic meters (Mm^3) of remaining capacity. Data in Table 18-7 summarise this information by landfill type; the change in capacity from 2019 to 2020 is also shown.

Table 18-7 - Remaining landfill capacity in the East of England (2019-2020)

Landfill type	Remaining capacity in 2019 (m^3)	Remaining capacity in 2020 (m^3)	2019 to 2020 change in capacity Mm^3 (%)
Hazardous (merchant)	0	0	0
Hazardous (restricted*)	0	0	0
Inert	21,921,490	24,979,617	3.1 (14%)
Non-hazardous (including stable hazardous waste cells)	28,524,345	27,514,659	-1.0 (-3.5%)
Total	**50,445,835**	**52,494,276**	**2.0 (4.1%)**
Notes	*Restricted landfill sites only accept waste from restricted sources and producers, e.g. site operator / managing site.		

18.5.23. The CPMWLP determines that there is sufficient inert landfill void space for inert and non-hazardous waste (including SNRHW) over the plan period (2036). In addition, some committed and allocated mineral extraction sites will require restoration through accommodating inert fill. Therefore, there is no requirement for additional landfill or recovery void space over the plan period.

18.5.24. Baseline regional capacity is detailed in Figure 18-3. Simple statistical forecasting (using the Microsoft Excel forecasting function) has been used to demonstrate long term void capacity to the year of planned C2C Scheme completion (currently anticipated to be 2024) in the absence of future provision.

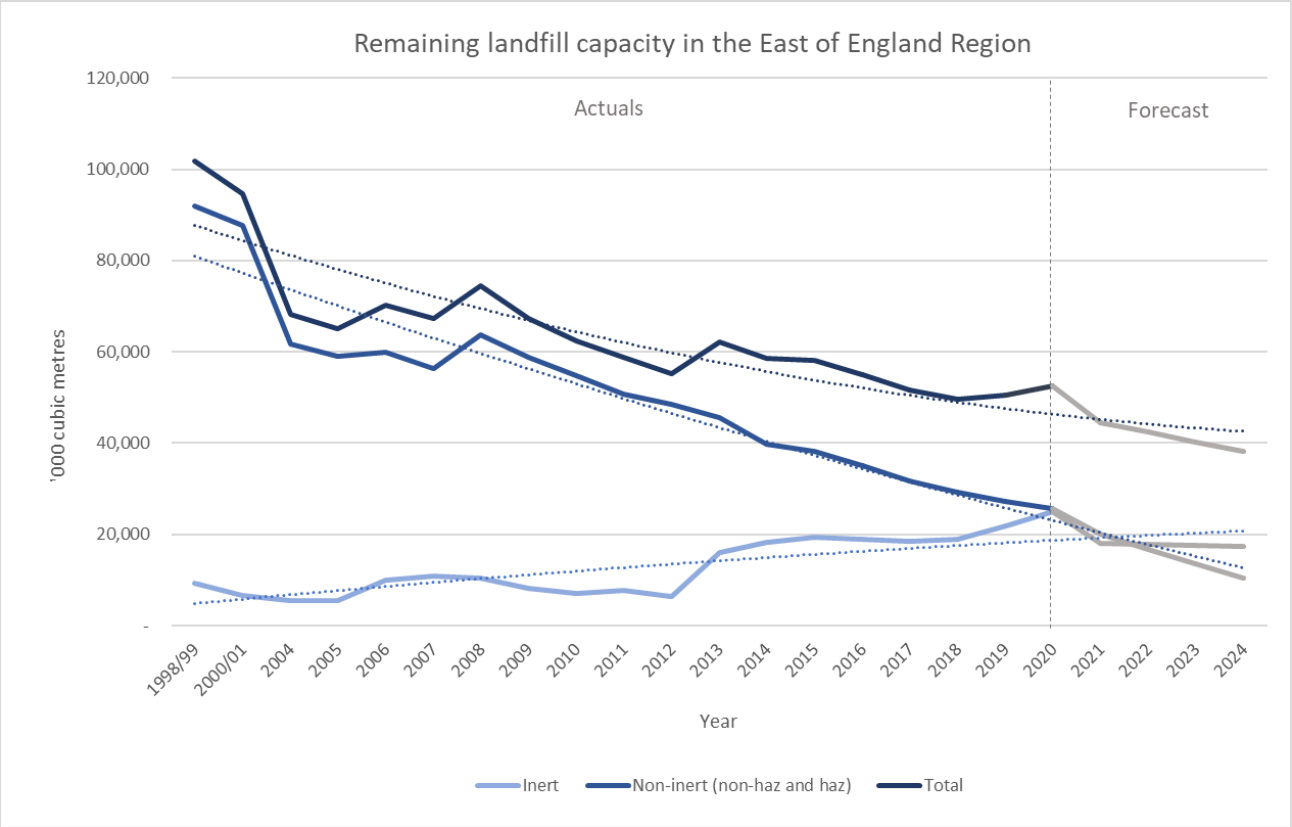


Figure 18-3 - Remaining landfill capacity in East of England

18.5.25. Baseline data indicates that in the absence of future provision, inert, non-inert and total landfill capacity is likely to become an increasingly sensitive receptor throughout the duration of the construction phase and in operation. Figure 18-3 shows that in the absence of future provision, waste capacity in the East of England region is forecast to reduce from 2020 to 2024 by as much as:

- Inert waste - 31% to 17.3 Mm3;
- Non-inert waste – 59% to 10.4 Mm3; and
- Total waste - 27% to 38.1 Mm3.

FUTURE BASELINE

18.5.26. In the future baseline and in the absence of the C2C Scheme, it is considered that the current land use within the development study area would remain the same. It is noteworthy that as the highway and associated infrastructure ages, increased maintenance and repair work may be required. However, given the scale of the current infrastructure within the site boundary, the consumption of materials resources and the recovery of site arisings is considered to remain minimal. Similarly, the potential for waste generation to landfill in the future baseline is also anticipated to remain minimal.

18.6 POTENTIAL IMPACTS

CONSTRUCTION

Material Resources

18.6.1. The C2C Scheme would be likely to require large quantities of material resources for construction, and would, therefore, have the potential for permanent direct adverse effects on the environment, through a reduction in the availability of material resources and potentially the depletion of natural resources. It will be outside of the scope of any assessment to assess the environmental effects associated with raw material extraction, and processing and manufacturing of products, as these are likely to be subject to separate environmental assessments. The use of material resources would also have the potential to generate adverse environmental effects through the transportation of materials (for use on-site), such as detrimental impacts to air quality and increase in local noise levels, however, the effects of these are more logically dealt with within other Chapters including Air Quality and Noise and Vibration.

18.6.2. As part of the EIA the materials required will be identified in more detail and the potential for supplying these resources from primary or secondary sources (i.e. recycling or re-use) will be set out. Primary resources will be mapped against local, regional or national availability. Any particularly scarce resources will be identified and the designer will be challenged as to whether these resources cannot be substituted by more sustainable material.

18.6.3. The construction phase could generate resources during the initial excavations and levelling works for the site. A cut/fill balance calculation will be carried out for the C2C Scheme and opportunities for re-use of any surplus material not required on the project will be identified during the EIA process. A key objective of the project is to minimise the need to import or dispose of materials for construction.

18.6.4. Further details on specific project activities that have the potential to generate significant effects from the use of materials is summarised in Table 18-8 below.

Table 18-8 – Potential Material Use

Project Activity	Material use and potential to generate significant effects
Site remediation/ preparation/ earthworks	Potential direct effects associated with the import and use of primary aggregates and/or fill material, which may result in the depletion of non-renewable resources.
Demolition	Any demolition would be unlikely to require the use of any materials.
Site construction	Construction of the C2C Scheme and associated new structures (such as potentially the provision of a facilities building), along with signage, lighting, safety barriers, drainage, communications infrastructure, pavement, and landscaping works, would require large amounts of materials. Although quantities of materials are not known at present, the type of materials that are likely to be required may include (and not limited to): Steel Aggregate Cement

Project Activity	Material use and potential to generate significant effects
	Concrete Bitumen Wood Plastic Other metal
Operation	Operation in this case includes maintenance activities. No significant effects relating to the operation of the new C2C Scheme and Travel Hub are anticipated on material assets as maintenance would be infrequent and unlikely to require large volumes of materials, therefore, it is proposed that this element is scoped out of further assessment.

Waste

18.6.5. The construction phase will generate some waste materials in the form of packaging and unwanted resources (e.g. offcuts of timber or steel) – Table 18-9. The CoCP will set out standard procedures to minimise this waste and will set out requirements for managing and recycling waste on site and for ultimate disposal where necessary. The CoCP will have to be adopted by the construction contractor and incorporated into their Construction Environmental Management Plan as appropriate.

18.6.6. An outline Site Waste Management Plan shall be drafted as part of the ES which will require the eventual construction contractor to develop into a detailed Site Waste Management Plan for the C2C Scheme.

Table 18-9 – Potential waste generation

Project Activity	Waste arisings and potential to generate significant effects
Site remediation/ preparation/ earthworks	Potential direct effects associated with the off-site disposal of waste, which may result from: The production of waste from site clearance, e.g. green waste, contaminated soils, inert waste. Exceeding the cut and fill balance, therefore, generating excess cut material as waste.
Demolition	If demolition of structures or properties is required, there may be direct effects associated with the generation of waste, in particular bricks, concrete and timber. This may cause indirect effects if disposal in landfill is required, which will result in a permanent reduction in landfill void capacity.
Site construction	It is likely that the majority of waste would be generated in the site preparation and demolition phases. However, the construction phase of the C2C Scheme may result in the following waste arisings: Materials brought to site that are not used for their intended purpose, e.g. damage items, offcuts, and surplus materials. Excavated materials such as soil which may be contaminated, unsuitable or surplus to requirements.

Project Activity	Waste arisings and potential to generate significant effects
Operation	Waste may also be generated during the operation of the C2C Scheme. Waste would be likely to arise from the following activities during operation: Domestic type waste from the potential facility building Maintenance, including road sweepings and gully clearings, replacement signage and lighting, road and parking area resurfacing and landscape maintenance Road debris and litter from users of the C2C Scheme.

OPERATION

Resources

18.6.7. Materials would be required for the maintenance of the C2C Scheme, once operational. This would likely include localised repairs and resurfacing. Significant effects from the use of material resources are considered unlikely during the operation of the C2C Scheme options, as maintenance activities would be infrequent and would likely require minimal quantities of material resources. There will be very minor quantities for consumables at the Travel Hub site, but these are not considered to be in significant quantities.

Waste

18.6.8. It is unlikely that significant effects would result from the generation of waste due to maintenance of the C2C Scheme, as maintenance activities would be infrequent and the waste hierarchy would be implemented to reduce waste generation. Additionally, domestic type waste generated by the potential users of the C2C Scheme would be unlikely to be significant, particularly if recycling facilities are provided. Waste from passengers, NMU users and staff will be collected and disposed of by the operator through standard recycling and waste disposal collection services.

18.7 DESIGN, MITIGATION AND ENHANCEMENT MEASURES

CONSTRUCTION

18.7.1. Mitigation measures will be identified to be implemented to reduce the effects of material resource use and waste generated by the C2C Scheme during construction.

18.7.2. Measures to reduce the effects of material resource use throughout the design process, involve the reduction in the use of virgin materials and aggregates, which may be achieved through reducing the material requirements in the design itself, the use of site-won or recycled materials and the use of materials with a high proportion of recycled content. Embodied carbon emissions of the material resources required for the C2C Scheme options will be calculated as the C2C Scheme design progresses, to inform a low carbon design, which would subsequently aid in reducing material requirements.

18.7.3. When considering the requirement for the supply of materials for use on site, local suppliers will be identified, where possible, to reduce fuel requirements and cost of delivery to reduce greenhouse gas emissions resulting from transportation.

18.7.4. The waste hierarchy would be applied to minimise generation (i.e. through the undertaking of a Design out Waste workshop) and maximise reuse and recycling. For example, through the reuse of

excavated soils and green waste onsite for landscaping, and through the recycling of inert material by crushing, blending and subsequent reuse e.g. as an aggregate.

18.7.5. Where waste cannot be re-used or recycled onsite, opportunities would be sought for the reuse of material on other nearby schemes, where possible, or in other uses with clear benefits to the environment, e.g. in the remodelling of agricultural land, or in the restoration of nearby quarries or other excavation sites. By reusing and recycling as much waste as possible, this would reduce the amount of waste going to landfill.

18.7.6. Where waste must be taken to recycling/disposal facilities, these facilities must have the appropriate permits to ensure environmental risks are reduced. The recycling/disposal facilities should be located as close to the works as possible to minimise transport, thereby reducing greenhouse gas emissions resulting from transportation. The closest and relevant treatment and disposal sites will be identified by the appointed Contractor.

18.7.7. The appointed Contractor would produce a CEMP. This would detail mitigation measures to be adhered to onsite to reduce potential impacts from material resource use and waste generation during the construction of the C2C Scheme.

18.7.8. Attention will be given to the need for a Site Waste Management Plan (SWMP), which would be produced for the preferred option by the appointed Contractor. This would consider the sourcing, transport and use, and disposal of waste and material resources, in a sustainable manner. It would also take account of, and capture, design changes as the C2C Scheme option design evolves and would ensure that unavoidable construction waste is identified, and able to be managed in accordance with the waste hierarchy and other relevant legislative requirements. The SWMP would be used to derive the management options that would achieve the highest practicable performance levels within the hierarchy.

18.7.9. Consideration of the need for a Materials Management Plan (MMP), under the CL:AiRE Definition of Waste Code of Practice (DoW CoP), should also be given. Where appropriate, the Contractor may be required to produce an MMP prior to starting works. This would enable the any site-won materials (or identified, imported waste materials) to be used on site, providing justification and certainty of use and ensuring that the materials comply with an earthworks specification.

18.8 PROPOSED SCOPE OF ASSESSMENT

SCOPED IN

Material Resources

18.8.1. Due to the size and scale of the C2C Scheme, there is potential for large volumes of material resources to be required for the construction phase. Therefore, there is potential for significant adverse effects on the environment, through a reduction in the availability of material resources and potentially the depletion of natural resources. However, mitigation measures such as reducing the material requirements of the C2C Scheme through design and utilising as much site-won materials as possible would be implemented to reduce the effects, which would be included within a CEMP for the C2C Scheme. Therefore, further assessment, which will benefit from material quantification, a cut/fill balance calculation and further design information, is required to confirm these conclusions.

Waste

18.8.2. The C2C Scheme would be likely to generate waste during construction which could result in the temporary occupation of waste management facility space (from treatment of waste) and the permanent reduction to landfill capacity (from disposal of waste). However, a SWMP is recommended to be produced by the Contractor, which would implement the principles of the waste hierarchy to reduce the amount of waste produced and maximise the re-use of any waste on-site. A baseline study will be undertaken to confirm sufficient capacity of waste infrastructure, within 10km of the C2C Scheme to deal with any waste generated that requires treatment or disposal. Therefore, it is unlikely that significant environmental effects would result from the generation of waste during the construction. However, at this stage there is limited design information for the C2C Scheme, and a lack of information on the quantities of material resources required and waste arisings, on which to base the assessment. Therefore, further assessment is required to confirm these conclusions.

SCOPED OUT

18.8.3. Once operational, the C2C Scheme would be unlikely to require large volumes of material resources as maintenance activities would likely be infrequent. Additionally, it is unlikely that large volumes of waste would be generated through maintenance and by users of the C2C Scheme, including litter, during operation. Therefore, no further assessment is required for the effects of material resource use and waste generation from the C2C Scheme during operation, as no significant direct or indirect effects are anticipated.

18.8.4. It is proposed to scope operational material resources and waste management out of the ES.

19 SUMMARY TO ES SCOPING

19.1 SUMMARY

19.1.1. This report sets out the proposals for the Cambourne to Cambridge Better Public Transport Scheme, known as C2C Scheme. It has been prepared to support a request to the Secretary of State to provide a scoping opinion on the information to be included in the ES for the C2C Scheme.

19.1.2. A summary of the proposed technical scope of the ES outlined in the preceding chapters is provided in Table 19-1 below.

Table 19-1 – Summary of proposed assessment

Topic	Construction	Operation	Comment
Air Quality	Scoped IN	Scoped IN	Section 5.7
Biodiversity	Scoped IN	Scoped IN	Section 6.7
GHG	Scoped IN	Scoped IN	Section 7.4
Climate Resilience	Scoped IN	Scoped IN	Section 8.4
Community and Human Health	Scoped IN	Scoped IN	Section 9.7
Historic Environment	Scoped IN	Scoped IN	Section 10.7
Land Use and Property	Scoped IN	Scoped IN	Section 9.7
Noise and Vibration	Scoped IN	Scoped IN	Section 12.4
Landscape and Visual	Scoped IN	Scoped IN	Section 11.4
Soils, Geology and Contaminated Land	Scoped OUT	Scoped OUT	Section 14.7 Impact on final mass balance to be assessed in relation to Carbon in the Climate Change Construction impact and in terms of traffic on local roads in the Traffic and Transport Chapter. Impact on agriculture to be assessed in Land Use and Land Take Chapter
Water Resources and Flood Risk	Scoped OUT	Flood risk scoped IN	Section 15.6 Only carrying out flood risk assessment for operations.

Topic	Construction	Operation	Comment
			No significant effects on groundwater or surface water anticipated so no EIA on these receptors.
Major Accidents and Disasters	Scoped OUT	Scoped IN	Section 16.8
Traffic and Transport	Scoped IN	Scoped IN	Section 17.5
Resources and Waste	Scoped IN	Scoped OUT	Section 18.4
Decommissioning Stage	N/A	Scoped OUT	Future decommissioning is not likely for many decades and so assessing impacts of decommissioning would be impractical.

APPENDIX A – MAJOR ACCIDCENTS AND DISASTERS SCOPING AND ASSESSMENT WORKBOOK

Major event group	Major event category	Major event type	Topic chapter(s) with relevant information	Relevant to scheme area?	Phases which exacerbate vulnerability	Potential receptors	Basis of decision to scope in/out	Scope in?
Natural Hazards	Geophysical	Earthquakes	Chapter 14: Soils, Geology and Land Contamination	N	N/A	N/A	Do not occur in Britain of a sufficient intensity owing to the motion of the Earth's tectonic plates causing regional compression. In addition, uplift from the melting of the ice sheets that covered many parts of Britain thousands of years ago can also cause movement. The BGS acknowledges that on average, a magnitude 4 earthquake happens in Britain roughly every two years and a magnitude 5 earthquake occurs around every 10 to 20 years. As such the Cabinet Office National Risk Register of Civil Emergencies states that "Earthquakes in the UK are moderately frequent but rarely result in large amounts of damage. An earthquake of sufficient intensity (determined on the basis of the earthquake's local effect on people and the environment) to inflict severe damage is unlikely". The C2C Scheme is not in or close to an active area.	N
Natural Hazards	Geophysical	Volcanic Activity	Chapter 14: Soils, Geology and Land Contamination	N	N/A	N/A	The C2C Scheme is not in an active area and it is highly unlikely that an ash cloud could significantly impact on any aspect of the C2C Scheme.	N
Natural Hazards	Geophysical	Landslides	Chapter 14: Soils, Geology and Land Contamination	Y	C,O	Workers Road Users Public and local community	The soil in the area of the C2C Scheme is described to have a clayey surface texture, and slightly impeded drainage. However, the affects of potential landslides are unlikley since the topograhy of area is generally flat. In addition the scheme does not involve the formation of deep cuts/high embankments.	N

Major event group	Major event category	Major event type	Topic chapter(s) with relevant information	Relevant to scheme area?	Phases which exacerbate vulnerability	Potential receptors	Basis of decision to scope in/out	Scope in?
Natural Hazards	Geophysical	Sinkholes	Chapter 15: Soils, Geology and Land Contamination	N	N/A	N/A	The bedrock geology varies across the scheme from west to east. The West Melbury Marly Chalk Formation (typically up to 12m in thickness) overlies the Gault Formation from Madingley Mulch to the Coton Orchard. This formation is potentially vulnerable to the formation of sink holes. The geotechnical team will obtain a natural cavities and mining database search and occurrence risk assessment, which, together with an assessment of groundwater conditions, will be used to provide a risk rating for the site. If required, mitigation would range from a site inspection at construction stage (after topsoil stripping) through to the inclusion of strengthened geogrids to reduce the risk associated with collapse settlement. It is notable that the existing A428 and the St Neots Road cross similar geological conditions, as does the High Street in Coton, and there are no known occurrences of solution features in the chalk.	N
Natural Hazards	Geophysical	Tsunamis	Chapter 15: Soils, Geology and Land Contamination	N	N/A	N/A	The C2C Scheme is located inland, outside a tsunamis risk zone.	N
Natural Hazards	Hydrology	Coastal Flooding	Chapter 15: Water Resources and Flood Risk	N	N/A	N/A	The C2C Scheme is located inland, outside a coastal area.	N

Major event group	Major event category	Major event type	Topic chapter(s) with relevant information	Relevant to scheme area?	Phases which exacerbate vulnerability	Potential receptors	Basis of decision to scope in/out	Scope in?
Natural Hazards	Hydrology	Fluvial Flooding	Chapter 15: Water Resources and Flood Risk	Y	C,O	Aquatic environment and ecological receptors Properties Road Users Public and local community	Review of the Environment Agency Flood Map for Planning (Rivers and Sea) indicates that the majority of the C2C Scheme is located within the low-risk Flood Zone 1 where the risk of flooding from fluvial sources is less than 1 in 1000 (0.1%) in any year. However, there is a small area located within Flood Zone 3 located to the eastern end of the C2C Scheme where the risk of flooding from fluvial sources is greater than 1 in 100 (1%) in any year. The identified fluvial flood risk is located along the Bin Brook and is associated with the floodplain of the River Cam located to the east. As the C2C Scheme will increase the area of hardstanding along the route and the route crosses Flood Zone 3 along the Bin Brook, a robust Flood Risk Assessment (FRA) will be undertaken, as part of the ES, to demonstrate the surface water drainage design of the C2C Scheme meets the requirements of the Lead Local Flood Authorities (LLFA). The FRA will assess the potential implications of the C2C Scheme on flood risk to people and property, as well as assess the potential risk of flooding to the C2C Scheme. The FRA will be based on the surface water drainage strategy for the C2C Scheme. The surface water drainage design and strategy will include a section that assesses potential pollution hazard risks to receiving surface waters. On the basis that a detailed FRA is being undertaken for the C2C Scheme, it is proposed to scope fluvial flooding out of the MA&D assessment.	N

Major event group	Major event category	Major event type	Topic chapter(s) with relevant information	Relevant to scheme area?	Phases which exacerbate vulnerability	Potential receptors	Basis of decision to scope in/out	Scope in?
Natural Hazards	Hydrology	Pluvial Flooding	Chapter 15: Water Resources and Flood Risk	Y	C,O	Aquatic environment and ecological receptors Properties Road Users Public and local community	Review of the Environment Agency's Flood Risk from Surface Water Map indicates that sections of the C2C Scheme are at high, medium and low risk of flooding from surface water sources. Flooding from surface water is typically associated with natural overland flow paths and local depressions in topography where surface water runoff can accumulate during or following heavy rainfall events. As pluvial flood risk will be assessed as part of the FRA and appropriately mitigated as required, it is proposed to scope pluvial flooding out of the MA&D assessment.	N
Natural Hazards	Hydrology	Groundwater Flooding	Chapter 15: Water Resources and Flood Risk	Y	C,O	Aquatic environment and ecological receptors Properties Road Users Public and local community	From Madingley Mulch to the Coton Orchard the area has the West Melbury Marl Chalk Formation present. The chalk formation is an isolated outcrop on the north western limit of outcropping chalk in East Anglia. It is draped over the underlying Gault Formation and is likely to be relatively thin in the study area. There are no springs visible in the area around the edge of the chalk formation which indicates the chalk is likely to have limited water within it. It is worthy of note that the Environment Agency has not included this outcrop within any designated groundwater body (under the Water Framework Directive). This reinforces the interpretation that the outcrop is a small, isolated outcrop that is not likely to hold any significant groundwater. Review of the Environment Agency's groundwater data indicates that there is a Zone 3 Source Protection Zone (SPZ) located approximately 650m to the south of the western end of the C2C Scheme. Zone 3 is defined as the area around a supply source within which all the groundwater ends up at the abstraction point. As groundwater flood risk will be assessed as part of the FRA and appropriately mitigated as required, it is proposed to scope groundwater flooding out of the MA&D assessment.	N

Major event group	Major event category	Major event type	Topic chapter(s) with relevant information	Relevant to scheme area?	Phases which exacerbate vulnerability	Potential receptors	Basis of decision to scope in/out	Scope in?
Natural Hazards	Hydrology	Avalanches	Chapter 14: Soils, Geology and Land Contamination	N	N/A	N/A	Not considered relevant given the geographical location of the C2C Scheme. The C2C Scheme's topography is relatively flat and therefore an avalanche will not occur.	N
Natural Hazards	Climatological and Meteorological	Cyclones, hurricanes, typhoons, storms and gales	Chapter 8: Climate Change	Y	C,O	Property Workers Road Users	Cyclones, hurricanes and typhoons do not occur in the UK. The winter of 2015/2016 was the second wettest winter on record and a series of storms (including 'Desmond' and 'Eva') resulted in heavy and sustained rainfall. 17,600 UK properties were flooded and several bridges collapsed, disrupting access to and from local communities. Storms and gales could result in damage to highway infrastructure and could affect journeys made by road users; however, the risk is no different to similar roads or road users in the locality.	N
Natural Hazards	Climatological and Meteorological	Thunderstorms	Chapter 8: Climate Change	Y	C,O	Workers	This type of event could result in lightning strikes to temporary elevated structures during construction (e.g. tower cranes) and new elevated structures (such as bridges) introduced as part of the C2C Scheme; however, the risk is no different to similar roads or road users in the locality. Specific measures are therefore not considered to be required as part of the C2C Scheme.	N
Natural Hazards	Climatological and Meteorological	Wave surges	Chapter 8: Climate Change	N	N/A	N/A	The C2C Scheme is located sufficiently inland, and therefore is not subject to wave surges.	N

Major event group	Major event category	Major event type	Topic chapter(s) with relevant information	Relevant to scheme area?	Phases which exacerbate vulnerability	Potential receptors	Basis of decision to scope in/out	Scope in?
Natural Hazards	Climatological and Meteorological	Extreme temperatures: Heatwaves Low (sub-zero) temperatures and heavy snow	Chapter 8: Climate Change	Y	C,O	N/A	This type of event could give rise to changes in climatic conditions, with road infrastructure exposed to greater heat intensity and exposure to sunlight. Heavy snow could cause workers and road users to be trapped on the highway. In August 1990, the UK experienced heatwave conditions with temperatures reaching what was then a record 37.1°C in Cheltenham, England. In August 2003 a UK heatwave lasted 10 days and resulted in over 2,000 deaths. Temperatures reached what was then a record 38.5°C in Faversham, England and 33°C in Anglesey, Wales. High temperature records are now being broken with increasing frequency. The most widespread and prolonged low temperatures and heavy snow in recent years occurred from December 2009 to January 2010. Daytime temperatures were mostly sub-zero across the UK. At night, temperatures in England regularly fell to -5°C to -10°C. Snowfall across the UK lasted for some time, allowing 20cm to 30cm of snow to build up, closing schools and making it very difficult to travel. Between 1981 and 2010, there have been 40 occurrences where summer mean temperatures exceeded 19.4°C on five or more consecutive days. Between 1981 and 2010, there have been 1,263 days with a maximum minimum temperature below zero degrees Celsius. Between 1981 and 2010, there were 224 days with snow lying at 0900 however, there are no records from the Met Office of the depth of snow. Extremely hot weather may affect the road surface itself and could affect the comfort and health of users of the C2C Scheme, and has the potential to pose a risk to scheme assets such as deformation and deterioration of asphalt surfacing. However, since this effect is no different to similar roads or road users in the locality the effect is considered to not be significant. Therefore, specific measures are not required as part of the C2C Scheme	N

Major event group	Major event category	Major event type	Topic chapter(s) with relevant information	Relevant to scheme area?	Phases which exacerbate vulnerability	Potential receptors	Basis of decision to scope in/out	Scope in?
Natural Hazards	Climatological and Meteorological	Droughts	Chapter 14: Soils, Geology and Land Contamination	Y	C,O	Aquatic environment and ecological receptors People Properties Workers Road users	The C2C Scheme should not be vulnerable to drought as water is not an essential service during the construction, use or maintenance phases. Prolonged periods of drought can impact road infrastructure as drying out and cracking of soils may affect structural stability and prolonged dry periods can lead to cracking of surfaces and more rapid deterioration of materials. Decreased rainfall combined with an increase in the average temperature can also increase subsidence, affecting the stability of the road infrastructure, including pavements and hard surfaces. The design of the C2C Scheme will follow good engineering practice taking into consideration future climatic changes (including drought) and will be resilient to ground shrinkage and this event type should remain in the design risk register until designed out.	N
Natural Hazards	Climatological and Meteorological	Severe Space Weather: Solar Flares	Chapter 2: Description of the Proposed Scheme	N	N/A	N/A	Solar flare events are known to interrupt radio and other electronic communications. Records from solar storms in 1921 and 1960 describe widespread radio disruption and impacts on railway signalling and switching systems. There is no increased reliance on roadside technology therefore the C2C Scheme is no more vulnerable than the existing route.	N
Natural Hazards	Climatological and Meteorological	Severe Space Weather: Solar Energetic Particles		N	N/A	N/A	Solar energetic particles which cause solar radiation storms, but only in outer space, so this major event type can be scoped out.	N
Natural Hazards	Climatological and Meteorological	Severe Space Weather: Coronal Mass Ejections		N	N/A	N/A	Coronal mass ejections (CME) cause geomagnetic storms. The geomagnetic storm in 2003 caused the UK aviation sector to lose some GPS functions for a day, however no known significant impact on road users or infrastructure.	N

Major event group	Major event category	Major event type	Topic chapter(s) with relevant information	Relevant to scheme area?	Phases which exacerbate vulnerability	Potential receptors	Basis of decision to scope in/out	Scope in?
Natural Hazards	Climatological and Meteorological	Fog	Chapter 2: Description of the Proposed Scheme	N	N/A	N/A	Fog is one of the most common weather conditions in the UK, particularly throughout autumn and winter. Severe disruption to transport occurs when the visibility falls below 50m over a wide area. However, the risk is no different to similar roads or road users in the locality. Specific measures are therefore not considered to be required as part of the C2C Scheme.	N
Natural Hazards	Climatological and Meteorological	Wildfires: Forest fire, Bush/brush, pasture	Chapter 2: Description of the Proposed Scheme	Y	C,O	Aquatic environment and ecological receptors Properties Workers Road users	The C2C Scheme is surrounded by agricultural land which has a low risk of wildfire events during hot, dry periods and/or fires initiated by construction related activities as opposed to areas of woodland. During construction, standard control measures would be implemented by the appointed contractor to manage the risk of fire. During operation however, the risk is no different to similar roads or road users in the locality. Specific measures are therefore not considered to be required as part of the C2C Scheme.	N

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Natural Hazards	Climatological and Meteorological	Poor Air Quality	Chapter 6: Air Quality Chapter 17: traffic and Transport	Y	C	Ecological receptors People Workers Road users	The proposed duration of the construction works for the C2C Scheme would be approximately two years. **Construction:** Construction effects would be temporary for the duration of the construction phase. Increased dust emissions from construction activities and combustion related emissions from on-site plant and vehicles could affect local air quality at nearby sensitive receptors (residential receptors). Traffic management measures during construction may also lead to changes in vehicles emissions which may, in turn, result in impacts on local air quality. Providing mitigation measures are in place during the construction phase, the changes in local air quality are not expected to be significant. **Operation:** Potential effects on air quality during the operational phase will include: (1) Changes in emissions associated with changes in traffic flows (including composition and speed) on the local road network; and (2) Changes in road layout which may bring road traffic emission sources closer to, or farther away from, sensitive receptors. The C2C Scheme aims to improve quality of life by relieving congestion and improving air quality, and as such it is unlikely that the C2C Scheme will result in a MA&D so this major event type can be scoped out.	N

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Natural Hazards	Biological	Disease epidemics: - Viral - Bacterial - Parasitic - Fungal - Prion	Chapter 9: Community and Human Health	Y	C	Aquatic and ecological receptors People Workers Road Users	The CRC Scheme is located in a developed country where the population is in general good health. Disease epidemics in England are currently limited to COVID-19, the first cases of which were identified in February 2020. COVID-19 is currently a global pandemic, and the vulnerability of the Project to a major event caused by this pandemic during construction and operation should be mitigated by the occupational health and safety processes that are implemented by both the contractor and government rules and guidelines on the control of spread of COVID-19. The Project itself is not going to give rise to any disease epidemics. Furthermore, the use of the C2C Scheme (highway) is not going to give rise to any disease epidemics. Public Health England, the executive agency of the Department of Health is responsible for protecting the nation from public health hazards, preparing for and responding to public health emergencies. One of Public Health England's functions is to protect the public from infectious disease outbreaks and the Agency has produced a document providing operational guidance for the management of outbreaks of communicable disease, 'Communicable Disease Outbreak management: Operational Guidance'.	N
Natural Hazards	Biological	Animal Diseases: - zoonotic: • avian influenza • West Nile virus • Rabies - non-zoonotic: • foot and mouth • swine fever	N/A	Y	C	Aquatic and ecological receptors People Workers Road Users	Low and highly pathogenic avian influenza has been recorded in poultry in the UK several times in the last 10 years, most recently in the winter of 2016/17, although with no human cases reported. There was a devastating foot and mouth outbreak in 2001. It is likely the major event will be scoped out as the use of the C2C Scheme (highway) is not going to be the source of any disease epidemics and spread would be controlled through containment of infected animals including prohibition of transportation. However, more information is required to understand if there are any Foot and mouth burial pits within the C2C Scheme area to confirm this.	Y

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Natural Hazards	Biological	Plants	Chapter 6: Biodiversity	N	C	Aquatic and ecological receptors People Workers	Initial baseline data does not identify any invasive/dangerous/regulated plants. Standard control measures would be implemented by the appointed contractor during construction to handle and dispose of any diseased plants and/or injurious weeds, and prevent their spread.	N
Technological or Manmade Hazards	Societal	Extensive public demonstrations which could lead to violence and loss of life.	N/A	Y	C	Road users Public and local communities	The C2C Scheme is in a developed country that has steady, yet small population growth. England is politically stable with no direct border with countries experiencing conflicts.	N
Technological or Manmade Hazards	Societal	Widespread damage to societies and economies.	N/A	N	N/A	N/A	The C2C Scheme is in a developed country that has steady, yet small population growth. England is politically stable with no direct border with countries experiencing conflicts.	N
Technological or Manmade Hazards	Societal	The need for large-scale multi-faceted humanitarian assistance.	N/A	N	N/A	N/A	The C2C Scheme is in a developed country that has steady, yet small population growth. England is politically stable with no direct border with countries experiencing conflicts.	N
Technological or Manmade Hazards	Societal	The hindrance or prevention of humanitarian assistance by political and military constraints.	N/A	N	N/A	N/A	The C2C Scheme is in a developed country that has steady, yet small population growth. England is politically stable with no direct border with countries experiencing conflicts.	N

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Technological or Manmade Hazards	Societal	Significant security risks for humanitarian relief workers in some areas.	N/A	N	N/A	N/A	The C2C Scheme is in a developed country that has steady, yet small population growth. England is politically stable with no direct border with countries experiencing conflicts.	N
Technological or Manmade Hazards	Societal	Famine	N/A	N	N/A	N/A	The C2C Scheme is located in a developed country that produces its own crops and imports food. It is politically stable and not subject to hyperinflation and therefore food is available, whether produced within the UK or imported. Famine is also not relevant to the use of the Scheme (highway).	N
Technological or Manmade Hazards	Societal	Displaced population	N/A	N	N/A	Public and local communities	There will be no significant displacement of populations as part of the C2C Scheme.	N

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Technological or Manmade Hazards	Industrial and Urban Accidents	Major Accident Hazard Chemical sites	Chapter 16: Major Accidents and Hazards	N	N/A	N/A	There are no industrial areas along the route that are likely to present a major hazard to the environment or human health. There are small commercial operations along St Neots Road in Hardwick but based on an Envirocheck report, no COMAH site of Planning Hazardous Substances Consents / Enforcements are recorded within 5km from the route. Cambridge University are proposing West Cambridge development, a research and development site associated with the University of Cambridge. Planning permission has been granted and detailed designs are being prepared. However, since this effect of the proposed project is no different to similar roads or road users in the locality the effect is considered to not be significant. Therefore, specific measures are not required as part of the C2C Scheme. Any specific measures relating to the environment and nearby stakeholders will be considered in the EIA for the West Cambridge development.	N

Major event group	Major event category	Major event type	Topic chapter(s) with relevant information	Relevant to scheme area?	Phases which exacerbate vulnerability	Potential receptors	Basis of decision to scope in/out	Scope in?
Technological or Manmade Hazards	Industrial and Urban Accidents	Major Accident Hazard Pipelines	N/A	N	C	Road users Public and local communities	One local high pressure National Grid gas pipeline under sections of the C2C Scheme and through the scheme's boundary. If the high pressure gas pipeline needs to be diverted (new sections of pipeline to be constructed) to meet current engineering and safety standards, there will be an increased risk of a major accident and disaster during the construction phase due to the nature of the work required on the pipeline. However, any work within the consultation zone of the pipeline must be undertaken with the agreement of the pipeline operator, which will include risk assessment and method statements covering the works to be carried out before they can commence, under existing legal requirements, namely The Pipelines Safety Regulations 1996. Risks during maintenance and operation of the scheme should not be significantly different than the baseline situation. On this basis, the local high pressure National Grid gas pipeline has been scoped out of the MA&D assessment. The previous scoping report notes the presence of a pipeline between Coton to Bourn which lies to the north of the adjacent A428, opposite Bourn Airfield, and further east, from Scotland Farm to the A1303/ A428 slip road, south of Park Farm before continuing south of the A428 to Coton. Based on its location and information in the public domain it is likely this pipleine was used to transport aviation fuel to Bourne Aifield. However, it is unknown whether this pipeline is currently operational. This will be further assessed in the Environmental Statement.	Y
Technological or Manmade Hazards	Industrial and Urban Accidents	Nuclear	N/A	N	N/A	N/A	Nuclear sites are designed, built and operated so that the chance of accidental releases of radiological material in the UK is extremely low. Last historical major accident in the UK was Windscale in 1957. No nuclear sites are within a 5km corridor along the C2C Scheme.	N

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Technological or Manmade Hazards	Industrial and Urban Accidents	Fuel storage	Chapter 16: Major Accidents and Hazards	Y	O	Workers Road Users	The nature of construction for the C2C Scheme is of routine civil engineering works involving earthmoving and construction of road infrastructure. Some hazardous substances will be used in the construction works (e.g. fuel, asphalt, cement and associated additives) but the storage and handling of these will be governed by standard health and safety procedures. Whilst the materials are hazardous and present a potential hazard to the environment and personnel if released in an uncontrolled manner, it is considered unlikely the volume and nature of the materials would be sufficient to risk the occurrence of a major accident.	N
Technological or Manmade Hazards	Industrial and Urban Accidents	Dam breaches	Chapter 15: Water Resources and Flood Risk	N	N/A	N/A	Dam breaches in the UK are rare; the last major breach was at the Cwm Eigiau dam in 1925, which caused 17 fatalities and widespread flooding. No dam has been identified within 5km of the scheme area. Grafham water reservoir is located approximately 34km from scheme area, it is the eighth largest reservoir in England by volume and created by building an earth and concrete dam in 1965.	N
Technological or Manmade Hazards	Industrial and Urban Accidents	Mines and storage caverns	Chapter 14: Soils, Geology and Land Contamination	N	C,O	Road users Workers	Coal Authority records state that there are no coal workings within the scheme footprint.	N
Technological or Manmade Hazards	Industrial and Urban Accidents	Fires	N/A	N	C,O	Cultural heritage sites People Road users	Fires could be initiated by construction related activities which impact areas adjacent to the construction activities. During construction, standard control measures would be implemented by the appointed contractor to manage the risk of fire. The risk of fires affecting the C2C Scheme during operation is no greater than risks for existing highways through/developments in an urban environment.	N

Major event group	Major event category	Major event type	Topic chapter(s) with relevant information	Relevant to scheme area?	Phases which exacerbate vulnerability	Potential receptors	Basis of decision to scope in/out	Scope in?
Technological or Manmade Hazards	Transport accidents	Road	N/A	Y	C,O	Aquatic environment and ecological receptors Properties Workers Road users	Significant transport accidents occur across the UK on a daily basis, mainly on roads, and involving private and/or commercial vehicles. During construction there will be an increase in heavy construction plant and equipment on local road network which may increase the risk of accidents. The C2C Scheme has been designed to achieve a reduction in existing accident rates on the road network, and to take account of any accidental spillages through modern drainage and treatment systems. The environmental risks posed by spillages of hazardous loads as a result of road accidents will be considered within the Environmental Impact Assessment.	N
Technological or Manmade Hazards	Transport accidents	Rail	Chapter 2: Description of the Proposed Scheme	Y	C,O	Aquatic environment and ecological receptors Properties Workers Road users	The existing rail network nearby does not serve movements along the A428/A1303 route and the proposed east west rail scheme is not within the vicinity of the C2C Scheme area.	N
Technological or Manmade Hazards	Transport accidents	Waterways	Chapter 15: Water Resources and Flood Risk	N	N/A	N/A	There are no waterways located in the study area used for significant transport by water that could impact the road network during construction and operational phases.	N
Technological or Manmade Hazards	Transport accidents	Aviation	Chapter 16: Major Accidents and Hazards	N	N/A	N/A	There have been no major air accidents in the UK since the Kegworth incident in 1989. Bourne airfield is an airfield east of Cambourne located south of the C2C Scheme within the study area. However, it is understood that this airfield is no longer operational and therefore no further assessment is required.	N

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Technological or Manmade Hazards	Pollution accidents	Air	Chapter 6: Air Quality	Y	C,O	People Road users	Construction activities may cause dust emissions which may contribute to poor air quality albeit on a temporary basis. The use of fossil fuelled mobile plant and equipment during the construction phase may contribute to events associated with poor air quality. Guidance from the Institute of Air Quality Management (IAQM) notes that effects from onsite exhaust emission are unlikely to be significant. Also given the local and temporary nature of the site, plant emissions are considered to have a negligible impact on local air quality, relative to the surrounding road traffic contribution on the local road networks. Emissions associated with vehicles travelling on new and improved sections of the C2C Scheme may contribute to events associated with poor air quality. The EIA will assess air quality effects of pollutants (NOx, PM10, PM2.5) generated during the operational phase and changes in road layout which may bring road traffic emission sources closer to, or farther away from, sensitive receptors.	N

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Technological or Manmade Hazards	Pollution accidents	Land	Chapter 14: Soils, Geology and Land Contamination	Y	C	Ecological receptors Local heritage Public and local community	Construction may increase the risk of leaks and spillages of hazardous materials associated with the construction activities (e.g. fuel, asphalt, cement and associated additives) but the storage and handling of these will generally be governed by standard health and safety procedures implemented by the appointed contractor to manage the risk of spillages and leaks. While the materials are hazardous and present a potential hazard to the environment if released in an uncontrolled manner, it is considered unlikely the volume and nature of the materials would be sufficient to risk the occurrence of a major accident. There is also a small risk that hotspots of contamination from Bourn Airfield's operational history could be encountered, but if these are encountered the risk they posed to receptors would be assessed as to whether they should be isolated and removed for appropriate disposal or can be left in-situ. The environmental risks posed by spillages of hazardous loads will be considered within the Environmental Impact Assessment.	N

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Technological or Manmade Hazards	Pollution accidents	Water	Chapter 14: Soils, Geology and Land Contamination	Y	C	Public and local community Water environment	During construction there are likely to be no significant below ground works except in the vicinity of the main structural elements at the M11 bridge crossing and the section closest to the A428 near the Waterworks site. At the M11 crossing the foundations would be based in the Gault clay formation. Along the A428 the route is largely on Gault clay – but closest to the Waterworks site the route encroaches onto the western extremity of chalk outcrop. In these areas some form of below ground piling for foundations maybe required. Piling creates an opportunity for pollutants to move more rapidly from the surface to any groundwater encountered by the piling but as the geology is of low permeability clays, or a dry area of chalk any piling is not likely to cause any significant effects on groundwater. It is also possible that in the circumstances of extreme rainfall the erosion of topsoil and other materials could cause environmental harm if released into, the local water courses. During such an event it is likely that the runoff from land would include significant suspended sediment from the surrounding land and pollute surface water. The EIA will detail how drainage along the route will minimise risks to water through the construction of a drainage network. The EIA will detail how a robust CoCP and CEMP is to be in place during construction to ensure all earthworks included mean to control runoff to minimise risks arising from natural events.	N

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Technological or Manmade Hazards	Utilities failures	Electricity	Chapter 16: Major Accidents and Hazards	Y	C	Public and local community Workers	Instances of electricity failure (also referred to as power loss or blackout) can be caused by a number of things, such as severe weather (e.g. very strong winds, lightning and flooding) which damage the distribution network. These tend of be mainly specific place, local (e.g. metropolitan area) and less frequently regional (e.g. North East) as a result of severe winter storms and consequent damage to the distribution overhead line network. Underground and/or above-ground electrical transmission lines are present across the C2C Scheme, the responsibilities of which lie with the relevant local operator or company should this infrastructure fail. Information regarding any diversions will be considered as part of the design risk register and in the ES. The potential risk of construction-related incidents when undertaking diversion works as part of the C2C Scheme would be covered by existing legislation. Therefore further consideration in the ES is not considered necessary.	N
Technological or Manmade Hazards	Utilities failures	Gas	Chapter 16: Major Accidents and Hazards	Y	C	Public and local community Workers	Underground gas transmission pipelines are present across the C2C scheme's boundary, the responsibilities of which lie with the relevant local operator or company should this infrastructure fail. The diversion works will be considered as part of the ES. The potential risk of construction-related incidents when undertaking diversion works as part of the scheme would be covered by existing Health and Safety legislation. No gas use is associated with the C2C Scheme.	N
Technological or Manmade Hazards	Utilities failures	Water supply	N/A	N	N/A	N/A	No water use associated with the C2C Scheme during its operation and relatively low use during construction which could be addressed by tankering in supplies if required.	N

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Technological or Manmade Hazards	Utilities failures	Sewage system	N/A	N	N/A	N/A	No use of the sewage system associated with the C2C Scheme. During construction phase temporary portable systems will be in place covered by H&S welfare requirements.	N
Technological or Manmade Hazards	Malicious Attacks	Unexploded Ordnance	N/A	Y	C	Property Public and local community Workers	Historically an RAF airfield was located at Borne airfield, as a result the potential for UXO risk cannot be discounted. It should be noted that this topic will be covered by the Geology and Soils Chapter of the scoping report. Measures would be undertaken during construction to brief operatives to raise awareness of this issue, and to define appropriate response strategies such this be discovered during the works. There would be a limited risk of unexploded ordnance affecting the C2C Scheme, once operational but no greater than similar schemes.	Y
Technological or Manmade Hazards	Malicious Attacks	Attacks Chemical Biological Radiological Nuclear	N/A	N	N/A	N/A	Extremists remain interested in Chemical, Biological, Radiological and Nuclear (CBRN) materials, however alternative methods of attack such as employing firearms or conventional explosive devices remain far more likely. Historical use has been in closed densely occupied structures (underground, buildings) or targeted at specific individuals. The C2C Scheme is unlikely to be a target for this type of event due to the low number of exposed targets.	N
Technological or Manmade Hazards	Malicious Attacks	Transport systems	N/A	N	N/A	N/A	Potential systems would include (but are not limited to) railways, buses, passenger ferries, cargo vessels and aircraft. The C2C Scheme is unlikely to be a target for this type of event due to the low number of exposed targets.	N
Technological or Manmade Hazards	Malicious Attacks	Crowded places	N/A	N	N/A	N/A	The C2C Scheme does not fall within the definition of a crowed place, i.e. pedestrian routes and other thoroughfares as well as sports arenas, retail outlets and entertainment spaces. The C2C Scheme is unlikely to be a target for this type of event due to the low number of exposed targets.	N

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Technological or Manmade Hazards	Malicious Attacks	Cyber	N/A	Y	O	Workers People Road users	Cyber-attacks occur almost constantly on key national and commercial electronic information, control systems and digital industries. The increasing reliance on roadside technology could render the C2C Scheme more vulnerable to a cyber-attack. As technology is not proposed to be installed as part of the C2C Scheme along the route (gantries and overhead signage). Notwithstanding this, it is not considered to be more vulnerable to attack than similar infrastructure installed and running elsewhere on the strategic road network. Highways England is accountable to the Secretary of State for Transport for ensuring the resilience of their strategic road network to national security risks, including from terrorism, cyber-attack, natural hazards and other risks outlines in the National Risk Assessment.	N
Technological or Manmade Hazards	Malicious Attacks	Infrastructure	N/A	N	N/A	N/A	Terrorists in the UK have previously attacked, or planned to attack, national infrastructure. Attempts were made to attack electricity substations in the 1990s. Bishopsgate, in the City of London, was attacked in 1993 and South Quay in London's Docklands in 1996. These attacks resulted in significant damage and disruption but relatively few casualties. The C2C Scheme would have minimal impact on local infrastructure or be considered a high profile attack.	N
Technological or Manmade Hazards	Engineering accidents and failures	Bridge failure	N/A	Y	C,O	Aquatic environment and ecological receptors People Road Users Workers	Bridge works are not proposed as part of the C2C Scheme. These structures have been designed to meet modern safety standards, which reduces their likelihood of future failure. The risk associated with the C2C Scheme of this event is considered no greater than other similar roads that include new structures designed to comparable standards.	N
Technological or Manmade Hazards	Engineering accidents and failures	Flood defence failure	Chapter 15: Water Resources and Flood Risk	Y	C,O	People Property Road users Workers	The study area associated with the C2C Scheme does not benefit from flood defences or flood storage areas. The design of the C2C Scheme has been developed to include allowances for future climate change predictions that could result in flooding. The potential risk of breech events is considered in the Environmental Impact Assessment	N

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Technological or Manmade Hazards	Engineering accidents and failures	Mast and tower collapse	N/A	N	N/A	N/A	There are no towers or masts in close proximity to the C2C Scheme or being built as part of the C2C Scheme.	N
Technological or Manmade Hazards	Engineering accidents and failures	Property or bridge demolition accidents	Chapter 8: Community and Human Health	Y	C	People Road users Workers	The C2C Scheme does not involve demolition works.	N
Technological or Manmade Hazards	Engineering accidents and failures	Tunnel failure/fire	N/A	N	N/A	N/A	There are no tunnel structures proposed as part of the C2C Scheme or wihtin the study area.	N

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