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Cambridge Waste Water Treatment Plant Relocation Project
Anglian Water Services Limited

Environmental Statement Chapter 9: Climate resilience

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Summary

Introduction

This chapter contains the assessment of the effects, and their significance, of climate change as it applies to the infrastructure that forms the Proposed Development and also considers in-combination climate impacts on the wider environment and community.

The approach to the assessment has applied guidance outlined within the Institute of Environmental Management and Assessment (IEMA) EIA Guide to: Climate Change Resilience and Adaptation (2020). It also follows relevant policy and regulatory requirements related to the consideration of climate resilience within wastewater infrastructure. This includes the National Policy Statement for waste water (2012), the National Planning Policy Framework (NPPF) (2021), and the National Adaptation Programme (2018). Local policy includes the South Cambridge District Council Local Plan (2018), the Cambridgeshire and Peterborough Minerals and Waste Local Plan (2021), the Cambridge City Local Plan (2018) and the Cambridgeshire Flood and Water Supplementary Planning Document (2019) , as well as the District and County declarations of climate emergency in response to climate change in 2019.

Climate change will exacerbate existing issues affecting waste water treatment infrastructure such as structural damage, odour, flooding and storm flow volumes. In the future climate change will result in:

- warmer, wetter winters;
- hotter, drier summers: and
- more extreme weather events.

The future baseline constructed for this chapter uses a precautionary approach, considering the effects of climate change under the latest available UK projections (UKCP18), using the highest emissions scenario available (RCP8.5). The baseline is constructed for the 2050s and for the 2090s to understand the extent and rate of climatic change in the area local to the Proposed Development. The impact assessment uses the 2090s future baseline to assess the potential significance effects of climate change upon the receptors that make up the Proposed Development and the workforce. These receptors include physical infrastructure such as the piping, mechanical and electrical equipment and structural components, as well as the landscaped areas, River Cam, local communities, soils and biodiversity as defined in other chapters of this Environmental Statement.

Summary relevant mitigation

<u>Design measures (primary mitigation)</u>

The design of the Proposed Development includes various embedded mitigations that will provide resilience to the effects of climate change. The design incorporates flexibility and capacity within the layout of the Proposed Development, ensuring that in the future, as the

climate continues to change, additional infrastructure or waste water treatment solutions can be introduced as part of maintenance and upgrade procedures to further enhance resilience. This includes the ability for the Proposed Development to manage higher storm flows in the future, and to continuously meet evolving permitting requirements even in the case of low flow and future drought conditions. There is also capacity to add additional infrastructure including more storm storage, additional heat recovery and cooling, and additional treatment infrastructure.

Other primary mitigations include the layout and specification of the design to allow the Proposed Development to operating safely under climate change. This includes the design of equipment and welfare facilities that will allow the future workforce to remotely digitally access the Proposed WWTW during storms and floods and to shelter from future high temperatures within cool buildings.

Management plans (secondary mitigation)

Secondary mitigation measures that will be incorporated into the operation phase of the Proposed Development include monitoring and management of impacts as they are observed during the lifetime of the Proposed Development. These are outlined in Chapter 5: EIA methodology and allow for flexibility during the operation phase to respond to climate change as it is observed and as climate projections are updated. The EIA methodology includes management of impacts such as the specifications of replacement and upgraded equipment to reflect future projected temperatures at the time of their renewal; inspection regimes to include a review of potentially climate-vulnerable plant and equipment following extreme weather events ; contingency planning for staff welfare and availability during extreme weather events; as well as broader responses such as the management of biodiversity habitats in line with regional biodiversity strategies over future decades.

Measures secured through legal requirements or those that are best practice (tertiary mitigation)

Where relevant, current best practice guidance had been incorporated into the primary mitigation, for example based on DEFRA guidelines for flood risk assessments. Various calculations and modelling exercises have included climate change allowances and the outputs used to inform the design, including fluvial modelling, the flood risk assessment, storm management modelling, modelling of discharge flows at the outfall, and the surface water Drainage Strategy.

Environmental compliance during the operational phase will be monitored under the Environmental Permit. The permit also requires the operator to have a written Environmental Management System (EMS), which includes a set of plans and procedures describing measures to avoid, reduce and eliminate potential environmental impacts associated with the activities covered by the permit.

Assessment approach

Design envelope approach

The worst-case climate scenario for the assessment of the impacts of climate change on the Proposed Development are dependent upon the future climate change scenario used, rather than on specific design parameters of the Proposed Development itself. As such, the maximum design envelope parameters for the climate resilience assessment refer to the climate parameters used within the future baseline. The start year of operation phase has no impact on validity of this assessment.

To identify the maximum parameters, projections for highest emission scenario (RCP8.5) were used, identifying the 90th percentile for flood-related and high-temperature impacts and 10th percentile for drought-related impacts of the probabilistic projections, in line with IEMA guidance.

How assessment takes account of primary and tertiary mitigation

Primary and tertiary mitigation are those built aspects which are embedded within the Proposed Development design. Therefore, the preliminary assessment of effects takes account of these measures.

The design of the proposed development has incorporated the primary and tertiary mitigations identified above. Furthermore, all relevant modelling includes climate change within the model parameters. The fluvial modelling used a 1 in 100 year rainfall event plus a 20% climate change uplift, the velocity and mixing models have incorporated a 20% climate change uplift. The drainage strategy commits to a 40% uplift for climate change. Discharge to the River Cam under low flow conditions have not been modelled however the proposed WWTP has been designed to be flexible and to accommodate changes relating to regulatory requirements. This assessment therefore assumes that environmental permitting will take into consideration any risk of river water quality deterioration due to the final effluent discharge.

As such, the assessment of the impacts of climate change and their significance upon the Proposed Development assumes that primary and tertiary mitigations have been applied.

How assessment takes account of secondary mitigation

Since secondary mitigation measures primarily consists of asset management plans which will be prepared prior to the commencement of the operation phase, the assessment does not consider that secondary mitigations have been applied. As such, the assessment of the impacts of climate change and their significance upon the Proposed Development assumes that secondary mitigations have not been applied.

Reporting of residual effects

Residual effects are those effects which remain after the application of secondary mitigations to the impacts identified.

Summary construction effects

The effects of climate change on the construction phase of the Proposed Development are not in scope for review. Climate vulnerabilities of the design focus on the operation phase as the effects of climate change compared to present-day will not be felt during the construction phase. Construction weather resilience measures have, however, been included within this chapter, such as preparation and planning a response to adverse weather events.

Summary operation effects

Proposed WWTP built infrastructure and Waterbeach transfer pipeline

Higher temperatures including increased average temperatures and heatwaves may lead to structural damage, more rapid deterioration of materials and increased maintenance costs, increased risk of overheating and fire risk of mechanical and electrical equipment at higher maximum temperatures leading to equipment and WWT process failure, reduced efficiency of boilers and CHP unit due to higher ambient temperatures. After considering the application of primary and tertiary measures, these effects are considered to be minor and not significant.

Increased frequency and intensity of heavy rainfall and extreme weather events may increase the risks of surface water flows leading to erosion of soils around structures, weakening and washout of the soil around culverts that support primary structural features, infrastructure damage and reduced design life, water ingress or egress from structures, likelihood of pipework failure when transferring waste water, erosion and damage to river banks around the outfall, soil erosion in the network leading to increased siltation and erosion within pipework. After considering the application of primary and tertiary measures, these effects are considered to range from negligible to minor and are not significant.

Greater seasonal range between wetter winters and drier summers may increase the risk of ground movement and subsidence of soils leading to damage of buried pipes and foundations. After considering the application of primary and tertiary measures, this effect is considered to be minor and not significant.

Waste Water Processes

Higher maximum summer temperatures and heatwaves may increase the risk of septicity within the proposed WWT process plant, tunnels/pipelines and shaft. After considering the application of primary and tertiary measures, these effects are considered to be minor and not significant.

Higher temperatures may also decrease anaerobic digestion efficiency. After considering the application of primary and tertiary measures, these effects are considered to be moderate and significant, however with after considering the secondary mitigation, which comprises the option of additional cooling units around digesters and reduction of insulation, these effects are considered to be minor and not significant.

Increased winter rainfall and extreme rainfall events increases the risk that the network is overwhelmed and that flooding of foul water may occur at the inlet or at upstream network locations. After considering the application of primary and tertiary measures, this effect is considered to be minor and not significant.

In-combination climate effects

A range of in-combination climate effects were identified, describing the potential impact of climate change to exacerbate or ameliorate impacts of the Proposed Development upon local environmental and social receptors. Due to high uncertainty around the combined impacts of both climate change and the Proposed Development upon these receptors, risk ratings have not been applied to all in-combination topics and effects are qualitatively described. The exceptions to this are the in-combination effects of climate change and the Proposed Development upon staff health, and upon water resources, for which uncertainty was lower and effects were able to be calculated. In-combination climate effects may include changes in air dispersal of the emissions from the energy plan, changes to biodiversity mitigation habitats, changes to tree planting success and growth rates, changes to community health, staff health and site accessibility, changes to landscape due to pest and disease outbreaks, changes to soil quality and erosion rates, changes to odour dispersion, changes to water quality and riverbank scour risk of the River Cam.

After considering the application of primary and tertiary measures, the in-combination climate effects of increased heavy rainfall on health and safety of staff are considered to be moderate and significant, however after considering the secondary mitigation, which comprises operational phase management for extreme weather and staff welfare, these effects are considered to be minor and not significant.

After considering the application of primary and tertiary measures, the in-combination climate effects on the River Cam are considered to be negligible and not significant.

Summary decommissioning effects

The effects of climate change on decommissioning are not in scope for review.

With the inclusion of mitigation measures, there are no potential significant effects upon the Proposed Development identified as a result of climate change.

1 Introduction

1.1 Purpose of this chapter

1.1.1 This chapter of the Environmental Statement (ES) presents the findings of Environmental Impact Assessment (EIA) completed in relation to the potential impacts of climate change on the Proposed Development.

1.1.2 The ES has been prepared as part of the application to the Planning Inspectorate (PINS) for development consent. This chapter considers the potential impacts of climate change on the Proposed Development during its operation and maintenance phase under future projected climatic conditions. Construction and decommissioning phases are not assessed within this chapter, in line with the Scoping Opinion.

1.1.3 Potential impacts of the Proposed Development on the following chapters are assessed in the relevant ES chapter and in Section 4.3 of this chapter, which outlines the in-combination impacts of these assessments under future climate conditions:

- Chapter 7: Air Quality,
- Chapter 8: Biodiversity,
- Chapter 11: Community,
- Chapter 12: Health,
- Chapter 14: Land Quality,
- Chapter 15: Landscape and Visual,
- Chapter 18: Odour, and
- Chapter 20: Water Resources.

1.1.4 This chapter summarises information from Chapter 2: Project Description, supporting studies, technical reports and publicly available data that are included within:

- Appendix 6.3: Soil Management Plan (App Doc Ref 5.4.6.3)
- Appendix 8.14: Landscape Ecology and Recreation Management Plan (LERMP) (App Doc Ref 5.4.8.14)
- Appendix 18.4: Preliminary Odour Management Plan (App Doc Ref 5.4.18.4)
- Appendix 20.1: Flood Risk Assessment (FRA) (App Doc Ref 5.4.20.1)
- Appendix 20.5: Fluvial Model Report (App Doc Ref 5.4.20.5)
- Appendix 20.6: 3D Velocity/mixing model (App Doc Ref 5.4.20.6)
- Appendix 20.7: Outfall CFD Report (App Doc Ref 5.4.20.7)

- Appendix 20.10: Storm Model Report (App Doc Ref 5.4.20.10)
- Appendix 20.21: Drainage Strategy (App Doc Ref 5.4.20.21)
- Appendix 18.2: Odour Impact Assessment (App Doc Ref 5.4.18.2)

1.2 Competency statement

1.2.1 Summaries of the qualifications and experience of the Chapter authors are set out in Table 1-1.

Table 1-1: Competent experts

Author	Qualification / Professional Membership	Years of experience	Project experience summary
[redacted]	PhD Social impacts of climate change, University College London and Brunel University, ongoing MSc Environmental Technologies, Imperial College London, 2016 BSc (Hons) Physics and Music, Imperial College London, Royal College of Music 2012	7 years	Author of climate resilience and adaptation assessments for city climate action plans, strategic climate planning for rail and water sectors in the UK, and climate change resilience assessments and EIAs of infrastructure projects. Is currently working towards a PhD on the social impacts of climate change with a focus on food security, livelihoods, human migration and policy implications.
[redacted]	MSc Environmental Management, University of Surrey, 1999 BSc (Hons) Geography, University of Wales, Aberystwyth, 1997 Chartered Environmentalist Member of the Institution of Environmental Sciences	22 years	Environmental manager for cross-discipline EIAs and environmental assessments of major infrastructure schemes and now leads on weather resilience and climate assessments within EIA. Has overseen and worked on projects across the clean water and wastewater sectors, highways, light and heavy rail, ports and flood alleviation schemes. Has a technical background in water and land quality, and has additionally gained experience in the public sector and the construction industry
[redacted]	MSc Climate Change, University of East Anglia, 2006 MA(Cantab) Geography, University of Cambridge, 2005 Chartered Water and Environment Manager	18 years	Leads on climate resilience assessments of infrastructure in the UK. Has overseen many projects as the technical lead, working across sectors including water companies, heavy and light rail, renewable energy, and airports. Has additionally provided technical leadership on adaptation reporting

Author	Qualification / Professional Membership	Years of experience	Project experience summary
	Chartered Environmentalist Fellow of the Royal Geographical Society		by water companies, and in developing climate assessment methodology.

1.3 Planning policy context

National Planning Statement (NPS) requirements

1.3.1 Planning policy on waste water Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to water resources, is contained in the National Policy Statement (NPS) for Waste Water (Department of Environment, Food and Rural Affairs, 2012).

1.3.2 Table 1-2 sets out how the scope proposed in this chapter complies with the NPS for Waste Water.

Table 1-2: Scope and NPS compliance

NPS requirement	Compliance of ES scope with NPS requirements
Paragraph 2.2.3 in relation to the Government's key policy objectives around climate change mitigation and adaptation. Namely to "ensure that climate change adaptation is adequately included in waste water infrastructure planning".	This requirement is met through the completion of the climate change impact assessment detailed within this chapter and identification of mitigation measures to ensure a physically and operational climate resilient Proposed Development.
Paragraphs 2.3.5 through 2.3.7 on adaptation to climate change and the anticipated greater pressure on public sewer systems, and higher standards of waste water treatment to meet statutory environmental requirements	The impacts of future climate change on effluent volumes, including stormflows, drought (low-flow) conditions, flooding and spills are considered within this assessment. Mitigations identified take account of both the impacts of climate change as well as future population growth and waste water requirements as outlined within the Project Description.
Paragraph 3.6.6 'New infrastructure will typically be long-term investments which will need to remain operational over many decades, in the face of a changing climate. Consequently, applicants must consider the impacts of climate change when planning the location, design, build, operation and, where appropriate, decommissioning of new waste water infrastructure. The ES should set out how the proposal will take account of the projected impacts of climate change. While not required by the EIA Directive, this information	The climate impact assessment considers the effects and impacts of climate change to the 2090s (2080-2099), which is the furthest time period for which climate modelling has been conducted. The mitigations identified and residual risks take into account mitigations that are embedded into the Proposed Development, as well as additional future mitigation (such as ongoing maintenance, renewals and upgrades) that will take place throughout the operational lifetime of the Proposed Development and which will take

NPS requirement	Compliance of ES scope with NPS requirements
will be needed by the examining authority and the decision maker'	climate change into account, as outlined throughout this chapter.
Paragraph 3.6.7 'Applicants should use the latest set of UK Climate Projections to ensure they have identified appropriate adaptation measures. Applicants should apply as a minimum, the emissions scenario that the Independent Committee on Climate Change suggests the world is currently most closely following – and the 10%, 50% and 90% estimate ranges. These results should be considered alongside relevant research which is based on the climate change projections'.	This Climate Resilience assessment has used the RCP8.5[1] highest emissions scenario for the East of England and considered the 50% value for average climate variables (such as increase change in average temperature) as well as the 10% and 90% values to show the range of projected change.
Paragraph 3.6.8 'The decision maker should be satisfied that the proposals have taken into account the potential impacts of climate change using the latest UK Climate Projections available at the time the ES was prepared and have identified appropriate mitigation or adaptation measures. This should cover the estimated lifetime of the new infrastructure. Should a new set of UK Climate Projections become available after the preparation of the ES, the examining authority should consider whether they need to request further information from the applicant.'	This Climate Resilience assessment has used the latest UK climate projections (UKCP18), considering RCP8.5 highest emissions scenario for the East of England. Impacts of climate change to the 2090s (2080-2099) as the furthest future time period for which climate projections are available and which are expected to cover the first approximately 60 years of the operational lifetime of the Proposed Development. The Proposed Development currently has no specified end-of-life and is therefore expected to continue to operate into the 2090s and beyond. During this time routine maintenance, renewals and upgrades to equipment and processes are expected. Some of these activities are included as mitigations to the future impacts of climate change. Statement of Requirement (Application Document Reference 7.2) includes requirements for the review of new UK Climate Projections as they become available during the operation phase and at appropriate occasions such as when renewing the specifications for equipment renewal or upgrade. Asset Management Plan (Appendix 9.1, App Doc Ref 5.4.9.1) includes requirements for the review of climate change risks and identification of additional mitigation

[1] Representative Concentration Pathways. RCPs are the scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) and used by most global climate models (and downscaled regional climate models) and the UKCP18 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 wm^{-2} in 2100. There are 4 RCPs in regular use (2.6, 4.5, 6.0 and 8.5).

NPS requirement	Compliance of ES scope with NPS requirements
	measures required as appropriate to ensure that the WWTP continues to operate safely and effectively.

National planning policy

1.3.3 National planning policy of relevance to climate resilience, and pertinent to the Proposed Development are listed below.

National Planning Policy Framework (NPPF) requirements

1.3.4 National planning policy of relevance to the Proposed Development includes:

- The National Planning Policy Framework (NPPF) (Ministry of Housing, Communites & Local Government, 2021) with particular reference to paragraphs 8, 11, 20, 98 and 131 in relation to adaptation, mitigation and climate change resilience; paragraphs 152-154 in relation to meeting the challenges of climate change and, paragraph 161 in relation to flood risk planning.

National Adaptation Programme

1.3.5 The National Adaptation Programme (NAP) and the Third Strategy for Climate Adaptation Reporting (Department for Environment, Food & Rural Affairs, 2018) sets focused priorities and specific and measurable objectives that address the findings of the second UK Climate Change Risk Assessment (Department for Environment, Food & Rural Affairs, 2017) and to build the nation's resilience to climate change. The programme responds to the requirement in the Climate Change Act to publish a programme for adaptation to climate change. The National Adaptation Programme includes the following actions relevant to the Proposed Development:

- manage floods and coastal erosion to save lives, better protect communities and support economic growth; and
- improve water quality, reverse the deterioration of groundwater, and reduce emissions of harmful substances.

Local planning policy

1.3.6 Local planning policy of relevance to the Proposed Development includes:

District Councils

1.3.7 Cambridge City Local Plan 2018 (Cambridge City Council, 2018) with particular reference to Section 4:

- Cambridge City Council declared a Climate Emergency in January 2019. This is in addition to the Climate Change Strategy (2016-2021) (Cambridge City Council, 2021) and a supporting Carbon Management Plan (2016-2021) (Cambridge City Council, 2021) that has already been put in place. The climate change strategy identifies six key themes to tackle, which include supporting Council services, residents, and businesses to adapt to the impacts of climate change.

1.3.8 South Cambridgeshire District Council Local Plan 2018 (South Cambridgeshire District Council, 2018) with particular reference to:

- 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.”

Cambridgeshire County Council.

1.3.9 Cambridgeshire County Council declared a climate emergency in May 2021 and published a Climate Change and Environment Strategy in 2022 (Cambridgeshire County Council, Climate Change and Environment Strategy, 2022). One of the nine priority areas within the Strategy is ‘Resilience of our services, Infrastructure and supporting vulnerable people’, with a target of ‘all Council buildings and infrastructure to be resilient to climate change impacts by 2045’, noting drought and flooding as key issues for the county

1.3.10 Cambridgeshire and Peterborough Minerals and Waste Local Plan 2021 (Cambridgeshire County Council, Cambridgeshire and Peterborough Minerals and Waste Local Plan, 2021) with particular reference to:

- Policy 1: Sustainable development and climate change, where mineral and waste management proposals will be assessed against their active role in guiding development towards sustainable solutions, including a proactive approach to climate adaptation for the lifetime of the development.
- Policy 22: Flood and Water Management, where mineral and waste management development will only be permitted where it can be demonstrated that there would be no significant adverse impact on water resources, and where development sites known to be at risk of flooding will require climate change allowances to be part of flood risk assessment over the lifetime of the development.

1.3.11 Cambridgeshire Flood and Water Supplementary Planning Document 2019 (Greater Cambridge Shared Planning, 2019), which provides detailed guidance to help implement policies on climate change, making particular references to flood risk and water resources/quality. It makes particular reference to warmer summers, wetter winters and increased river flows by 2115, in the East of England, and the need for FRAs and surface water drainage strategies to take the impacts of climate change into account for the lifetime of the development. Guidance is provided on national precautionary sensitivity ranges for peak river flows and their use. These parameters are further defined within Section 3.3.12 of this chapter and within Chapter 20: Water Resources and Appendix 20.1: Flood Risk Assessment (App Doc Ref 5.4.20.1). Peak rainfall intensity allowances have also been provided, which aligns with the parameters used in this assessment, as well as suggestions for mitigation.

Corporate policy and guidance

1.3.12 Anglian Water published their strategic direction statement 2020-2045 (Anglian Water, 2017) which stated that climate change was one of their biggest challenges due to its effects on water scarcity and drought as well as increased risk of flooding and service disruptions and commits to overcoming this and other challenges through innovative and resilient strategies.

1.3.13 Anglian Water Services Ltd climate change Adaptation Report 2020 (Anglian Water, 2020) recognises the challenges presented by climate change and presents the long-term ambition of Anglian Water Services Ltd to make the East of England resilient to the risks of drought and flooding.

- In 2019, Anglian Water made changes to its Articles of Association, enshrining public interest within the purpose of the business and making a long-term commitment to environmental and social interests.

1.4 Legislation

1.4.1 Legislation relating to climate change which is relevant to the Proposed Development comprises the following:

European Legislation

1.4.2 The EU's Environmental Impact Assessment (EIA) Directive 2011/92/EU, as amended by 2014/52/EU includes requirements for projects to consider climate within their environmental impact. This 2014 amendment was transposed into UK's national Town and Country Planning (Environmental Impact Assessment) Regulations in 2017.

National Legislation

1.4.3 National legislation relating to climate change which is relevant to the Proposed Development comprises the following:

- The Nationally Significant Infrastructure Projects (NSIPs) - Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (UK Government, 2017) which came into effect on 16th May 2017, as secondary legislation to the Planning Act 2008 (UK Government, 2008) introduce climate change as a new topic. Schedule 4 (Information for inclusion in environmental statements), paragraph 5 requires the impact that the project will have on climate change to be assessed alongside an assessment of the project's vulnerability to climate change.
- The Climate Change Act 2008 (UK Government, 2008) and its 2019 amendment (UK Government, 2019) established the context for Government action and the requirements to undertake Climate Change Risk Assessments and develop a National Adaptation Programme to address opportunities and risks from climate change.

- The UK Climate Change Committee, the Government's independent advisor on climate, produces an Independent Assessment of UK Climate Risk, the third of which (CCRA3) was published in June 2021 (Climate Change Committee, 2021). This report provides statutory advice to government on the priorities for the forthcoming national adaptation plans and wider action and provide a synthesis of the emerging cross-cutting issues and the Committee's recommendations. The CCRA identifies 61 risks and opportunities across the UK, across the following sectors: natural environment, infrastructure, health and communities and built environment, business, and international dimensions.
- As required by the Climate Change Act 2008, the UK government has undertaken and published five-year assessments of the risks of climate change on the UK. The third of these risk assessments was published in January 2022 (HM Government, 2022) This is based on the advice within CCRA3.
- In addition, the UK Climate Change Committee reports to Parliament every two years on the UK Government's progress in adapting to the impacts of climate change through the Government's National Adaptation Programme (NAP). The National Adaptation Programme and the Third Strategy for Climate was published by DEFRA in 2018 (Department for Environment, Food & Rural Affairs, 2018) and the most recent progress report was the 2021 Progress Report to Parliament (Climate Change Committee, 2021).

1.5 Consultation

Scoping

1.5.1 Table 1-3 provides a summary of key points raised during scoping.

Table 1-3: Key points raised during scoping

ID	Consultee	Points raised	Response
3.5.1	PINS	On the basis that the construction will occur in the short-term, whereas future climate change impacts are expected in the medium and long term, the Inspectorate is satisfied that the climate resilience chapter of the ES would summarise construction stage control measures for extreme weather events and that it need not include separate consideration of climate resilience impacts.	A summary of the measures to be incorporated into the construction phase Code of Construction Practice (CoCP) and Construction Environmental Management Plan (CEMP) are outlined in Section 4.1.
3.5.3	PINS	Cross referencing to relevant sections of Water Resources chapter and standalone FRA sections. Assessment conclusions should be provided within Climate Resilience chapter so as to understand the context in terms of climate resilience.	Climate effects on Water Resources are noted in Section 4.3.74, with reference to the climate risk assessments carried out within Chapter 20: Water Resources and Appendix 20.1: Flood Risk Assessment (App Doc Ref 5.4.20.1).
3.5.4	PINS	Waterbeach assets are not part of the storm flow management solution, the Inspectorate agrees there are no likely significant effects in terms of susceptibility of these assets at Waterbeach to extreme rainfall and storm flow events and agrees that this matter can be scoped out at this zone.	Assets at Waterbeach are therefore not considered. Climate effects on the Waterbeach pipeline are outlined in Section 4.2.
3.5.5	PINS	Resilience to high winds is a matter to be dealt with as part of the design and that,	Consideration of wind loading is scoped out of this ES chapter.

ID	Consultee	Points raised	Response
		subject to the Proposed Development's compliance with industry wind loading design standards, that significant effects are unlikely to occur and can be scoped out.	Wind loadings are taken into account within structural designs, in compliance with industry standards.
3.5.6	PINS	The assessment should consider the risks of increased drought causing a major "first flush" of pollutants that may affect the treatment process and resulting outfall to the river. The assessment in the ES should also be clear on the basis for any assumptions as to the frequency that drought events could occur in line with relevant guidance on climate change allowances.	Chapter 20: Water Resources, Section 4.2 states "Operation of outfall (normal conditions) – water quality" outlines the assessment of "first flush" effects on water quality as a result of heavy rainfall following a dry spell leading to higher effluent loading at the outfall, which is summarised in this chapter in Section 4.3.74. Projected data on future summer rainfall, intense rainfall events and temperatures are detailed in Section 3.3.3 and has been used to inform the consideration of low flow impacts on the River Cam within the Chapter 20: Water Resources. Climate projections do not at present include detail on the frequency of drought conditions, however assumptions regarding this are provided in Chapter 20: Water Resources. Regulatory compliance monitoring and Environment Agency ongoing assessment of permit conditions for the proposed WWTP will ensure that the quantities of consented determinands in the final effluent discharge are within the current permit conditions for the existing WWTP. This assessment therefore assumes that environmental permitting will take into account any risk of river water quality deterioration due to the final effluent discharge.
3.5.7	PINS	Clarity is sought over qualitative assessments of the in-combination climate impacts. The chapters to which The Applicant refers in this context should contain assessment of interactive effects with the climate chapter where significant effects are likely to occur.	In line with IEMA guidance, in-combination climate impacts are identified and assessed for matters identified within the following ES chapters: Chapter 6: Agriculture Land and Soils, Chapter 7: Air Quality, Chapter 8: Biodiversity, Chapter 11: Community, Chapter 12: Health, Chapter 14: Land Quality, Chapter 15: Landscape and Visual, Chapter 18: Odour and

ID	Consultee	Points raised	Response
N/A	Greater Cambridge Shared Planning	Recommendation that water resources / water quality is included in these impacts, in addition to the biodiversity, odour, health, air quality, landscape and visual aspects already noted.	Chapter 20: Water Resources (including water quality). In-combination climate impacts are outlined in Section 4.3.
3.5.8	PINS	Query over the use of a long term climate projection period the 2080s rather than the 2090s, given the Proposed Development is not intended to be decommissioned.	This assessment includes a future baseline for the 2090s (2080-2099) to reflect that there is no definitive end-of-life for the Proposed Development and as such, the farthest time period for which climate projections exist will be utilised. This is detailed in Section 3.3.
N/A	Greater Cambridge Shared Planning	This chapter refers to both “the whole lifespan of the development” and “the projected lifespan of the Proposed Development up to 2050”. Clarity is sought on this and recommend that a longer lifespan (to at least 2080) is considered for the assessment and leading into the ES.	Mitigation of future climate risks will include consideration that individual elements of design will have shorter lifespans and that future climates will be considered within routine repairs and replacements throughout the operational phase of the Proposed Development. This is further detailed in Section 2.3.1 and additionally with respect to climate change risks during the operation phase, outlined in Section 4.2.
N/A	Greater Cambridge Shared Planning	Recommendation that the impacts of extreme weather events (wetter winters and more extreme floods) on pumping and processing capacity and discharge quality, including impact on downriver ground conditions and hydrologies are scoped in. In terms of spatial scope, the area of the River Cam downstream of the outfall should be ‘scoped in’ to a suitable distance. We note that transfer pipes from City and Waterbeach are already included in the scope and adequate capacity to deal with an extreme storm event should be provided.	The impact of climate change upon future storm flows and treatment capacity is outlined in Section 4.2.90, with further detail in Chapter 2: Project Description. The impacts of climate change upon future flows and hence upon water quality are addressed within Chapter 20: Water Resources Section 4.2 “Storm spills (abnormal operations) – water quality”, and referenced in Section 4.3.74 of this chapter. This includes the results of the water quality impacts in the River Cam in relation to climate change. The capacity of the Transfer tunnel and the Waterbeach pipeline to deal with an extreme future storm event is outlined in Section 4.2.113, which sets out the increased capacity to manage storm flows, with further detail provided in Chapter 2: Project Description.

ID	Consultee	Points raised	Response
N/A	Fen Ditton Parish Council	The need to address sewer flooding is raised, and the need to consider future flows and quality in the River Cam in relation to the need for additional treatment plant.	
N/A	Greater Cambridge Shared Planning	Accounting for wetter winters and climate extremes, floods are increasingly frequent and severe. We would encourage the EIA to consider what the new 1:100 year flood baseline relevant to the proposed development should be.	Flood modelling includes consideration for climate change by performing sensitivity testing in line with Environment Agency guidance on flood risk assessments and the application of the appropriate climate change uplift factor for the River Cam basin, as outlined in Section 3.3. The results of these models are detailed in Chapter 20: Water Resources and referenced in Section 4.3.74 of this chapter.
N/A	Greater Cambridge Shared Planning	Assurance is sought that the construction of any buildings undertake a full overheating risk assessment at the earliest opportunity to ensure mitigating measures are in place in line with the cooling hierarchy.	The construction of temporary buildings will be addressed within the CEMP. While the construction phase is not within the scope of this assessment, weather resilience considerations have been included in Section 2.8.23 to be included within the CEMP for the construction phase, as part of good practice. The design of permanent buildings and structures is addressed within Section 2.4.2 and Section 4.3.38 of this chapter.
N/A	Greater Cambridge Shared Planning	Is it requested that cumulative climate impacts resulting from the building-out of these developments (for example, increased levels of storm water run-off and Urban Heat Island (UHI) effects) will be considered within the climate impacts for the Proposed Development.	Cumulative climate impacts are considered within Section 4.5, which includes consideration of Urban Heat Island effects. Cumulative effects of storm water have been considered within the waste water network modelling outlined within Chapter 20: Water Resources and Section 4.2.113 of this chapter.
N/A	Natural England	The 'England Biodiversity Strategy' published by Defra establishes principles for the consideration of biodiversity and the effects of climate change. The ES should reflect these principles and identify how the development's effects on the natural	Biodiversity and the climate impacts on it within the context of the Proposed Development are outlined in Chapter 8: Biodiversity and in the Section 4.3.13 of this chapter.

ID	Consultee	Points raised	Response
		environment will be influenced by climate change, and how ecological networks will be maintained.	

Technical Working Groups

1.5.2 There were no Technical Working Groups conducted specifically as part of the climate resilience assessment. The impacts of climate change on future storm flows and discharge to the River Cam was discussed as part of bilateral consultation and technical working groups conducted as part of the water resources assessment, as outlined in Chapter 20: Water Resources. Table 1-4 provides a summary of key points raised within Technical Working Groups with relevance to this climate resilience assessment.

Table 1-4: Key points raised during engagement with Technical Working Groups

Date	Consultee	Points raised	How and where addressed
17-May-2021	Cambridge Past Present and Future	Water quality issues	Water quality in relation to climate resilience is discussed in Section 4.3.74 of this chapter with reference to Chapter 20: Water Resources
27-Jan-2022	Cam Conservators	Outfall scour protection	Scour impacts in relation to climate resilience are discussed in section 4.3.74 of this chapter with reference to Chapter 20: Water Resources, Appendix 20.6: 3D Velocity/mixing model (App Doc Ref 5.4.20.6) and Appendix 20.7: Outfall CFD Report (App Doc Ref 5.4.20.7)
23-Jul-2021	Cam Conservators	Advice from Cam Conservators to ensure good weed control at outfall	No specific actions raised for climate resilience
02-Sep-2021	DEFRA	Stormwater discharge approaches	Storm management in relation to climate resilience is discussed in Section 4.2.11 with reference to Chapter 20: Water Resources and Appendix 20.10: Storm Model Report (App Doc Ref 5.4.20.10)
6-Jun-2022	Environment Agency	Stormwater management	Storm management in relation to climate resilience is discussed in Section 4.2.11 with reference to Chapter 20: Water Resources and Appendix 20.10: Storm Model Report (App Doc Ref 5.4.20.10)
28-Aug-2021	Environment Agency	Pre scoping meetings.	No specific actions raised for water resources or climate resilience

Date	Consultee	Points raised	How and where addressed
15-Dec-2020	Greater Cambridgeshire Partnership	Waterbeach pipeline.	No specific actions raised for climate resilience
16-Mar-2022	Ofwat	Presentation of approach.	No specific actions raised for water resources or climate resilience
07-Jan-2020 to present	Parish Councils: • Waterbeach • Histon and Impington • Landbeach Parish • Milton • Stow-cum-Quy • Great Wilbraham • Little Wilbraham & Six Mile Bottom • Horningsea • Fen Ditton	Impacts of flooding or overflow on SSSI. Groundwater impacts. Stormwater management (spills). Pipeline river crossings.	Storm management in relation to climate resilience is discussed in Section 4.2.11 with reference to Chapter 20: Water Resources and Appendix 20.10: Storm Model Report (App Doc Ref 5.4.20.10)
14-June-2021	South Cambridge District Council	Updates of approach	No specific actions raised for water resources or climate resilience
14-Oct-2021	TWG (Environment Agency, Swaffham IDB, Cam Valley Forum)	20% climate change allowance query. Stormwater discharge impact on water quality	Fluvial flood risk has been scoped out of this chapter, as outlined in Section 2.8 Storm management in relation to climate resilience is discussed in Section 4.2.11 with reference to Chapter 20: Water Resources and Appendix 20.10: Storm Model Report (App Doc Ref 5.4.20.10)
10-Jun- 2021	TWG Environment Agency	Future environmental permit limits for water discharge activities. Flood risk.	Discharge consent limits are discussed in Chapter 20: Water Resources. Fluvial flood risk has been scoped out of this chapter, as outlined in Section 2.8

Date	Consultee	Points raised	How and where addressed
		Advice provided on use of existing River Cam model.	
18-Mar-2021	TWG Environment Agency	River Cam water quality (project overview and discussion of initial expectations on effluent discharge limits).	Water quality in relation to climate resilience is discussed in Section 4.3.74 of this chapter with reference to Chapter 20: Water Resources
19-Aug-2021	TWG Natural England	Pre scoping meetings.	No specific actions raised for water resources or climate resilience
	TWG Natural England	River Cam water quality (project overview and discussion of initial expectations on effluent discharge limits).	No specific actions raised for climate resilience
11-Feb-2022	Waterbeach Level Internal Drainage Board	Discussion of IDB managed flow in Bannold Drove Drain and wider catchment. IDB indicates that in dry periods, when river water is used to supplement flows in the catchment, the river water does not extend to the reach north of the outfall at Bannold Drove Drain.	Assessment of Bannold Drove Ditch is considered within Chapter 23: Cumulative Effects Assessment
21-Sep-2021	Waterbeach Level and Swaffham Internal Drainage Board	Advice provided that water within Bannold Drove Drain is used for agriculture downstream.	No specific actions raised for climate resilience
15-Nov-2021	Wildlife Trust	Water quality impact to Quy Fen.	No specific actions raised for climate resilience

Statutory s42 consultation

1.5.3 Table 1-5 provides a summary of key points raised during statutory s42 consultation relevant to climate resilience.

Table 1-5: Key points raised during statutory s42 consultation

Date	Consultee	Points raised	How and where addressed
27 April 22	Cam Valley Forum	Drought and much greater rainfall events need to be built into a works' capacity	Changes in precipitation are addressed in Section 4.2.90, as appropriate to the capacity of the Proposed WWTW

Statutory s47 consultation

1.5.4 The Consultation Report (App Doc Ref 6.1) details the responses to all comments made during the public consultation. Table 1-5 provides a summary of key points raised during statutory s42 consultation relevant to climate resilience.

Table 1-6: Key points raised during statutory s47 consultation

Date	Consultee	Points raised	How and where addressed
30 September 2022	Save Honey Hill	Clarity needed on the design inlet and outlet storm water flow at the works under the 1:100 +20% condition in 2040 and 2050. Asked if the storage provision will be 23,000m^3 total and asked how this will work without extra CSO events if the existing storage is also 23,000m^3 total. Requested data to support the statement that the ground storm tank storage and transfer tunnel will attenuate future storm flows at 68 L per person, per day. Asked for clarification for the upper design air temperature range of 40°C as being a daily average or peak value.	Provision has been made within the Proposed Development for future population increase and climate change, as outlined in Chapter 2: Project Description. Capacity within the design for storm drainage is addressed in Section 4.2.90. Design air temperatures are addressed in Section 2.8.9. Low flows and septicity in the transfer tunnel are addressed in Section 4.2.91.

Date	Consultee	Points raised	How and where addressed
		Asked if the water supply to the transfer tunnel, in order to alleviate low flows, will be sourced from drinking water or elsewhere.	

2 Assessment Approach

2.1 Guidance

2.1.1 The National Planning Practice Guidance includes a dedicated Section on climate change (Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government, 2019), which sets out key legislation and drivers for considering climate change in planning. The guidance sets out examples of adaptation to climate change, for example, consideration of flood risk and the availability of water and water infrastructure for the whole lifespan of the development.

2.1.2 The NPPF is supported by the Environment Agency Flood Risk Assessment: climate change allowances (Environment Agency, 2022). Current and future flood risk is assessed as part of the Flood Risk Assessment (FRA) (Appendix 20.1, App Doc Ref 5.4.20.1) which accompanies this EIA.

2.1.3 The IEMA Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation (Institute of Environmental Management and Assessment , 2020) is followed. This includes guidance on emissions scenarios to use, the use of UKCP18 climate projection data produced by the UK Met Office and consideration of both short-term weather such as extreme events as well as longer-term climatic change such as variations in average precipitation or temperature.

2.2 Assessment methodology

2.2.1 The general approach to assessment is described in Chapter 5: Assessment Methodology.

2.2.2 Following the preliminary assessment of the likely significant effects on the Proposed Development, any further mitigation measures (secondary mitigation) are identified and described. These mitigation measures would further reduce an adverse effect or enhance a beneficial one. The assessment of likely significant effects is then carried out taking into account the identified secondary mitigation measures to identify the ‘residual’ environmental effects.

2.2.3 This section provides specific details of the climate resilience methodology applied to the assessment of the Proposed Development.

2.2.4 The climate resilience assessment is comprised of two methodologies described within this section:

- An assessment of the risks associated with future climate change and extreme weather conditions to the infrastructure and processes that form the Proposed Development. The methodology for this part of the climate resilience assessment is detailed in Section 2.2.5.

- An assessment of the impacts of the project on the environment and communities, as assessed within the other technical chapters of this ES, which climate change may exacerbate or ameliorate (referred to as in-combination climate impacts). The methodology for this part of the climate resilience assessment is detailed in Section 2.2.19.

Impact assessment criteria

2.2.5 The significance of an effect is determined based on the magnitude of an impact and the sensitivity of the receptor affected by the impact of that magnitude. This section describes the criteria applied in this chapter to characterise the magnitude of potential impacts and sensitivity of receptors. The terms used to define magnitude and sensitivity are based on the above guidance.

2.2.6 The assessment criteria used to assess the potential effects of climate change on the Proposed Development differs from the generic EIA methodology and are described below.

2.2.7 A qualitative methodology for assessing the resilience of the Proposed Development assets to climate change has been produced in line with the IEMA Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation 2020, leading to the evaluation of the significance of the effects as follows:

- The impacts (hazards and opportunities) for each matter have been 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 Proposed Development to both normal weather and extreme weather-related scenarios under future climates, throughout its lifecycle to the end of the century (2099), are identified and reported within this assessment.
- Once the climate change impacts (hazards and opportunities) were identified, a risk assessment of those impacts on the Proposed Development was undertaken using magnitude and sensitivity of each impact using the impact assessment criteria described below.
- The outputs of the impact assessment were then used to assess if impacts are significant.

2.2.8 A qualitative assessment of the in-combination climate impacts was carried out in line with the IEMA Environmental Impact Assessment Guide to Climate Change Adaption and Resilience (2020) (Institute of Environmental Management and Assessment , 2020). The assessment was based on professional judgement of the information available where published quantifiable methods were not available. The assessment included the following steps:

- identification of impacts due to the Proposed Development on the present-day environment for impacts identified within other in-scope ES chapters;
- identification of how staff and services (and by extension, the customers) may be affected by future climate conditions; and

- an assessment of the significance of impacts on the environment, where risks and sufficient information are available, based on the in-combination impacts of the Proposed Development under future climate conditions.

Magnitude of impact

2.2.9 The criteria for defining magnitude for the assessment of impacts of climate change on the climate resilience of the Proposed Development are defined within in Table 2-1.

2.2.10 The assessment of the magnitude of a climate change impact was undertaken in two steps. Firstly, the identified impacts were categorised as beneficial or adverse. Secondly, impacts were categorised as major, moderate, minor or negligible based on how intense or severe the scale of the climate impact is likely to be in relation to a given receptor.

2.2.11 The magnitude was based on information from the climate change projections, together with knowledge and professional judgement on the nature of the impacts and level of certainty associated with the projections. For example, there is a higher degree of certainty within climate projections in relation to temperature change (with a greater certainty that temperatures will rise overall); however, there is a lower level of certainty in relation to the exact change in rainfall patterns throughout the seasons, or the frequency of the most extreme rainfall or temperature maximums, as demonstrated in the wider range within the future projections outlined in the future baseline.

Table 2-1: Impact magnitude criteria

Magnitude of impacts	Criteria	Examples
Negligible	Small or undetectable change in climatic or weather conditions	Change in average wind direction for a few days in a year
Minor	Change in climate conditions that may have measurable effect on a receptor but which are low likelihood / infrequent	Increased average annual frequency of lightning strikes
Moderate	A large, measurable change in climate conditions at a regular frequency	Increase in the intensity and volume of extreme rainfall events of an intensity that could lead to surface water flooding
Major	Large change to climate condition and large increase in the frequency of the event	Increased and prolonged maximum summer temperatures that create extreme regional heatwaves throughout each summer

Sensitivity of receptor

2.2.12 The criteria for defining receptor sensitivity for the assessment of impacts of climate change on the Proposed Development are defined within in Table 2-2.

2.2.13 The sensitivity of the receptors is the ability of the receptor to withstand and recover from a climate impact (such as high temperatures), while keeping or shortly returning to its normal functionality.

2.2.14 For the purposes of the assessment of the resilience of the Proposed Development, the receptors are outlined in Table 2-4.

2.2.15 The sensitivity of a receptor takes into account its susceptibility to a change in climatic conditions or an extreme weather event, and the consequences of this change.

Table 2-2: Receptor sensitivity criteria

Sensitivity	Criteria	Examples
Negligible	No change to the integrity of receptor or a small, temporary, reversible change to receptor performance following the occurrence of a climate impact	Underground/buried assets have negligible susceptibility to higher temperatures due to being buried below ground.
Low	**Adverse**: small, measurable impact to a receptor's performance following climate impact, or small reduction in receptors lifespan due to chronic deterioration (e.g. slight decrease in lifespan of an asset due to increased higher temperatures)	Ability of reinforced concrete receptors to withstand daily changes in temperature, which can result in a small but noticeable increase in the rate of spalling and deterioration (due to expansion of metal components).
	Beneficial: small, measurable increase in matter lifespan due to less severe deterioration, increase performance or reduced need for maintenance.	Key personnel onsite attendance improves as the inability to travel to work on days of severe snow and ice will reduce slightly due to increase in average temperatures leading to fewer snow and ice events
Medium	**Adverse**: measurable decrease in receptor performance (short-term or long-term) or lifespan, or increase in necessary maintenance frequency and costs following the occurrence of climate impact.	Landscaping vegetation that is susceptible / reactive to changes in weather conditions – the climate impact of longer growing season will lead to increased growth (impact on the receptor) and associated maintenance costs.
	Beneficial: moderate measurable increase in matter lifespan or performance, or a measurable reduced need for maintenance	None identified
High	**Adverse**: short-term, acute impact to receptor functionality or a large, measurable decrease in receptor lifespan following the occurrence of a climate impact. Major increase in need for periodic maintenance or in maintenance costs.	Stormwater storage reservoirs/tanks that are already on some occasions insufficiently large to manage stormwater – these are receptors with a high sensitivity to an increase in frequency of heavy rainfall events. The occurrence of the climate impact will

Sensitivity	Criteria	Examples
		lead to an acute impact on the functionality of the receptor.
	Beneficial: very strong improvement to matter's performance, lifespan or a large reduction maintenance requirements.	None identified

Significance of effect

2.2.16 The significance of the effect upon identified water resources receptors is determined by assigning an impact magnitude and sensitivity to the receptor. Table 2-3 sets out the significance matrix used to determine significant effects. Where a range of significance is presented, the final assessment for each effect is based upon expert judgement.

2.2.17 For the purpose of this assessment, any effects with a significance level of minor or less are considered to be not significant.

2.2.18 Significance criteria for the resilience of the Proposed Development to climate change were developed following the guidance in the IEMA Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation. The criteria were tailored to the Proposed Development, i.e., they were defined in relation to impacts of future climate on the operational status of the Proposed Development and its ability to deliver its intended function.

Table 2-3: Significance matrix

		Magnitude						
		Adverse				Beneficial		
		Major	**Moderate**	**Minor**	**Negligible**	**Minor**	**Moderate**	**Major**
Sensitivity	**High**	**Major Significant**	**Major Significant**	**Moderate Significant**	Minor Not Significant	**Moderate Significant**	**Major Significant**	**Major Significant**
	Medium	**Major Significant**	**Moderate Significant**	Minor Not Significant	Negligible Not Significant	Minor Not Significant	**Moderate Significant**	**Major Significant**
	Low	**Moderate Significant**	Minor Not Significant	Negligible Not Significant	Negligible Not Significant	Negligible Not Significant	Minor Not Significant	**Moderate Significant**
	Negligible	Minor Not Significant	Negligible Not Significant	Negligible Not Significant	Negligible Not Significant	Negligible Not Significant	Negligible Not Significant	Minor Not Significant

Impact assessment methodology of In-combination climate impacts (ICCI)

2.2.19 In line with IEMA guidance, the methodology for the assessment of in-combination climate impacts (ICCI) differs from the methodology for the rest of this chapter (as outlined in Section 4.3.1). Instead of assessing the impact of climate change on project receptors identified within the climate resilience study area (Section 2.3), the assessment of ICCI considers those receptors that may be affected by the project plus climate change. As such, those receptors are defined within the study areas of other technical chapters, namely Air Quality, Biodiversity, Community, Health, Land Quality, Landscape and Visual, Odour, and Water Resources. Such receptors are then assessed for in-combination climate impacts within Section 4.3 of this chapter.

2.2.20 Due to the complexity of interactions between climate change and other dynamic receptors that are undergoing change over time in the wider environment and society, there are varying levels of certainty in the future magnitude of impacts or the sensitivity of receptors under the future baseline. As such, it is often not possible to reliably assign an impact magnitude or sensitivity rating to ICCI.

2.2.21 Where this is the case, a description of the risk is provided. Where possible primary, secondary and tertiary mitigations are also provided.

2.2.22 Where knowledge of ICCI are better understood, due to less uncertainty around how receptors are likely to respond to the combined impacts of both climate change and the Proposed Development, an impact assessment is performed. For these impacts the magnitude of in-combination climate impacts considers the magnitude of additional impact due to climate change over and above the identified risk in the technical chapter.

2.2.23 The sensitivity of the receptors is defined and identified in the technical chapter except where it is considered that the addition of climate change may further exacerbate or ameliorate the sensitivity, in which case a different sensitivity rating may be applied within this assessment, including justification.

2.2.24 The significance of effect follows the same methodology for assessing climate impacts as outlined above.

2.2.25 The ICCI for which an assessment was able to be quantified are as follows:

- The ICCI on the health of the future workforce staff due to the combination of increased frequency and severity of extreme weather events with the requirement for travel and outdoor labour, resulting in increased exposure of staff to sustained high temperatures and adverse weather conditions, resulting in adverse health impacts such as heat stress or injury during storms or floods. A risk assessment for this was able to be carried out because the future health baseline (as described within Chapter 12: Health) does not include exposure of staff to future changes in extreme weather, but assumes the present-day baseline. This reduces uncertainty around the potential impacts of climate change in combination with impacts of the Proposed Development upon staff health.
- The ICCI risk assessment was carried out on the impact to River Cam water quality due to the combination of increased intensity and volume of extreme rainfall events due to climate change, in combination with changes to discharge into the river from the Proposed Development. An assessment for

ICCI upon the River Cam was possible because the Chapter 20: Water Resources have already considered climate change within all relevant modelling and design parameters. This reduces uncertainty around the potential impacts of climate change in combination with impacts of the Proposed Development.

Residual effect

2.2.26 The assessment of effects follows the approach set out within Chapter 5: Assessment Methodology. Effects have been assessed to take into account for both embedded (primary) mitigation best practice and measures secured by legal requirements (tertiary mitigation), and after the application of further mitigation measures (secondary mitigation). Effects after mitigation are referred to as 'residual effects'.

2.3 Study area

2.3.1 Since the aim of the climate resilience assessment is to consider the impacts of future climate on the Proposed Development itself, the study area is the geographical area within the Scheme Order Limits (App Doc Ref 4.1).

2.3.2 Climate resilience considers the impacts of climate change upon specific design receptors within the Proposed Development as defined in Table 2-4.

2.3.3 This assessment uses a future baseline for the 2090s (2090-2099) to reflect that there is no definitive end-of-life for the Proposed Development and as such, the farthest future for which climate projections exist is utilised. This is detailed in Section 3.3.

2.3.4 Mitigation of future climate risks will include consideration that individual elements of design will have shorter lifespans and will undergo routine repairs and replacements throughout the operation phase of the Proposed Development. Mitigation relating to the Proposed Development to be constructed is outlined in Section 4.2 with secondary mitigation detailed in risks assessments, which takes into consideration the design life of components of the Proposed Development outlined in Table 2-4.

Table 2-4: Proposed Development receptors

Receptor	Receptor detail	Proposed design-life
Built infrastructure	Buildings, structures and foundations	50
	Access road, internal roads hardstanding and hard surfaces, car parking	60
	Mechanical and electrical equipment, including solar voltaic panels, electrical wiring and control boards and communications equipment	15
	Surface water drainage pipework	60
	Fencing and lighting	20

Receptor	Receptor detail	Proposed design-life
Utilities and communications	Energy production infrastructure and battery storage system, renewable energy generation via anaerobic digestion processes	varied
	Utilities infrastructure – water, gas, electricity and communications structures, and their foundations	15
	Electric vehicle charging points	15
Waste Water Treatment Processing infrastructure	Inlet including buried pipes leading to terminal pumping station, treatment facilities (primary, secondary and tertiary), and sludge treatment infrastructure	Small pumps <7.5kw: 10years Control panels / MCC: 25years Other mechanical and electrical (excluding MCC and borehole pumps): 20years Onsite pipework: 60years Steel building frames: 50years Sewers / outfalls: 160years
	Gas to grid membrane plant or CHP and boiler units	20
Storm Management infrastructure	Storage tanks and their foundations	60
Odour Management infrastructure	Odour control units, covers for reception areas such as Terminal Pumping Station, Inlet Works and Sludge Tanks, aeration equipment	Varies depending on equipment. 10-25 years for pumps and steel equipment
Outfall	Final effluent channel and new outfall into the River Cam	160
Landscaping	Landscaping and planting around the Proposed Development	Whole project life
Workforce	Maintenance and renewal	Whole project life
Transfer tunnel	Transfer tunnel between the existing Cambridge WWTP and the Proposed Development	120
Waterbeach pipeline	New buried pipeline (rising main) and pumping station	100

1.1.1 The aspects outlined in Table 2-5 are considered for the assessment of in-combination climate impacts. When assessing in-combination climate impacts on other aspects, the study area used was as defined for that aspect. Additional details regarding each receptor can be found within the relevant aspect chapter of this Environmental Statement, with a details of the climate risks outlined in Section 4.3.

Table 2-5: Scope of in-combination climate impact assessment

Aspect	Description of receptor(s)
Agriculture and Soils	Effects on agricultural soils and farming infrastructure and access routes that are affected by the Proposed Development, due to climate change
Air Quality	Climate effects on air quality impacts, including emissions from the Gas to Grid or CHP unit and odour management infrastructure
Biodiversity	Climate effects on habitats and species within designated study area for the Biodiversity aspect, and on the efficacy of the biodiversity mitigation
Community	Climate effects during the operation of the Proposed Development on Private and public properties, open spaces and communal facilities including Public Right of Ways within the defined Community study
Health	Changes in the effects on the general population due to climate change, with emphasis on vulnerable groups within the study area Climate effects on workforce health
Landscape and Visual	Climate risks to key landscape features, including landscape management during the operation phase
Land Quality	Changes in impacts to soils, geology, geodiversity and mineral resources within the study area due to climate changes during the operation phase
Odour	Changes in the odour due to climate change
Water Resources	Changes to impacts to the River Cam due to climate changes, including changing impacts to water quality risks, flows, levels and hydromorphological characteristics

2.4 Temporal scope of assessment

Construction

2.4.1 The assessment of construction phase is not in scope for climate resilience assessment. The construction phase is deemed resilient, taking into account the short construction timeframe in the 2020s whereby events are considered tolerable under current construction practices and associated construction management approaches. Any impacts arising from severe weather events in the present-day climate have been identified and managed by measures included in the CoCP and the CEMP.

Operation and maintenance

2.4.2 The assessment considers effects that start once the proposed WWTP is commissioned and fully operational and includes the physical effects of climate change on the infrastructure, its operation, use and maintenance.

2.4.3 The assessment of operational effects will be throughout the full operational lifetime of the Proposed Development, which may be to the 2080s and beyond, as there are no current plans to decommission any part of the proposed WWTP. The proposed WWTP is proposed to become fully operational in 2028, therefore the assessment year for the Operational Phase for the purposes of assessing climate change impacts, is from 2028 to the end of the century (2099), which is the longest future horizon for which climate change projection data are available. This temporal range is a deviation from the scoping report, in which only impacts to the 2080s were considered. The points raised at scoping and how they are addressed are provided in Section 1.5. Any delay to the operation commencement year (later than 2028) is not considered to affect the climate change impact assessment because the impacts of physical climate change will not be altered, and because sensitivity of aging receptors by 2099 is unlikely to be materially impacted by a small delay (a few years) in their construction and operational commencement.

Duration of effects

2.4.4 For the purposes of this assessment, all effects of climate change are considered to be permanent effects.

2.4.5 Although acute events (such as a storm, or flood event) only last for a short duration (such as 1-5 days), the change in their likelihood and magnitude and as such, their impact rating, are considered permanent.

2.5 Baseline study

Desktop data

2.5.1 Baseline information within the climate resilience study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 2-6 below.

Table 2-6: Desktop information sources

Item or feature	Year	Source
UKCP18 climate projection dataset, 25km resolution probabilistic projections. From these projections, future climate values are selected for the 10th, 50th and 90th percentile in line with IEMA guidance (see Section 2.1 for further details).	2018	UK Met Office

Surveys

2.5.2 Surveys have not been carried out for the climate resilience assessment.

2.6 Maximum design envelope (Rochdale) parameters for assessment

2.6.1 The design parameters and assumptions presented are in line with the 'maximum design envelope' approach (base scheme design) as described in introductory chapters of the ES (Chapter 2 and Chapter 5). For each element of this chapter the maximum design envelope parameters detailed within Table 2-7 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group.

2.6.2 The assessment parameters are based on the design encompassing the whole of the proposed WWTP, access roads, transfer tunnel route, outfall, Waterbeach pipeline route and connections within the existing Cambridge WWTP as described in Chapter 2: Project Description. The assessment considers a realistic maximum design envelope based on the maximum scale of the elements and as a result no effects greater significance than those assessed are likely.

2.6.3 The worst-case scenario for the assessment of the impacts of climate change on the Proposed Development are dependent upon the future climate change scenario used, rather than on specific design parameters of the Proposed Development itself. As such, the maximum design envelope parameters for the climate resilience assessment refer to the climate parameters used within the future baseline. The start year of operation phase has no impact on validity of this assessment.

2.6.4 To identify the maximum parameters, projections for highest emission scenario (RCP8.5) were used, identifying the 90th percentile for flood-related and high-temperature impacts and 10th percentile for drought-related impacts of the probabilistic projections, in line with IEMA guidance.

2.6.5 The Environment Agency Central peak river flow climate change allowance and the Upper End rainfall intensity climate change allowances were identified as being applicable to the design. Refer to the Flood Risk Assessment (FRA) (Appendix 20.1, App Doc Ref 5.4.20.1) and to the Drainage Strategy (Appendix 20.21, App Doc Ref 5.4.20.21) for further details on these allowances and justification for these limits being applied. The maximum climate change envelope parameters are outlined inTable 2-7. Further details on the climate change parameters and the reference period (baseline) from which they are derived are provided within Section 3.2.1.

Table 2-7: Maximum design envelope (Rochdale) for climate resilience assessment

Potential impact	Maximum design scenario	Justification
Outfall not functional during extreme event.	Peak river flow levels including climate change allowance uplift of 20%. Used to inform the outfall design.	Environment Agency guidelines for climate change allowances recommends using the Central allowance for changes in river flow levels (95^{th} percentile) of 9%. Use of 20% factor in river flood model and outfall design is therefore conservative and beyond Environment Agency requirements.
Waste water network exceeds capacity, creating waste water spillages. Structural damage to the Proposed Development. Flooding of internal roads and access road during extreme rainfall event.	Peak rainfall intensity uplift of 40% for a 1 in 100 year event used to inform waste water drainage strategy and also the surface water drainage design.	According to Environment Agency guidelines (for developments with design life beyond 2060, the site is in very low risk area of surface flooding and a 40% uplift factor is in line with the Upper End allowance they outline for a 1% annual exceedance rainfall event (Environment Agency, 2022). Furthermore, there is no evidence of overland flow routes across the site, it is considered likely that additional future rainfall, in the event of climate change, could be adequately managed by onsite drainage (subject to verification of greenfield runoff rates according to the CIRIA 753 guidance).
	Maximum amount of rainfall (mm) that may fall in 24hours: • during winter (Dec-Feb) by the 2090s is 50.04mm • during summer (Jun-Aug) by the 2090s is 86.06mm	90^{th} percentile of the UKCP18 climate extremes probabilistic projections in line with IEMA guidance.
	Change in precipitation rate (winter) of 46.83% by the 2090s.	90^{th} percentile of the UKCP18 probabilistic projections in line with IEMA guidance.
Extreme summer temperatures cause structural or mechanical and electrical damage, which in	Change in average maximum daily temperatures in summer during the 2090s of +10.19°C. Summer maximum temperatures reached during the 2090s is 47.02°C.	90^{th} percentile of the UKCP18 probabilistic projections in line with IEMA guidance.

Potential impact	Maximum design scenario	Justification
turn affects the operation of the Proposed Development. Extreme summer temperatures affect optimal operation of the proposed WWTP. Extreme summer temperatures create hazardous working conditions for the operational workforce.		
Drought conditions that may affect biodiversity and landscaping.	Maximum change in precipitation rate (summer) of --66.74% (10th percentile).	10th percentile of the UKCP18 probabilistic projections in line with IEMA guidance.
Low waste water network flows affecting influent quantity and quality, which in turn affects optimal operation of the WWTP and septicity risk.	Use of 2018-2019 dry weather conditions as a baseline for future low flows (based on the prolonged, severely-dry conditions of 2018-2019 across the UK.	The 2018-2019 drought presents a suitable proxy for future drought periods and is in line with climate change projections for temperatures and precipitation rates, and associated drought risk.
Warmer winter temperatures affects biodiversity and landscaping.	Change in average seasonal minimum air temperature (°C) (winter) of +6.17°C (i.e. warmer winters).	90th percentile of the UKCP18 probabilistic projections in line with IEMA guidance.
Extreme low fluvial flows resulting in less dilution and so poorer water quality in the River Cam.	The UK Centre for Hydrology and Ecology models for the 2050s, shows up to 20% decrease in low flows (Q_{95} flows) in the East Anglian region for most modelled scenarios.	Ongoing regulatory compliance monitoring (Cambridge City Council, 2018) and Environment Agency review of permit conditions is expected to prevent deterioration of water quality within the River Cam in future baseline low flow conditions.

2.7 Impacts scoped out of the assessment

2.7.1 In line with the Scoping Report (Appendix 4.3, App Doc Ref 5.4.4.3) and as adjusted based on the Scoping Opinion (Appendix 4.2, App Doc Ref 5.4.4.2), the following aspects are scoped out of the climate resilience assessment (Table 2-8).

Table 2-8: Impacts scoped out of the climate resilience assessment

Potential impact	Justification
Resilience to climate change during construction	Climate change will not have a discernible difference between the present-day and the construction timeframe in the 2020s. Any impacts arising from severe weather events in the present-day climate will be managed by standard current construction practices, including measures included in the CoCP Part A & Part B (Appendix 2.1, App Doc Ref 5.4.2.1 & Appendix 2.2, App Doc Ref 5.4.2.2) and the CEMP.
Climate resilience – decommissioning activities at existing assets	Deemed resilient taking into account the short construction timeframe in the 2020s whereby events are considered tolerable under current construction practices and associated construction management approaches.
Climate resilience – surface water flood risk for Waterbeach	Waterbeach transfer pipeline will be a buried asset and as such not impacted by surface water flooding.
Climate resilience – fluvial flood risk	Fluvial flood risk has been assessed within the FRA (Appendix 20.1, App Doc Ref 5.4.20.1) and the results have been reported in Chapter 20: Water Resources. Modelled flood contours Fluvial Model Report (Appendix 20.5, App Doc Ref 5.4.20.5)) incorporate a 20% climate change allowance (1% AEP + 20% CC), which is deemed to be in line with Environment Agency requirements. A 20% uplift factor for climate change (1%AEP + 20%) has been applied within the fluvial flood risk assessment in the FRA.
Resilience – high winds	Proposed Development will comply with industry standards regarding wind loading.
In-combination climate impacts for carbon, historic environment, noise and vibration, material resources and waste, traffic and transport, major accidents and disasters	Considered not to have significant interaction with climate, and not leading to in-combination climate impacts.

2.8 Mitigation measures adopted as part of the Proposed Development

2.8.1 This section refers to the mitigation types, as defined in Section 1.5 of Chapter 5: EIA Methodology, and how they apply to the assessment of the impacts of climate change on the Proposed Development.

2.8.2 In developing the Proposed Development through an iterative process including consultation and engagement with consultees, and through the Environmental Impact Assessment, (EIA) The Applicant has sought to identify and incorporate suitable measures and mitigation for potentially significant adverse effects, as well as maximising beneficial effects where possible.

2.8.3 Some measures are **'embedded'** in the design of the Proposed Development for which consent is sought by virtue of the scope of the authorised development as set out in Schedule 1 to the DCO and the accompanying Works Plans. These are considered **primary mitigation**. For example, adjustment of Order Limits to avoid sensitive features, amending the sizing and location of temporary access routes and compounds.

2.8.4 Secondary measures may be detailed activities for example the preparation of detailed AIMS in accordance with the CoCP, the preparation and delivery of a monitoring plan for specific matters (air quality, water quality) or the preparation and delivery of specific environmental management plans (for example air, noise, water), and the preparation and implementation is secured through the CoCP. These secondary measures are differentiated from the good practice measures

2.8.5 Tertiary measures comprise good practice measures (such as measures within Considerate Contractors Scheme) and measures integrated into legal requirements secured through environmental permits and consents (least flexible as either the legislation exists to create the mitigation or does not (i.e. Protected Species Licensing).

2.8.6 Consents and other permits register (Application Doc Ref 7.1) sets out required permits and consents related to the Proposed Development.

2.8.7 Where beneficial effects are voluntarily introduced without the requirement to mitigate an effect, these are termed 'enhancement measures'.

2.8.8 The remainder of this section sets out the embedded measures (primary) and tertiary, and additional measures (secondary) relevant to the assessment of the impacts of climate change on the Proposed Development

Primary (embedded) and tertiary measures

2.8.9 Primary and tertiary mitigation form part of the Proposed Development and therefore, the preliminary assessment of effects takes account of these measures.

2.8.10 Table 2-9 sets out the primary and relevant tertiary mitigation measures that will be adopted during the operation of the Proposed Development.

2.8.11 The overarching resilience of the Proposed Development include site selection outside of the River Cam floodplain, and a design that incorporates flexibility and capacity. This flexibility means that there is capacity for change within the treatment process to deal future influent flow rates under future heavy rainfall and drought conditions. The flexibility also includes capacity for adaptation and change within the Proposed Development, allowing the design to be modified in the future to provide additional climate resilience in response to higher temperatures, changing storm flows or drought conditions that require additional treatment to meet the Environmental Permit.

2.8.12 The design is being prepared using a variety of water resource assessments and models with the following allowances for climate change. Additional information regarding each of these models is available within Chapter 20: Water Resources.

Storm modelling

2.8.13 Storm modelling has been conducted to inform the storm management of the Proposed Development. The modelling used a calibrated waste water catchment network model to predict the storm events for various storm intensities, taking consideration of climate change impacts. The proposed WWTP will have increased flow to full treatment (FFT) compared to the existing Cambridge WWTP.

2.8.14 Preliminary storm water modelling indicates that, in a ten year simulation, increased treated flows would result in fewer storm water discharge incidents to the River Cam. The storm model was run to simulate storm flows for ten consecutive years, during which the maximum simulated storm experienced was 13,873m^3 and which resulted in no storm water discharge incidents to the River Cam. Refer to Appendix 20.10: Storm Model Report (App Doc Ref 5.4.20.10) for further information.

2.8.15 Fluvial flood modelling has been undertaken to understand how the treated effluent and storm water discharges from the outfall to the river could affect flood levels. This involved mathematical modelling of river flows and levels to complete an initial assessment of this increased risk. The model indicates that in a 1 in 100 year flood event, with an 20% allowance for climate change, there would be a less than 7mm increase in water levels in the River Cam leading to a negligible change in the potential area of inundation across the floodplain. Refer to Appendix 20.5: Fluvial Model Report (App Doc Ref 5.4.20.5) for further information.

Velocity and mixing modelling

2.8.16 Velocity / mixing modelling for river velocities 1km from the outfall, and CFD modelling of discharge flows within 100m of the outfall have been conducted, each including where appropriate a 20% uplift factor to account for the potential impacts of climate change upon maximum flow volumes. Refer to Appendix 20.6: 3D velocity / mixing model (App Doc Ref 5.4.20.6) and Appendix 20.7: Outfall CFD report (App Doc Ref 5.4.20.7) for further information.

Drainage Strategy

2.8.17 A Drainage Strategy (Appendix 20.12, App Doc Ref 5.4.20.12) has been prepared, which dictates that all surface water drainage design is to be based on a 1:100-year storm event +40% allowance for climate change. This climate change allowance is in line with Environment Agency guidance (refer to Table 3-5 for further details).

2.8.18 The Strategy is based on the overall surface flood risk of the area being very low, as per Environment Agency flood zone ratings and due to no evidence of overland flow routes across the site.

2.8.19 The strategy also identified that additional future rainfall, in the event of climate change, could be adequately managed by onsite drainage (subject to verification of greenfield runoff rates according to the CIRIA 753 guidance). The Drainage Strategy does not provide details for consideration for groundwater flooding, however the risk of groundwater flooding is considered to be low due to the potential inflow of groundwater to the surface water drainage at the WWTW, due to its lowered elevation. As outlined within the Chapter 20: Water Resources, groundwater flood risk will be taken into account in the drainage design.

2.8.20 The strategy also includes a SuDS hierarchy for the management of surface water runoff, and greenfield runoff rates will be agreed with regulating authorities such as the Environment Agency. Refer to Appendix 20.12: Drainage Strategy (App Doc Ref 5.4.20.12) for further information.

Low flows

1.1.2 Low flow scenarios have not been used so far to consider dilution at the outfall. However, regulatory compliance monitoring (UK Government, 2021) and Environment Agency ongoing assessment of permit conditions for the proposed WWTP will ensure that the quantities of consented determinands in the final effluent discharge are within the current permit conditions for the existing WWTP.

2.8.21 Permit conditions are likely to vary over time in response to changes in effluent discharge and river flow, including changes arising from population growth, water usage, climatic or environmental factors and phasing of development. The UK Centre for Hydrology and Ecology models (UK Centre for Ecology & Hydrology, accessed April 2022) for the 2050s indicate reductions of up to 20% in low flows in the East Anglian region for most modelled scenarios.

2.8.22 The changes indicated by these model scenarios could cause a substantial reduction in river flow available to dilute the final effluent discharge. The proposed WWTP has, however, been designed to be flexible and to accommodate changes relating to regulatory requirements. This assessment therefore assumes that environmental permitting will take into consideration any risk of river water quality deterioration due to the final effluent discharge.

Table 2-9: Primary and tertiary mitigation measures relating to climate resilience of the Proposed Development

Mitigation measures		Type	Applied to	Justification
Operation				
Built Infrastructure: building and structures, foundations, pipework, utilities supplies, access road	Choice of materials for piping and insulation to include consideration of future temperature ranges and maximums. Design basis temperature range is [-10 to 40°C] and there is allowance within the site of the Proposed WWTW for the installation of additional infrastructure, including innovation technologies that may be introduced in the future when temperatures begin to more regularly approach or exceed the upper thermal design limits Additional thermal protection measures such as painting, shading or inclusion of natural ventilation / air conditioning options within buildings will be considered during the detailed design phase Buildings and structures will be designed to the climate conditions projected at the end of their design life	Primary	Proposed Development	Provides protection against rising temperatures
	Detailed design will include appropriate consideration for water proofing, including consideration for increased winter precipitation and extreme rainfall events	Primary	Proposed Development	To mitigate the risk of heavy rainfall and water ingress
Surface water drainage design	Surface water drainage design includes an uplift factor of 40% to account for additional extreme rainfall and surface flooding risk associated with climate change Surface water drainage to allow capacity to fit larger pipes in the future to manage onsite drainage under future climate conditions Use of SUDs where appropriate. Natural flood management through measures such as landscape planting	Primary	Proposed Development	To mitigate the risk of heavy rainfall and surface flooding
Outfall design	Outfall design to minimise river scour risk including modelling of discharge flows used to inform design to reduce turbulence and scours. Permanent scour protection along the river bank near the	Primary	Outfall	Minimisation of river scour at outfall

Mitigation measures		Type	Applied to	Justification
	outfall. More information is available within Chapter 20: Water Resources			
Utilities and communication systems	Lightning protection installed in line with industry standards	Primary	Proposed Development	Provides protection against lightning strike
Pipeline / tunnel design	Majority of the Transfer Tunnel will be located at an depth of 18m and Waterbeach pipeline at a depth of 2-5m, which is below the frost line and provides summer thermal insulation	Primary	Transfer Tunnel Waterbeach pipeline	Protection against temperature extremes
	Above ground parts of the pipeline including the manhole covers for the air valves will be designed to be above future flood levels, including an appropriate climate change allowance Pipe design will include resilience to subsidence risk such as floating measures and use of flexible materials	Primary	Transfer Tunnel Waterbeach pipeline	To mitigate subsidence risk for underground pipework
	Pipeline design including appropriate modelling to minimise septicity risk under a range of flow scenarios, which include allowances for climate change	Primary	Transfer Tunnel Waterbeach pipeline	To mitigate the risk of increased septicity
Waste water Treatment process infrastructure	Choice of materials to include consideration of future temperature ranges and maximums. Design basis temperature range is [-10 to 40˚C] An allowance has been made within the design for additional cooling technologies to be added should when temperatures begin to rise to near or beyond this design range. Additional capacity for cooling (via air ventilation or recycling of final effluent) will be available for key components of the waste water process and sludge treatment works, including pumps, settlement tanks, digesters, final effluent cooling and critical M&E equipment. Sludge levels in the aeration tanks can	Primary	Proposed WWTP plant	Provides protection against rising temperatures

Mitigation measures		Type	Applied to	Justification
	also be controlled and reduced in high temperatures as necessary. Detailed design will include appropriate air-cooling system (e.g. air conditioning units or natural ventilation / nature based solutions) to be designed with consideration for adaptation to future temperatures The design of the WWTP processes have additional capacity and the ability for the final effluent flow to be recycled and rerouted back to the inlet works in order to introduce cooling, thereby reducing septicity risk within the WWTW plant and pipework. Workforce welfare in hot temperatures will be accounted for through ventilation and cooling solutions in key areas (offices and workshops) and there will be outdoor shade provided on the site of the Proposed Development. Capacity within the design also allows for additional outdoor shading to be introduced in the future			
	Flexible design that provides capacity for increased sediment load in waste water from soil erosion within the catchment and a design that allows for future modifications to improve treatment capability	Primary	Proposed WWTP plant	Provides capacity to higher sediment loads in waste water
	Ability to recycle final effluent flows as a source of dilution (and cooling) to influent during low flow situations to provide dilution and reduce septicity risk Pipeline design including appropriate modelling to minimise septicity risk under a range of flow scenarios, which include allowances for climate change	primary	Proposed WWTP pipelines Transfer tunnel	Provides capacity to handle future more intense and frequent drought conditions
Storm management infrastructure	6 storm pumps available at terminal pumping station to handle flows beyond 2,000l/s. Onsite storm storage of up to 20,400m^3 (based on 68 litres per person in line with population growth rates) including onsite stormwater storage and the transfer tunnel providing storage of up to 5,186m^3]	Primary, tertiary	Storm tanks Terminal pumping station Transfer Tunnel	Reduces the risk of spills due to storms via adequate storm management design

Mitigation measures		Type	Applied to	Justification
	There is also capacity to add more pumps and additional stormwater storage onsite, an additional primary settlement tank and final settlement tank in the future to address higher flows if necessary Storm management storage designed to include allowances for future climate change under maximum design envelope parameters Waste water network drainage model including an appropriate uplift factor to account for the increased peak rainfall intensities due to climate change of 40%, in line with Environment Agency guidance		Waterbeach pipeline	
Odour Management infrastructure	Aeration equipment selection, hydraulic design and layout arrangements design to minimise turbulence Moving the preferred layout geographically, to achieve the least impact to existing receptors Pumped flows to uncovered tanks discharged below water level to reduce turbulence Covering of reception areas and use of odour control units to control odour at points of source Existing odour sources are expected to comply with the requirements of their environmental permits and mitigate any increases in future odour emissions associated with changes in climate. Specific odour control technology will be selected at the detail design stage and will consider options for future higher temperatures such as the use of more activated carbon to increase odour removal. Further details of existing and future odour management solutions can be found in Chapter 18: Odour	Primary, Tertiary	Proposed WWTP	To mitigate odour risk at source and risk of increased odour in the future due to higher temperatures
Landscaped areas	Implementation of the landscape masterplan and landscape design for the proposed WWTP site. The masterplan comprises a circular earthwork bank up to 5m high, woodland, trees, hedgerows, grassland and sustainable drainage swales.	primary	Landscaped areas	Earth work bank and landscaping provide resilience in drought

Mitigation measures		Type	Applied to	Justification
	The earthwork bank will surround the proposed WWTP and will be made from soils excavated from the footprint of the proposed WWTP and from the tunnel and pipelines. The earthwork bank will be made up of four curved landforms, sloping down to ground level at the end of each landform to allow an air gap for ventilation across the proposed WWTP. The ends of the landforms will overlap, forming oblique gaps in the earthwork bank. The outside slopes of the bank will be gently sloped and seeded with grass and wildflowers and planted with trees. A hedgerow with groups of standard trees will be planted around the top of the earthwork bank.			conditions and high temperatures

Secondary mitigation

Construction

2.8.23 Climate resilience effects have not been identified for the construction phase as the climate will not have significantly changed within the timescales of construction.

2.8.24 The risks associated with present-day climate conditions and associated weather events experienced during the construction phase, are addressed within the CoCP and associated management plans. More details can be found within the CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1).

2.8.25 Specific measures in the CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) and CEMP will consider extreme weather risks and appropriate measures for the construction phase, such as:

- Procedures and precautions to be implemented in case of flooding, including temporary demobilisation plans. These procedures should consider prolonged and intense rainfall events that may lead to staff safety risks or pollution risks where construction materials (e.g. dust, contaminants, metals, or oils) have potential to runoff into watercourses. This should consider likely surface water runoff routes and plans for the protection of plant such as fuel storage and materials stockpiles or demobilisation of vehicles and items of mobile plant.
- Workforce health and safety plans and welfare management systems to be put in place by the contractor, including details to be outlined within works plans and task briefs as appropriate. These should consider both low temperatures, snow and ice which may lead to injury to construction staff due to slips and falls, and also high temperatures, which may lead to risks of heatstroke, especially for construction staff working in exposed locations at a distance from welfare facilities.
- Contingency plans for situations where flooding leads to restricted site access or key staff being unable to get to work, leading to construction delays.
- Contingency plans for situations where storms, high winds or flooding lead to loss of mains power supply or communications, and the identification of safety critical and construction programme consequences.

2.8.26 The CoCP Part A (Appendix 2.1, App Doc Ref 5.4.2.1) will include subscription by key construction staff to Environment Agency flood alerts, and UK Met Office weather warnings and other industry weather alert systems as available.

Operation

2.8.27 This section outlines the operational management plans that will be adopted during the operation phase and which will support resilience of the Proposed Development.

Landscape, Ecological and Recreational Management Plan

2.8.28 The LERMP is included within the Application (Appendix 8.14, App Doc Ref 5.4.8.14). The purpose of the LERMP is to set out how landscape, recreational features and ecological habitat and enhancements (vegetation and habitats) would be protected and managed following construction for a period of 30 years and will provide mitigation for the in-combination impacts of climate change as well as the Proposed Development upon these features during this period. Post grant of the DCO and prior to commencement of landscaping works an updated plan will be prepared and agreed with the local authority.

2.8.29 Beyond the temporal frame of the LERMP, the effects of climate change on landscape and biodiversity will be managed as part of The Applicant's asset management plan, in line with biodiversity strategies and management plans to be written and updated in subsequent decades through the remainder of the operational phase, within the context of the observed effects on climate change and projected effects on climate change on the wider geographical area.

Operational Management Plans related to EMS as part of Environmental Permit

2.8.30 Operation and maintenance activities would be subject to operational management plans and procedures. The management plans and procedures will sit within the EMS required under the environmental permitting regime. These would be 'live' documents that identify the environmental risks and legal obligations associated with the operations of the Proposed Development once construction has been completed. These specify the management measures the operator will implement in order to prevent or minimise both the environmental effects associated with the Proposed Development and the impacts of climate change upon the Proposed Development.

Asset management plan

2.8.31 Periodic inspection and maintenance of structure conditions will be included within The Applicant's asset management plan for the Proposed Development throughout the operation phase. The asset management plan will include inspection and monitoring of key assets including structures, electrical equipment, boiler, gas to grid and CHP units, outfall, earthworks, pipework. Weather triggers (specific temperatures and/or durations of weather extremes that trigger an inspection will be defined within the relevant plans. A repairs and replacement regime will form part of The Applicant's asset management plan, which will include replacement or repairs of damaged assets and which will assist in improved resilience of those assets. Such planned inspection and maintenance will also be used to keep the waste water processes and the surface water drainage infrastructure clear and operating effectively and efficiently.

2.8.32 The applicant's asset management plan will include the review of projected maximum temperatures in order to determine renewal requirements of equipment and any necessary amendments to the specification (such as operational temperature ranges) of climate sensitive equipment such as electrical equipment and cooling equipment, according to updated climate projections. Upgrades will be made to equipment should they encounter failure due to temperatures within their design life.

2.8.33 The applicant's asset management plan will include monitoring of the frequency and size of flood events and the response of the Proposed Development and waste water network to these, with a forward plan for installing additional pump capacity as required as climate change affects winter rainfall.

2.8.34 For individual flood events, The Applicant's asset management plan will outline the use of available early warning systems such as Met Office weather forecasts and Environment Agency flood warnings to inform and alert key staff as part of flood management procedures.

2.8.35 Further details of secondary mitigation to be included within The Applicant's asset management plan are included within Appendix 9.1 (App Doc Ref 5.4.9.1). The mitigation listed in this document are secured through inclusion in DCO Schedule 2 of a requirement to implement the mitigation listed.

Odour Management Plan

2.8.36 The Preliminary Odour Management Plan (Appendix 18.4, App Doc Ref 5.4.18.4) notes that capacity has been included within the design to allow for the installation of additional equipment to manage future increases in turbulence, aeration and odour emissions that may be exacerbated due to climate change. Monitoring of odour levels and determination of the need for future odour management mitigations will be ensured through the odour management plan.

2.8.37 Details regarding the specification of odour control technology and options for management of odour in future higher temperatures will be considered and managed through the Odour Management Plan secured by the Environmental Permit, which will dictate the process for reporting and managing odour units and identifying future need for odour management. Further details of existing and future odour management solutions can be found in Chapter 18: Odour.

Monitoring of Climate Risks to the Proposed Development

2.8.38 During the operational phase, monitoring will be carried out according to the Applicant's asset management plan that are to be created post-construction for the Proposed Development.

2.8.39 The Applicant's asset management plan will include the following monitoring:

- periodic monitoring of structure conditions for deterioration of metals and plastic elements due to higher temperatures;
- monitoring following extreme storm, rainfall and temperature weather events, according to weather triggers for inspection (such as temperatures above design tolerances limits, surface water flooding of the access road or essential areas of hardstanding);

- temperature monitoring within the housings of electrical equipment that are expose to high temperatures;
- temperature monitoring of further temperature-vulnerable elements of the design as required according to the response of structures or equipment to high temperatures;
- inspection of the boiler and CHP components to ensure its function in extreme temperature events;
- periodic inspection of the surface water drainage infrastructure and wastewater network for siltation or obstruction;
- periodic inspection of surface water drainage pipework, structures, pipeline bedding and outfall structure for surface water scour or damage;
- periodic inspection of earthworks for signs of ground movement;
- monitoring of temperatures within digesters and other wastewater systems to identify the need for additional coolers; and

2.8.40 Monitoring of the frequency and size of flood events and the response of the Proposed Development and waste water network to these, with a forward plan for installing additional pump capacity as required.

Decommissioning

2.8.41 Decommissioning of the existing Cambridge WWTP would be subject to a Decommissioning Management Plan, which is to be agreed with the Local Planning Authority. An outline Decommissioning Management Plan Application (Appendix 2.3, App Doc Ref 5.4.2.3) describes measure applied to this activity. Post grant of the DCO and prior to commencement of decommissioning a detailed plan will be prepared and agreed with the LPA.

2.8.42 Decommissioning of the existing Cambridge WWTP is outside the scope of the climate change impact assessment.

2.9 Assumptions and limitations

Data limitations and assumptions

2.9.1 The baseline has been constructed using data for the 25km grid square within which the study area is located. The grid square used is coordinates x = 537500, y = 262500 as provided from the UKCP18 probabilistic projections dataset.

2.9.2 The baseline for climate resilience considers both the present-day climate and how the climate may change in the future as a result of climate change, expressed as the outputs of climate modelling, referred to as projections and obtained from a third-party source (the UK Met Office). Climate projections are not predictions or forecasts but scenarios of future climate under a range of hypothetical emissions scenarios and assumptions. The results, therefore, from the experiments performed by climate models cannot be treated as exact or factual, rather they are scenarios. They represent internally consistent representations of how the climate may evolve in response to a range of potential forcing scenarios and their reliability varies between climate variables. Scenarios exclude outlying "surprise" or "disaster" scenarios in the literature and any scenario necessarily includes subjective elements and is open to various interpretations. Generally global projections are more certain than regional, and temperature projections more certain than those for precipitation and other variables. Further, the degree of uncertainty associated with all climate change projections increases for projections further into the future. Figures for climate variables provided in this report are based upon these projections and are based on a high emissions scenario which assumes a scenario of continued greenhouse gas emissions (RCP8.5), as recommended for use in EIA in the IEMA Environmental Impact Assessment Guide to Climate Change Adaption and Resilience (2020).

Assessment assumptions

2.9.3 The assessment of the climate change impacts on the Proposed Development required data from Anglian Water on the Proposed Development design. Where information is not available (for example because it will be available at the detailed design stage), expert judgement and industry benchmarking has been used to undertake the assessment.

2.9.4 The COVID-19 pandemic did not influence the methodology or data used to prepare this Environmental Statement as no consultations or surveys were conducted that may have affected the baseline. The pandemic did result in changes in global emissions, which raised uncertainties in future emission scenarios, due to significant changes in lifestyles (such as reduced international travel and reduced commuter traffic due to more employees working from home). However, this has not impacted upon the assessment for climate resilience as a conservative approach using the high emissions scenario (RCP8.5) has still been used. There is currently not sufficient evidence to support the use of a less conservative scenario and it has been seen that effect of COVID-19 on future emissions has not been permanent.

3 Baseline Environment

3.1.1 The climate baseline is defined in two-parts:

- Present-day baseline (current baseline); and
- Future baseline.

3.1.2 The climate change baseline is defined in two-parts: the present-day baseline conditions (averaged over the period 1981-2000) and projections of future climate, modelled as a departure from present-day conditions.

3.1.3 This baseline has been constructed using desk-based reviews and no surveys or modelling has been used to inform the baseline. The effect of COVID-19 on prevailing conditions has not impacted the baseline.

3.2 Current baseline

3.2.1 The present-day baseline is defined as the average climate over the 20-year time period 1981-2000 that has been used in the UKCP18 climate models.

3.2.2 For the Scoping Report, historic and projected changes in regionally averaged climate data was used. This regional data captures average climate values for across the East of England UK administrative region (as defined by the UK Met Office) (Met Office, 2016) within which the study area resides.

3.2.3 In order to provide an improved level of detail for the present-day climate baseline within the study area, the baseline values presented here are for the 25km grid square[2] within which the Proposed Development is situated. For some climate variables, data is not available at the 25km spatial resolution, in which case this is stated and the regional values for the East of England are presented (Met Office, 2016).

3.2.4 The present-day baseline is presented in Table 3-1. The variables presented are the maximum summer and minimum winter values for temperature, and seasonal averages for rainfall. Winter is defined as the average values for the months of December - February (inclusive) and summer is defined as the average values for the months of June - August (inclusive).

Table 3-1: Present-day (1981-2000) climate baseline

Climate variable	Baseline value
Average seasonal maximum air temperature (summer)	21.5 °C
Average seasonal minimum air temperature (winter)	1.27 °C
Average seasonal mean temperature (summer)	16.3 °C
Average seasonal mean temperature (winter)	4.3°C

[2] Grid square id: 537500.00, 262500.00

Climate variable	Baseline value
Precipitation rate (mm) (winter)	125.15 mm / season (equivalent to 1.4mm per day[3])
Precipitation rate (mm) (summer)	144.93 mm / season (equivalent to 1.6mm per day)
High winds, storms and lightning events	Out of scope
Snow and ice	25km grid data not available. The average number of days with snow or icefall each year is between 20-30. Snow does not always settle and the number of days with snow lying is between 5-15.
Air Frost	25km grid data not available. The average number of days a year with air frost is approximately 55 inland in the East of England.
Sunshine and solar gain	25km grid data not available. Across the region, annual averages range from about 1450 hours to 1600 hours.

3.2.5 It should be noted that, unusually, summer rainfall is high in the east of England (whereas for much of the UK it is expected that summer is drier than winter). This is due to a combination of both the 'rain-shadow' effect caused by higher ground to the west, which attenuates the effect of Atlantic depressions on winter rainfall, as well as a higher frequency of convective rainfall in summer (Met Office, 2016).

3.3 Future baseline

3.3.1 The projected future climate is expressed as a departure from the present-day baseline, in accordance with climate modelling standard practice. The future climate baseline refers to the projected climate that may be experienced at the study site in both the 2050s (the average climate for the period 2040-2059) and the 2090s (the average climate for the period 2080-2099).

3.3.2 The impact assessment considers risks to the 2090s but takes account of embedded design mitigations including routine replacements for receptors whose operational lifetime is not to the 2090s (such as mechanical and electrical equipment). As such, the interim period of the 2050s is taken into consideration to determine if climate impacts are likely to be significant even before the end of life of some receptors. This is an updated approach from the Scoping Report in response to the Scoping Opinion. It is based on the assumption that critical elements of design that constitute the Proposed Development and its operation do not have a projected end-of-design-life and as such are assessed for climate resilience to the end of the century (2099). Refer to Section 4.2 for more details on the receptors and on assumptions around design-life.

[3] Daily precipitation is calculated as the seasonal precipitation divided by 90 days

Temperature and rainfall projections

3.3.3 Temperature and precipitation variables were used to understand the extent of climate change, both chronic changes to average seasonal conditions as well as changes to the intensity of acute, extreme weather events. This information is used to inform both the magnitude and sensitivity of impacts identified, either where impacts are directly related to the specific climate variables outlined, or to the overall trend that the variables are indicative of. For example, future summer temperatures and rainfall are indicative of increased drought-like conditions.

3.3.4 Where impacts relate to overall trends, or to climate variables that do not have quantified projected model data, a qualitative assessment is used based on expert knowledge of climate change trends under the RCP8.5. Refer to Section 2.2 for further details on the assessment methodology.

3.3.5 An overall summary for climate change trends for the East of England (under a range of emissions scenarios modelled in UKCP18) is to experience hotter, drier summers, and warmer, wetter winters.

Temperatures

3.3.6 Table 3-2 outlines:

- Projected probabilistic changes in key average climate variables under RCP 8.5 emissions scenario, for the 2050s and the 2090s. The resultant values in °C are calculated based on these increases against the present-day observed baseline
- UKCP18 dataset projections for the extent of future maximum temperatures. It should be noted that these values are modelled as absolute values (rather than as a departure from the 1981-2000 present-day baseline).

Table 3-2: Projected future temperature baseline in the 2050s and 2090s

		Projected value in the future					
		2050			2090		
Climate variable		10th percentile	50th percentile	90th percentile	10th percentile	50th percentile	90th percentile
Winter							
Average seasonal minimum air temperature	*projected increase (°C)*	0.52	2.07	3.76	1.15	3.47	6.17
	resultant temperature (°C)	1.79	3.34	5.03	2.42	4.74	7.44
Average seasonal mean temperature	*projected increase (°C)*	0.57	2.07	3.63	1.36	3.53	5.78
	resultant temperature (°C)	4.87	6.37	7.93	5.66	7.83	10.08
Summer							
Average seasonal mean temperature	*projected increase (°C)*	1.06	2.92	4.85	2.49	5.35	8.52
	resultant temperature (°C)	17.36	19.22	21.15	18.79	21.65	24.82

		Projected value in the future					
Average seasonal maximum air temperature	*projected increase (°C)*	0.96	3.32	5.84	2.33	6.10	10.19
	resultant temperature (°C)	22.46	24.82	27.34	23.83	27.60	31.69
Maximum modelled temperature (°C) during summer months (Jun-Aug)		35.62	38.10	40.97	35.86	41.11	47.02

3.3.7 Figure 3.1 shows graphically the projected trend in hotter summers and warmer winters under the high emissions scenario s under the high emissions scenario (RCP8.5).

3.3.8 Under this scenario, temperatures are projected to rise across both summer and winter. By the 2090s, summer average daily temperatures may increase from 16.3°C to 21.6°C, or to 24.8°C for the hottest projected conditions. Winter average daily temperatures are also increasing and by the 2090s may increase from 4.23°C to 7.9°C, or 10.0°C for the warmest projected conditions.

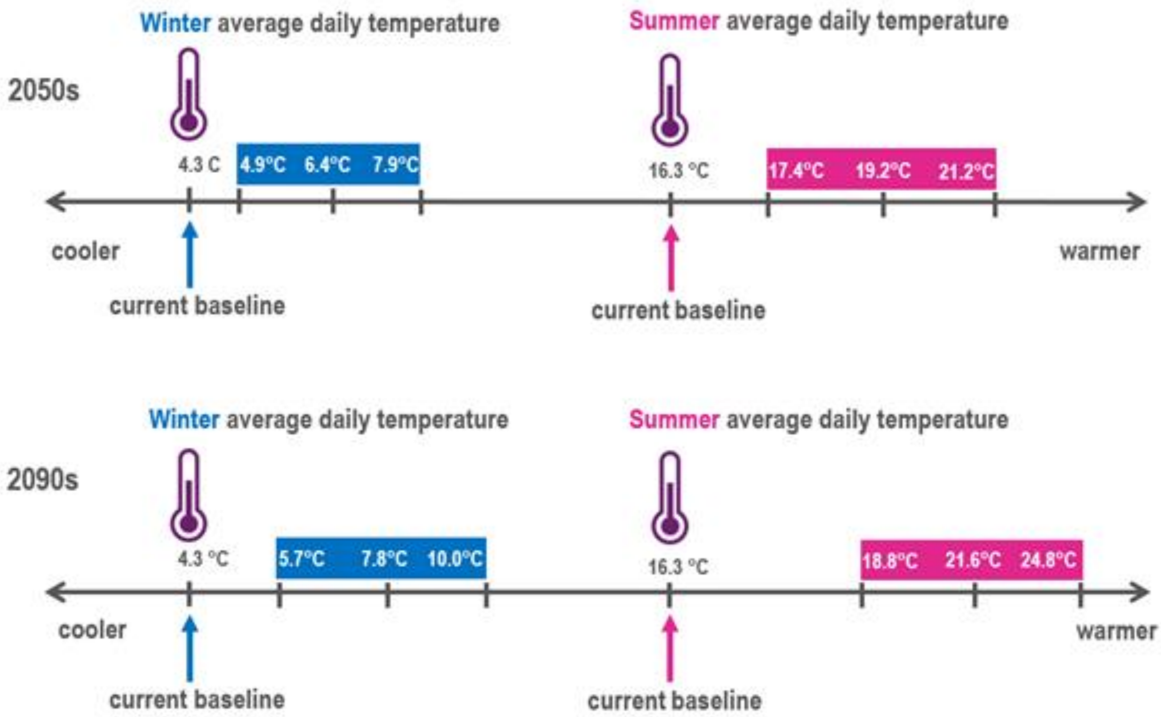

Figure 3.1: Baseline and future average daily temperature range in the 2050s and 2090s

Source: Adapted by Mott MacDonald from UK Climate Projections (2018) Probabilistic Projections, UK Met Office, Crown Copyright. Note: The shaded areas show the range in the projected change. Not to scale.

Precipitation

3.3.9 Table 3-3 outlines:

- Projected probabilistic changes in precipitation under RCP 8.5 emissions scenario, for the 2050s and the 2090s. The resultant values in mm are calculated based on these increases against the present-day observed baseline

- UKCP18 dataset projections for the extent of future maximum amount of rainfall (mm) that may fall in a 24hour period during winter (Dec-Feb). It should be noted that these values are modelled as absolute values (rather than as a departure from the 1981-2000 present-day baseline).

Table 3-3: Projected future precipitation baseline in the 2050s and 2090s

		Projected value in the future					
		2050			2090		
Climate Variable		10th percentile	50th percentile	90th percentile	10th percentile	50th percentile	90th percentile
Winter							
Precipitation rate	*projected % change*	-4.93	12.28	31.50	0.86	22.09	46.83
	Resultant precipitation (mm)	1.33	1.57	1.84	1.41	1.71	2.06
Summer							
Precipitation rate	*projected % change*	-51.77	-22.95	6.30	-66.74	-35.50	-0.19
	Resultant precipitation (mm)	0.77	1.23	1.70	0.53	1.03	1.60
Maximum modelled amount of rainfall (mm) that may fall in 24hours during winter (Dec-Feb)		26.97	33.41	41.69	28.77	37.93	50.04

3.3.10 Figure 3.2 shows graphically the projected trend in drier summers and wetter winters under the high emissions scenario by the 2090s under the high emissions scenario (RCP8.5). Under this scenario, by the 2090s, the summer average daily precipitation rate may remain the same at 1.6 mm or decrease to 0.5 mm under the driest conditions[4]. By contrast, by the 2090s, winter average daily precipitation rate may remain at 1.6 mm or increase up to 2.3 mm under the wettest conditions[5].

[4] Summer average daily precipitation rates in the 2090s are taken as the 50th percentile probabilistic estimate (1.0 mm) and the 10th percentile for the driest probable conditions (0.4 mm)
[5] winter average daily precipitation rates in the 2090s are taken as 50th percentile probabilistic estimate (2.3 mm per day) and the 90th percentile for the wettest probable conditions (2.9 mm)

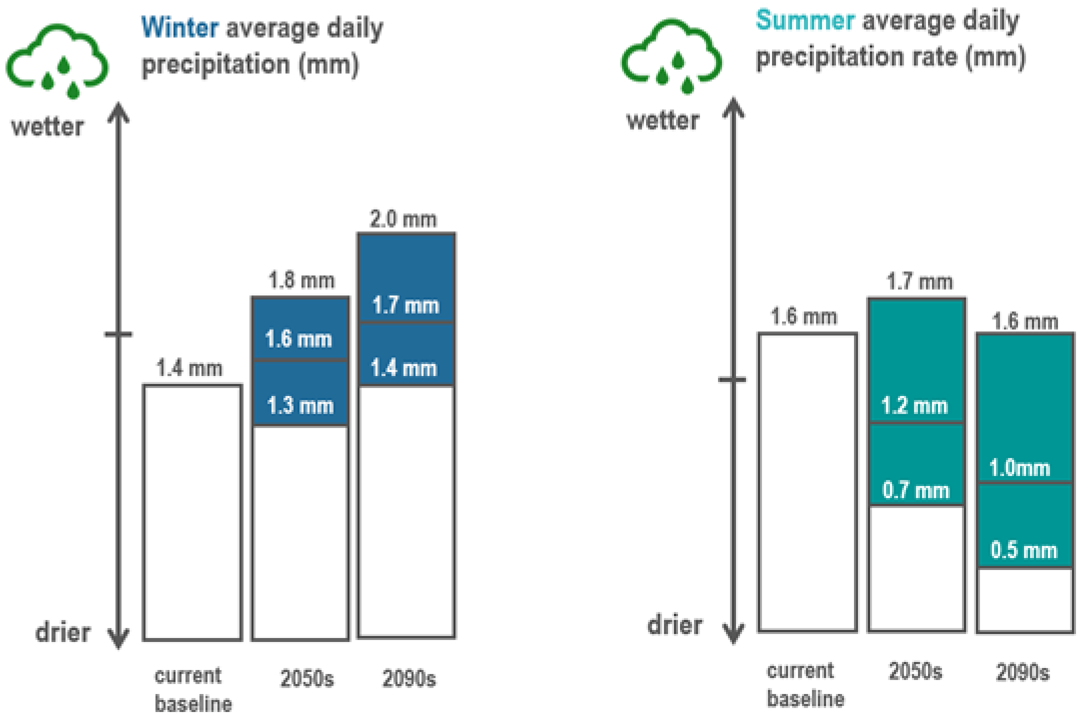

Figure 3.2: Baseline and future precipitation in the 2050s and 2090s

Source: Adapted by Mott MacDonald from UK Climate Projections (2018) Probabilistic Projections, UK Met Office, Crown Copyright. Note: The shaded area shows the range of the projected change. Not to scale.

Snow and Ice

3.3.11 As can be seen from Table 3-2, minimum temperatures are projected to increase which will lead to a decrease in the number of cold events (days when snow and ice fall or settle). Data is not available for the projected change in the number of snow and ice days. Whilst increased precipitation during winter and spring, as shown inTable 3-3, could increase the potential for frozen precipitation (i.e., snow and ice), increasing temperatures reduce the likelihood. Overall, by both the 2050s and by the 2090s there is likely to be a reduction in the frequency of ice and snow fall and a decreased risk of it settling.

River flow and rainfall intensity allowances

3.3.12 For indicative purposes, the future baseline also presents peak river flow allowances for the Cam and Ely Ouse Management Catchment area (Environment Agency, 2022) (Table 3-4:) and the peak rainfall intensity allowances (Table 3-5) as provided by the Environment Agency (Environment Agency, 2022). These values do not represent projected future river levels or surface flood levels. Instead, they are indicative of the extent of change from present day levels that could occur and which the Environment Agency recommends that infrastructure projects should consider within their flood risk assessments. The impact assessment considered these values when assessing flood risk but considers precipitation projections when assessing impacts to infrastructure and vulnerabilities due to changes in rainfall pattern.

3.3.13 The fluvial flood modelling conducted and used within Appendix 20.1: Flood Risk Assessment (App Doc Ref 5.4.20.1) identified the Central (9%) peak river flow allowance as being applicable, based on peak river flow allowance categories identified and in consideration of the life-time of the development to the 2080s epoch (2070-2125). For precautionary purposes, the fluvial modelling has used a 20% climate change allowance which is therefore beyond the Environment Agency requirements (and is in line with the Higher Central estimates).

Table 3-4: Peak river flow climate change allowances

Parameter	Time horizon	Central	Higher Central	Upper end
Cam and Ely Ouse Management Catchment peak river flow climate change allowances	2080s	9%	19%	45%

3.3.14 For developments with a lifetime beyond 2100, the Environment Agency requires that peak rainfall intensity allowances be considered for the Upper end allowance is used for both the 1% and 3.3% annual exceedance probability events for the 2070s epoch (2061 – 2125) as noted in Table 3-5.

Table 3-5: Peak rainfall intensity allowances

Parameter	Time horizon	Central	Upper end
3.3% annual exceedance rainfall event	2050s	20%	35%
	2070s	20%	35%
1% annual exceedance rainfall event	2050s	20%	40%
	2070s	25%	40%

3.3.15 The Drainage Strategy (Appendix 20.1, App Doc Ref 5.4.20.21) outlines the management of surface drainage at the Proposed Development and mitigation of the risk of surface flooding. The strategy states that a climate change allowance of 40% rainfall uplift (for a 1 in 100 year event) will be used for the drainage design. This is in line with the Upper end allowance recommended by the Environment Agency the Proposed Development.

3.3.16 Furthermore, according to the Environment Agency Risk of Flooding from Surface Water (RoFSW) maps, the risk of surface water flooding on site is considered to be "Very Low". Areas identified to be at "Very Low" risk have a less than 1 in 1,000-year (0.1%) annual risk of flooding from surface water sources. In a "Low" risk (1 in 1,1000-year to 1 in 100-year) surface water flooding event, the site would largely be unaffected. Maximum flood depths of 0.6m to 0.9m may occur in a "Low Risk" event along the track at Snouts Corner, north-east of site. As there is no evidence of overland flow routes across the site, it is considered likely that additional future rainfall, in the event of climate change, could be adequately managed by onsite drainage (subject to verification of greenfield runoff rates according to the CIRIA 753 guidance) and additional drainage designed in line with the Drainage Strategy. In the 2080s and beyond, there is flexibility and design capacity within the Proposed Development to enhance the drainage system (for example by installing larger pipework as pipes are replaced upon end-of-life). In summary therefore, the risk of flooding from surface water sources is considered to be low, and a 40% uplift factor to account for climate change is considered appropriate and in line with Environment Agency guidance. Refer to Chapter 20: Water Resources for further details.

3.3.17 Fluvial flood modelling of the River Cam water levels has been undertaken (Appendix 20.5: Fluvial Model Report (App Doc Ref 5.4.20.5)) to understand how the treated effluent and storm water discharges to the river could affect flood levels. The model indicates that in a 1 in 100 year flood event, with an 20% allowance for climate change, there would be a less than 7mm increase in water levels in the River Cam, leading to a negligible change in the potential area of inundation across the floodplain. Therefore, the magnitude of impact to fluvial flood risk due to final effluent and storm water discharges from the proposed WWTP is considered negligible. The effect on potential receptors, which could include properties, dwellings and infrastructure of high or very high sensitivity, is assessed as slight adverse and therefore not significant.

3.3.18 The Proposed Development includes provision for population growth, and storm water management to ensure storm water spillages are managed within the design under future climate conditions. Refer to Appendix 20.10: Storm Model Report (App Doc Ref 5.4.20.10) for further details.

Summary

3.3.19 The above climate variables identify the following trends in climate and related climate hazards that are considered to be of relevance for the assessment of climate impacts and the likely significant effects:

- Increasing average seasonal temperatures during both summers and winters
- Increased maximum summer temperatures
- Increased total rainfall in winter
- Reduced total rainfall during summer
- Increased frequency and intensity of heavy rainfall events

Impacts of climate change on future baseline

3.3.20 The assessment of in-combination climate impacts will address the impacts of climate change on the future baseline for other aspects. Refer to the in-combination climate impacts heading within Section 4.3.

4 Assessment of Effects

4.1.1 The section presents the assessment of effects and sets out a preliminary assessment that takes into account primary and tertiary mitigation in determining effects and then considers secondary mitigation and the assessment of residual effects.

4.1 Construction phase

4.1.1 Climate resilience effects have not been identified for the construction phase as the climate will not have significantly changed within the timescales of construction. The assessment of the construction phase is outside of the scope of this assessment.

Monitoring

4.1.2 For climate resilience no monitoring is required for construction of the Proposed Development.

4.2 Operation phase

4.2.1 This section sets out the assessment of effects in relation to the operation and maintenance of the proposed WWTP including the landscaping proposals, final effluent pipeline, outfall, transfer tunnel and new access connection connecting with the B1047 Horningsea Road.

4.2.2 During the Proposed Development's first 50-60 years of operational lifetime (up until 2099), changes in climate as outlined in Section 3.3 are likely to be experienced in the study area. These changes in climate may result in a range of impacts on operation of the Proposed Development.

4.2.3 Impacts on the Proposed Development due to changes in future climate conditions are outlined within this section, taking into account the primary mitigation within the design, and outlining the secondary mitigation that will be put in place during the operation phase.

4.2.4 Impacts due to the Proposed Development that may affect the local community and wider environment under future climate conditions are considered in Section 4.3.

Proposed WWTP built infrastructure and Waterbeach transfer pipeline

4.2.5 This section sets out the assessment of climate effects and potential for physical damage in relation to the elements of built infrastructure within the Proposed WWTP and connecting pipelines/tunnels and the Waterbeach transfer pipeline. The Waterbeach pipeline consists of a transfer section running from the north near Waterbeach to Low Fen Drove Way, a section crossing the area of land required for the construction of the proposed WWTP, a section south of the A14 which connects to the area of land where the existing Cambridge WWTP is located. The following built infrastructure receptors are included:

- buildings
- structures
- buried pipework
- overground pipework
- water utilities infrastructure
- access road
- internal roads
- areas of hardstanding
- transfer tunnel structure
- Waterbeach pipeline structure
- outfall Structure
- surface water drainage
- Gas to Grid membrane and carbon filter, or CHP unit, and boilers

4.2.6 Effects on the operation of the waste water process performed within these structures, pipework and tunnels are considered in Section 4.2.90.

4.2.7 Effects on workforce health and on landscaping are considered in Section s 4.3.33 and 4.3.52 respectively.

4.2.8 This assessment excludes the infrastructure at the existing Cambridge WWTP. Demolition of the existing Cambridge WWTP is also outside the scope of this project.

Higher summer temperatures: structural damage

4.2.9 Structural damage at higher maximum summer temperatures may occur due to expansion and thermal loading of metallic features and concrete structures, particularly for above ground structures such as pipelines, and parts of tunnels and parts of shafts that are above ground. This will in particular affect elements with metals and plastics, joints between concrete slabs. More rapid deterioration of structures or component parts may also occur due to higher average temperatures. This may lead to increased maintenance costs to address structural damage and disruption to operations of the Proposed Development during repairs.

4.2.10 The future summer maximum temperatures will present a risk of structural damage during shorter duration heatwave events, which is likely to affect exposed metal and plastic components in particular. Structures with a greater mass or with elements of the design that provide a cooling function, including those through which cooler effluent flows (such as effluent that from underground tunnels and pipework), will have greater resilience to these shorter duration events.

4.2.11 Primary mitigation for this risk includes a materials specification for future temperature ranges and maximums and a design basis temperature range of [-10 to 40°C]. The 50th and 90th percentile maximum summer temperatures are projected to exceed the design temperature range by the 2090s, with maximum temperatures of 41.11°C and 47.02°C. For the interim period of the 2050s, summer temperatures are projected to reach 38.1°C (50th percentile) and be as high as 40.97°C (90th percentile). Based on these projections, the design temperature range will be adequate for the 2050s but additional mitigations may be required beyond this time period.

4.2.12 Additional primary mitigation includes thermal protection such as painting or inclusion of natural ventilation / air conditioning options within buildings and outdoor shading, which will be specified to be included within the detailed design.

4.2.13 Since the lifetime of many of the most temperature sensitive receptors, including steel structures, M&E components and cabling is less than 30 years, routine replacement cycles will occur by the 2050s, at which time additional primary mitigations such as higher heat tolerances may be sought for the replacement parts.

4.2.14 Receptors with longer lifetimes include concrete structures, which will be resilient to the shorter-duration highest maximum temperatures due to their mass and structural qualities, and tunnels and pipework, which will have the cooling effect of the effluent or surface water drainages flows within them, and will be partially or wholly buried as described below, and are therefore not considered as sensitive.

4.2.15 For elements of the Proposed Development that are buried, such as pipelines and foundations, thermal insulation will be afforded by the ground and are therefore not considered as sensitive.

4.2.16 Materials such as the asphalt surface of the access road and areas of hardstanding will be particularly vulnerable to heat and solar gain, with the risk of localised melting and deterioration in exposed areas without shade.

4.2.17 Some of the Proposed WWT structures including pumps, settlement tanks, digesters, final effluent cooling and critical M&E equipment have an allowance within the design for additional cooling, if temperatures begin to rise to near or beyond the top of the design temperature range. Sludge levels in the aeration tanks can also be controlled and reduced in high temperatures as necessary. Whilst additional capacity is primarily to aid the future functionality of the WWTP processes (see Chapter 2: Project Description), this will additionally provide a cooling effect for the structures themselves.

4.2.18 The design has the flexibility and capacity to allow for changes in building materials as industry standards and techniques adapt to risks posed by increased summer temperatures during the operation phase. This additional capacity is embedded within the design however will be utilized at the appropriate point in the future based upon secondary mitigation measures outlined in Section 4.2.23.

Magnitude of impact

4.2.19 Increased average summer temperatures from present-day 16.3°C to between 18.8°C and 24.8°C by the 2090s[6] and higher summer maximum temperatures from present-day 35.62°C to between 35.86°C and 47.02°C by the 2090s that lead to frequent heatwaves for several days at a time are considered to be of **moderate** magnitude of impact.

Sensitivity of receptor

4.2.20 Based on the primary mitigations and monitoring that will take place as well the intention to replace (and upgrade) receptors as they reach their end of life, the sensitivity to temperature of the receptors that constitute the Proposed Development is considered to be **low.**

Significance of effect

4.2.21 The significance of effect is **adverse, minor**, and **not significant.**

Secondary mitigation or enhancement

4.2.22 There is a requirement for The Applicant to develop and implement an asset management plan, as outlined in Section 2.8.31 and Section 5.2. The plan will include periodic monitoring of structure conditions throughout the operation phase, to include inspection and monitoring of structures. This will include note of particular above ground elements comprising metals and plastics that are vulnerable to deterioration or damage due to heat, to be inspected during periods of high temperatures. Weather triggers (specific temperatures and durations that trigger an inspection will be defined within the relevant plans. A repairs or replacement regime will be part of The Applicant's asset management plan, which will include replacement of damaged structural assets and resurfacing of hardstanding, which will assist in improved resilience of those assets.

4.2.23 The design has the flexibility and capacity to allow for changes in building materials as industry standards and techniques adapt to risks posed by increased summer temperatures during the operation phase. Management of this renewal process and selection of climate-appropriate future components will be managed through The Applicant's asset management plan. The renewal and update of components of the Proposed Development at the end of their design lives, as outlined in Table 2-4: , will additionally give an opportunity to review up to date climate projections and replace with components specified to the appropriate climate parameters for their next design life period. This review of design standards with respect to future climate will form an ongoing element of The Applicant's asset management systems.

[6] 2090s average summer temperatures may range from 18.8°C (10th percentile) to 24.8°C (90th percentile). The 50th percentile increase is 21.6°C.
2090s summer maximums may range from 35.86°C (10th percentile) to 47.02°C (90th percentile). The 50th percentile is 41.11°C.

4.2.24 As the climate changes, the option to install temperature monitoring of sensitive structures or components will additionally be implemented as part of asset management.

4.2.25 Taking these into account the management and maintenance of assets throughout the operation phase, the sensitivity of the assets to higher temperatures will remain minor the significance of effect remains not significant.

Residual effect

4.2.26 The residual effect remains as **minor** and is not significant.

Higher maximum summer temperatures and in-combination weather events: mechanical and electrical equipment failure

4.2.27 Projected higher maximum summer temperatures will have effects on mechanical and electrical equipment that may include increased risk of overheating and fire risk, leading to safety risks and WWT process failure. This is likely to primarily relate to the summer maximum temperatures which, as outlined in Section 4.2.11, is projected to exceed the design parameter of 40^{o}C in the 2090s in both the 50th and 90th percentile scenarios. Most mechanical and electrical equipment has a lifetime of 10 to 25 years (as outlined in Table 2-4:) and will therefore be replaced during the 2050s. By the 2050s, maximum temperatures may reach 40 ^{o}C under the (90th percentile projections are for 40.97 ^{o}C as outlined in Table 3-3:). Upon replacement of equipment, new technologies (where available) and additional cooling options will be introduced in line with The Applicant's asset management plan, which will provide resilience to even higher temperatures in the future.

4.2.28 An additional risk to electrical and communications equipment relates to weather risks occurring at the same time, such as high summer temperatures in-combination with, or followed by, summer storms with flooding and/or lightning strike. While of a low likelihood of occurring, this could potentially lead to a sequence of electrical communications failures. Lightning risk has been addressed through the inclusion of lightning protection to installed in line with industry standards, and surface water flooding is addressed within the Chapter 20: Water Resources.

4.2.29 Increased summer temperatures in-combination with storm events may also increase the risk of a future loss of communications to the site, for example through storm damage to off-site mobile phone communication towers, which may occur in-combination with an inability of staff to access site (see Section 4.3.33). The detailed design specifications will incorporate primary mitigation such as situating critical equipment in less-sensitive parts of the building. A secondary means of maintaining remote digital communications, and/or automatic shut-off of systems, will also comprise M&E equipment where considered necessary, for instances when the key personnel cannot access the site.

4.2.30 The detailed design specification for the electrical and communications equipment includes contingency for a combination of extreme weather events, in particular for safety critical functions such as fire alarms. The design of the Proposed Development allows capacity for the installation of further equipment or systems if required in future decades in respond to changing climatic conditions.

Magnitude of impact

4.2.31 Increased average summer temperatures from present-day 16.3°C to between 18.8°C and 24.8°C by the 2090s[6] and higher summer maximum temperatures from present-day 35.62°C to between 35.86°C and 47.02°C by the 2090s that lead to frequent heatwaves for several days at a time are considered to be of **moderate** magnitude of impact.

Sensitivity of receptor

4.2.32 Based on the primary mitigations and monitoring that will take place as well the intention to replace (and upgrade) receptors as they reach their end of life, the sensitivity to temperature of the receptors that constitute the Proposed Developed is considered to be **low**.

Significance of effect

4.2.33 The significance of effect is **adverse, minor**, and **not significant.**

Secondary mitigation or enhancement

4.2.34 The Applicant's asset management plan will include the inspection of electrical and communications equipment to ensure its function in extreme temperature events. Monitoring of temperatures within key electrical housings and components exposed to high temperatures will be carried out, with the addition of extra cooling features as necessary.

4.2.35 The Applicant's asset management plan will include the review of projected maximum temperatures on renewal of equipment and an amendment to the specification of M&E equipment made accordingly according to updated climate projections. Upgrades will be made to equipment should they encounter failure due to temperatures within their design life.

4.2.36 Taking these into account the implementation of The Applicant's asset management plan to maintain and monitor heat-sensitive equipment and future thermal requirements, the residual sensitivity of affected receptors would remain low and the effect would be minor and not significant.

Residual effect

4.2.37 The residual effect remains **minor** and **not significant**.

Higher maximum summer temperatures: efficiency of energy plant (boilers, gas to grid and CHP unit)

4.2.38 It is currently proposed that biogas produced at the new sludge treatment centre will be firstly burned within onsite steam raising boilers to generate heat for use in the sludge treatment process and the surplus cleaned and exported from site to the national natural gas network, in a Gas to Grid treatment process. However, the more traditional approach of burning biogas within CHP engines to generate electricity, with the waste heat utilised within the process remains a fallback option and will also, at this stage, still be considered. In both options, the efficiency of the boilers as well as the CHP efficiency (for the fallback option only), will be detrimentally impacted by higher ambient temperatures. The Gas to Grid membrane and carbon filter are at a lower risk of overheating than CHP and boilers as they are not heat sensitive or heat producing. Therefore assessing the risks to CHP and boilers is a worst case assessment as the risk to Gas to Grid infrastructure is lower.

4.2.39 Furthermore, higher temperatures and regular overheating of mechanical and electrical equipment, including in the fallback of CHP, may marginally increase deterioration and lead to increased maintenance costs and downtime to perform maintenance and overhaul services to recover efficiency and conduct repairs. The lifetime of CHP units vary depending on their usage, with CHP units typically requiring overhaul approximately every 5000 hours (UK Government, 2021). The operational capacity of the CHP unit is -10°C to 40°C and has an expected lifetime of the CHP unit is 20years and so will be upgraded before the 2090s, when average daily temperatures are projected to exceed this thermal operating range.

4.2.40 Primary mitigations for the CHP unit include the ability to introduced additional air flow as a cooling measure, as well as replacement / upgrades to include new technology with a higher maximum temperature operating limit.

Magnitude of impact

4.2.41 Increased average summer temperatures from present-day 16.3^{o}C to between 18.8^{o}C and 24.8^{o}C by the 2090s[6] and higher summer maximum temperatures from present-day 35.62^{o}C to between 35.86^{o}C and 47.02^{o}C by the 2090s that lead to frequent heatwaves for several days at a time are considered to be of **moderate** magnitude of impact.

Sensitivity of receptor

4.2.42 Based on the primary mitigations and monitoring that will take place as well the intention to service and overhaul the CHP and boiler units as required, the sensitivity to temperature of the CHP and boiler units are considered to be **low**.

Significance of effect

4.2.43 The significance of effect is **adverse, minor**, and **not significant.**

Secondary mitigation or enhancement

4.2.44 The Applicant’s asset management plan will include the inspection of boiler and CHP components to ensure its function in extreme temperature events.

4.2.45 Secondary mitigations will also include monitoring of ambient temperatures and air pressure as well as processing efficiency of the Gas to Grid treatment mechanical equipment, CHP, and boiler. Boiler function can be managed during short duration peak temperatures by adjusting upstream effluent and sludge treatment if needed and applying sludge recycling to reduce gas emission rates from this sludge. This will allow the systems to manage extreme heat events.

4.2.46 Taking these into account the implementation of The Applicant's asset management plan to maintain and monitor receptor condition and operational efficiency, the residual sensitivity would remain low and the effect would be **minor** and not significant.

Residual effect

4.2.47 The residual effect remains **minor** and **not significant**.

Increased winter rainfall and heavy rainfall events: structural damage and flooding

4.2.48 Future rainfall projections will increase the risk of surface water flows from heavy rainfall events leading to erosion of soils and other materials around structures, making them vulnerable to damage. There will additionally be an increase in the risk of weakening and washout of the soil around culverts that support primary structural features, leading to structural damage.

4.2.49 An increase in rainfall intensity and standing water (at ground level and on flat roofs) may increase scour and erosion of buildings and structural elements, leading to increased risk of water ingress or egress from structures, building damage and reduced design life.

4.2.50 Intense rainfall may cause damage to the access road and areas hardstanding through scour or undermining of pavement sub-surfaces, which in the case of the access road could lead to restricted use of the sole access to the Proposed WWTW.

4.2.51 Surface water flooding of the access road and hardstanding areas could additionally lead to temporary lack of access and egress to and from the Proposed WWTW during and immediately following intense rainfall events.

4.2.52 Specifications for the detailed design will include appropriate consideration for water proofing, including consideration for increased winter precipitation and intensity of summer and winter rainfall events, to avoid water ingress or egress. Hardstanding areas will also be designed to include consideration of climate and will be well constructed to minimize scour and cracking.

4.2.53 The drainage design directs surface water into the drainage system and away from structures, therefore avoiding scour. The surface water drainage has also been designed to avoid surface water flooding of the access road, landscaped areas and areas of hardstanding within the Proposed WWTW. Flood waters due to rainfall directly onto process areas where any contamination risk (e.g. due to spillages) exists will be fed back to the works for treatment.

4.2.54 Future rainfall events may lead to an increased risk of damage and degradation of tunnels and pipework, including to the erosion of surrounding bedding material, which may lead to an increase in the likelihood of failure when transferring waste water to the Proposed WWTW, between processes, and to the outfall. An increased risk of surface water flooding exists to above ground parts of the pipeline, including the manhole covers for the air valves. These have been designed to be above future surface water flood levels, including an appropriate climate change allowance, to avoid this risk.

4.2.55 It is noted in the FRA that the Proposed Development is located at a very low risk flood site, defined as having a less than 1 in 1,000-year (0.1%) annual risk of flooding from surface water sources.

4.2.56 Surface water drainage will be managed on site through the surface water drainage system plus natural flood management through landscape planting. The surface water drainage design has been prepared in accordance with the Drainage Strategy (Appendix 20.21, App Doc Ref 5.4.20.21) and has included an uplift of 40% to account for additional extreme rainfall and surface flooding risk associated with climate change.

4.2.57 This achieves both the 25% Central climate change allowance recommended by the Environment Agency for a development within the Cam and Ely Ouse Management Catchment for a 1% AEP rainfall event in the 2070s epoch (as outlined in Table 3-5) and also the 40% Upper End climate change allowance recommended by the Environment Agency for the 2100s.

Magnitude of impact

4.2.58 Increased winter rainfall and heavy rainfall events that may result in structural damage and surface flooding are considered to be of **moderate** magnitude of impact, however it is noted that this risk is one that is likely to occur towards the end of the century.

Sensitivity of receptor

4.2.59 The sensitivity of receptors is considered to be **low**, as the surface water drainage system will manage rainfall taking into account the Environment Agency 40% uplift recommended for climate change.

Significance of effect

4.2.60 Given the primary mitigation of a surface water Drainage Strategy and drainage design, the risks of structural damage and surface water flooding due to heavy rainfall are considered to be **adverse, minor,** and **not significant**.

Secondary mitigation or enhancement

4.2.61 The Applicant's asset management plan will outline a proactive inspection and maintenance regime which will be carried out to keep surface water drainage infrastructure clear and operating effectively.

4.2.62 Inspections of the condition of the surface water drainage system, structures and pipeline bedding will be undertaken periodically as part of The Applicant's asset management plan, with repairs or replacement as required.

4.2.63 Taking into account the implementation of The Applicant's asset management plan to maintain drainage assets, the residual sensitivity would remain low and the effect would be **minor** and not significant.

Residual effect

4.2.64 The residual effect remains **minor** and **not significant**. No significant residual effect(s) have been determined.

Increased winter rainfall and higher fluvial flows: damage to the outfall structure

4.2.65 A risk of water ingress and physical damage exists from the flow of fluvial floodwater in or around the outfall structure, in addition to scour from surface water, and scour from the flows of effluent through the outfall itself. These are all likely to increase due to climate change as flow rates in the River Cam increase in response to projected increased rainfall within the catchment, and as surface water runoff and effluent flows increase. This will lead to increased scour rates during flood flows in the river leading to more rapid deterioration and need for earlier replacement of the outfall structure.

4.2.66 The design of the outfall has factored in CFD modelled fluvial flows, with an allowance for climate change of 20% to manage discharge flows and avoid turbulence. The modelling will inform the outfall design and will ensure discharge flows are dissipated and that scour is therefore minimised. The Proposed Development design at the outfall also includes scour protection works and the new outfall will be a permanent modification of the river bank.

Magnitude of impact

4.2.67 Higher fluvial flows due to heavier winter rainfall may lead to **minor** increases in structural damage to outfall and surrounding areas.

Sensitivity of receptor

4.2.68 Implementation of permanent scour protection at the outfall renders the sensitivity of the outfall and surrounding river bank to be considered **medium.**

Significance of effect

4.2.69 The significance of effect is **adverse, minor,** and **not significant.**

Secondary mitigation or enhancement

4.2.70 The Applicant's asset management plan will include a regime for inspections of the condition of the outfall will be undertaken periodically, with repairs or replacement as required.

4.2.71 Taking into account the implementation of The Applicant's asset management plan to maintain the outfall, the residual sensitivity would remain medium and the effect would be **minor** and not significant.

Residual effect

4.2.72 The residual effect remains **minor** and **not significant**.

Greater seasonal range between wetter winters and drier summers: ground movement

4.2.73 Ground movement and subsidence may become more likely due to climate change as soils become wetter during the winter due to heavier winter rainfall and then dry out and shrink during periods of drier, hotter weather in summers. This may lead to damage to buried pipework, the Waterbeach pipeline and Transfer Tunnels, structure foundations, and road and areas of hard standing, which in turn may lead to leakage or spillage of effluent, pollution events, and disruption to the operation of the Proposed Development.

4.2.74 Ground movement is very unlikely to affect the majority of the transfer tunnel which will be buried 24m below ground. For parts of pipes, air valves and shafts that are near the surface and at risk of subsidence, flexible HDPE (high-density polyethylene plastic) will be used, allowing the pipes to withstand the majority of ground movements.

4.2.75 Further primary design to manage this risk will include bedding design for pipeline and tunnel trenches and other subsidence resilience measures, to be determined during the detailed design phase according to geotechnical ground conditions.

Magnitude of impact

4.2.76 The magnitude of the impacts of ground movement due to climate change upon buried receptor performance and life are considered to be **moderate**

Sensitivity of receptor

4.2.77 Based on the primary mitigations including depth of buried pipework as well as material choice and ground movement protection, the sensitivity of receptors is considered to be **Low**

Significance of effect

4.2.78 The significance of effect is **adverse, minor,** and **not significant.**

Secondary mitigation or enhancement

4.2.79 The Applicant's asset management plan will outline a regime of inspections of the condition of all earthworks assets with repairs or replacement as required.

4.2.80 Taking into account the implementation of The Applicant's asset management plan to maintain the outfall, the residual sensitivity would be **negligible** and the effect would be **negligible** and not significant.

Residual effect

4.2.81 The residual effect is **negligible** and **not significant**. No significant residual effect(s) have been determined.

Increased winter rainfall, heavy rainfall events and summer droughts: pipework siltation

4.2.82 Climate change may create an increase in sediment load within waste water due to soil erosion within the catchment served. This can cause siltation within pipes within the waste water network and increased maintenance requirements. Soil erosion may be exacerbated by increased summer temperatures and drought leading to soil desiccation and vegetation dieback, leaving soils vulnerable to wind erosion and runoff during heavier rainfall events. This may also occur on a more localised scale within the surface water drainage system for the Proposed Development.

4.2.83 Pipework design includes consideration to manage siltation levels within flows. Furthermore, at the terminal pumping station there is capacity for additional inlet channel and screenings and grit handling.

Magnitude of impact

4.2.84 The impact of additional silt load due to climate change in the future is considered to be **minor.**

Sensitivity of receptor

4.2.85 Primary mitigations at the inlet design mean that the sensitivity of the receptors to additional silt load is considered to be **low.**

Significance of effect

4.2.86 Based on the primary mitigations within the pipework and inlet works design, the increased risks of pipework siltation due to climate change are considered to be **adverse, negligible,** and **not significant**.

Secondary mitigation or enhancement

4.2.87 The Applicant's asset management plan will outline an inspection and maintenance regime to keep the waste water network and surface water drainage infrastructure clear and operating effectively.

4.2.88 Taking into account the implementation of The Applicant's asset management plan to maintain the outfall, the residual sensitivity would remain **low** and the effect would be **negligible** and not significant.

Residual effect

4.2.89 The residual effect remains **negligible** and **not significant**.

Waste Water Processes

4.2.90 This section considers the effects of climate change on function of the waste water processes, within the Proposed WWTP and the Transfer Tunnel and Waterbeach pipeline.

Higher maximum summer temperatures and lower summer rainfall: septicity in process plant and tunnels

4.2.91 Higher projected summer temperatures, including higher maximum summer temperatures, may lead to an increased risk of septicity within Proposed WWT process plant, in the Transfer Tunnel and shaft, and Waterbeach pipeline. This may be a particular issue with maximum summer temperatures in-combination with low summer rainfall, which may lead to lower flows within the waste water network.

4.2.92 Within the tunnel and pipeline, lower future summer rainfall may affect the ability to function under low flow conditions, with changes to influent quality (less dilution within the catchment) and longer retention time slowing the movement of water within the transfer tunnel, contributing to risks of septicity. The majority of the Transfer Tunnel and the Waterbeach pipeline will be buried, which will provide thermal insulation during summer maximum temperatures. Risks will remain in at- and above ground WWTP structures, plant and pipework, however water temperatures will not increase by as much as air temperatures due to higher specific heat capacity and constant flows that will reduce solar water heating.

4.2.93 A septicity study has been conducted and used to inform the design of the transfer tunnel and tunnel shafts in order to avoid the risk of septicity and 'dead zones'. No specific allowances were applied to account for future drought conditions when determining dry weather flow rates within the network. However, conservative estimates for future low-flows were used by using the 2018 to 2019 low flow conditions, when there was a heatwave and a prolonged severely-dry period across much of the UK including the Cambridge area. Consideration for future higher temperatures of wastewater due to climate change was also made for corrosion calculations, using a maximum temperature of 30°C. Although future ambient temperatures may far exceed 30°C, due to the subterranean nature of the network, especially the transfer tunnel and Waterbeach pipelines, it is unlikely that climate change will affect flow temperatures beyond this extent (Appendix 20.5: Fluvial Model Report, App Doc Ref 5.4.20.5).

4.2.94 Combined climate effects of higher temperatures and drought conditions are likely to lead to regional water scarcity. However, the effect of this on low flows within the waste water network may be partially mitigated by population growth. Future dry weather flows used within the septicity design (including population growth) are estimated to be higher than current dry weather flows.

4.2.95 Primary mitigation for the risk of septicity includes design for low flows and for an operating temperature of the WWT process plant between air temperatures of -10 and +40 °C.

4.2.96 Further primary mitigation includes design of the pipeline which is based on modelling to minimise septicity risk under a range of flow scenarios, which includes consideration for the effects of climate change on flow rates and wastewater temperature (Appendix 20.6: 3D velocity/mixing model, App Doc Ref 5.4.20.6). The design of the WWTP processes have additional capacity and the ability for the final effluent flow to be recycled and rerouted back to the inlet works in order to introduce cooling, thereby reducing septicity risk within the WWTW plant and pipework.

Magnitude of impact

4.2.97 Based on septicity modelling conducted and future dry flow conditions which are estimated to be higher than present day (despite climate change) due to population growth, the magnitude of this impact is considered to be **minor**

Sensitivity of receptor

4.2.98 The sensitivity of the receptors to septicity risk is considered to be **medium**

Significance of effect

4.2.99 The significance of effect is **adverse, minor,** and **not significant.**

Secondary mitigation or enhancement

4.2.100 The Applicant’s asset management plan will include a regime of inspection and maintenance for the Proposed Development processes, to keep waste water network and surface water drainage infrastructure clear and operating effectively.

4.2.101 Taking into account The Applicant’s asset management plans to maintain the wastewater network and drainage infrastructure, the residual sensitivity would remain **medium** and the effect would be **minor** and not significant.

Residual effect

4.2.102 The residual effect remains **minor** and **not significant**.

Higher summer temperatures: anaerobic digestion efficiency

4.2.103 Projected increases in summer temperatures, including higher maximum summer temperatures are likely to negatively affect the efficiency of anaerobic digestion. During digestion, sludge is fed into a vessel in the absence of oxygen and maintained at about 35 to 42°C. Exceeding this temperature threshold affects the ‘pleasantness’ of handling sludge, and may affect the processes that reduce pathogen activity and odour however, due to the size of the digesters, there is capacity to maintain steady temperatures during temperature fluctuations, including short term heatwaves.

4.2.104 Under the maximum temperatures projected for the 2090s, for durations of heatwave conditions up to a week, temperatures within the digester are unlikely to consistently exceed their temperatures design limits.

4.2.105 Primary design mitigations includes the option to utilise additional capacity incorporated into the design for the installation of additional cooling plant and reduction in insulation as required.

4.2.106 The Proposed Development design also incorporates an allowance for future-fitting cooling equipment to the digesters should this be required, or for capacity to install digesters with additional cooling capacity during future replacements and upgrades.

Magnitude of impact

4.2.107 Increased average summer temperatures and higher summer maximum temperatures that lead to frequent heatwaves for several days at a time are considered to be of **moderate** magnitude of impact.

Sensitivity of receptor

4.2.108 Given the primary mitigation, the sensitivity of the digesters to future maximum summer temperatures is considered to be **low**.

Significance of effect

4.2.109 The significance of effect is **adverse, minor**, and **not significant.**

Secondary mitigation or enhancement

4.2.110 The Applicant's asset management plan will include the monitoring of temperatures and addition of extra cooling features as necessary around the digesters, using the capacity allowed for within the design. A review of projected summer maximum temperatures will be carried out on renewal of equipment and used to inform the specification of operational temperature ranges within the design life of renewed equipment.

4.2.111 Taking these into account the implementation of additional monitoring of anaerobic digestion processes within The Applicant's asset management plan, with additional changes being implemented as required, the residual sensitivity would remain **low** and the effect would be **minor** and not significant.

Residual effect

4.2.112 The residual effect is **neutral** and **not significant**. No significant residual effect(s) have been determined.

Increased winter rainfall and heavy rainfall events: stormwater

4.2.113 Increased winter rainfall due to climate change increases the risk that the stormwater volumes will exceed the capacity of the Storm Water Management Unit. There is also a risk that storm water may overwhelm the waste water network, causing foul water flooding at inlets or at locations upstream of the Proposed Development, which is considered within this section.

4.2.114 Risks to the River Cam are outlined in Chapter 20: Water Resources and in Section 4.3.74.

4.2.115 Storm storage has been designed to include allowances for future climate change under maximum design envelope parameters. The storm management system has been designed to have six storm pumps at terminal pumping station to handle flows beyond 'Flow to Full Treatment' flows of 2,000l/s, with the capacity to add more in the future to address higher flows if necessary. 20,400m^3 of storm storage has been provided (based on 68 litres per person in line with population growth rates) which includes onsite Storm Tanks (buried 5m) as well as the transfer tunnel providing as a source of storm storage of 5,186m^3. This amount of storm storage is in line with

Environment Agency allowances and the Storm Management approach has been agreed with the Environment Agency.

4.2.116 At the point of interception of the transfer tunnel to the Proposed Development inlet works, the tunnel increases in diameter and the invert steps down which aids the shaft to be hydraulically better than a flat pipe and reduce the risk of spills. The terminal pumping station is also designed to make the tunnel free discharging thereby not allowing the tunnel to fill and reach capacity.

4.2.117 Embedded within the design is additional capacity such that in the future, additional storm storage can be introduced as necessary based on changes to storm flows or discharge guidelines regarding stormflows.

4.2.118 These design features effectively avoid the overwhelming of the upstream waste water network or the Proposed Development by incorporating an allowance for climate change and additional capacity at the Proposed Development for the addition of further pumping station pumps if needed in the future.

Magnitude of impact

4.2.119 Increased stormflows in the future and the risk of foul water flooding at the Proposed Development or at the outfall are considered to be of **minor** magnitude.

Sensitivity of receptor

4.2.120 The sensitivity of the receptors (the Proposed Development infrastructure, and upstream waste water network) to higher future stormflows is considered to be **medium.**

Significance of effect

4.2.121 The significance of effect is **adverse, minor,** and **not significant.**

Secondary mitigation or enhancement

4.2.122 The Applicant's asset management plans will include monitoring of the frequency and size of flood events and the response of the Proposed Development and waste water network to these, with a forward plan for installing additional pump capacity as required as climate change affects winter rainfall.

4.2.123 For individual flood events, The Applicant's asset management plan outline the use of available early warning systems such as Met Office weather forecasts and Environment Agency flood warnings to inform and alert key staff as part of flood management procedures.

4.2.124 Taking these into account the use of The Applicant's asset management plan to monitor storm events and stormwater management efficacy, the residual sensitivity of receiving water bodies remains medium and the impact remains minor, the effect would be **minor** and not significant.

Residual effect

4.2.125 The residual effect remains as **minor** and is **not significant**.

Monitoring

4.2.126 During the operational phase, monitoring will be carried out according to The Applicant's Asset Management Plan that are to be created post-construction for the Proposed Development, which will outline the maintenance, repair and replacement of physical infrastructure and also will outline procedures to control and manage the wastewater processes. Details of monitoring activities to be included within The Applicant's Asset Management Plan are included within Appendix 9.1 (App Doc Ref 5.4.9.1).

4.2.127 The Applicant's Asset Management Plan will include:

- periodic monitoring of structure conditions for deterioration of metals and plastic elements due to higher temperatures;
- monitoring following extreme storm, rainfall and temperature weather events, according to weather triggers for inspection (such as temperatures above design tolerances limits, surface water flooding of the access road or essential areas of hardstanding);
- temperature monitoring within the housings of electrical equipment that are expose to high temperatures;
- temperature monitoring of further temperature-vulnerable elements of the design as required according to the response of structures or equipment to high temperatures;
- inspection of the boiler and CHP components to ensure its function in extreme temperature events;
- periodic inspection of the surface water drainage infrastructure and wastewater network for siltation or obstruction;
- periodic inspection of surface water drainage pipework, structures, pipeline bedding and outfall structure for surface water scour or damage;
- periodic inspection of earthworks for signs of ground movement;
- monitoring of temperatures within digesters and other wastewater systems to identify the need for additional coolers; and
- monitoring of the frequency and size of flood events and the response of the Proposed Development and waste water network to these, with a forward plan for installing additional pump capacity as required.

4.3 In-combination effects during operation phase

4.3.1 The impacts of the Proposed Development on the local community and wider environment in-combination with climate change are assessed within this section. These include changes in impacts on agricultural soils, air quality, biodiversity, community, health, landscape and visual impact, land quality, odour and water resources due to climate change, as the future climate may directly interact with these aspects. These impacts all relate to the operational phase.

4.3.2 In-combination effects are outlined as qualitative assessments, as agreed in the Scoping Opinion. Where risk assessments have been carried out by the aspect concerned, these are referenced within this section. Where in-combination climate impacts are identified within this chapter and where levels of certainty allow, risk ratings have been assigned. In line with IEMA guidance, these risk ratings follow the methodology outlined in Section 2.2, in assigning a magnitude of impact due to climate change over and above the magnitude of impacts identified in the associated technical chapter.

4.3.3 Sensitivity of receptors is allocated based upon the sensitivity identified in the associated technical chapter, unless it is considered that climate change may exacerbate or ameliorate the existing sensitivity. Where this is the case, this is outlined within the following text. Effect significant is assigned using the same criteria as defined within each respective technical chapter.

4.3.4 Uncertainties in the effects of climate change are noted as well as a summary of primary, tertiary and secondary mitigations where appropriate.

Agriculture and soils

4.3.5 Effects on agricultural soils and crops due to climate change may include water stress, soil desiccation and erosion, and flooding, as well as effects on farming infrastructure and access routes. The reinstatement of agricultural soils and field drainage post-construction will follow the mitigation measures set out in Chapter 7: Agricultural land and soils, including measures within the outline Soil Management Plan (Appendix 6.3, App Doc Ref 5.4.6.3), which will take place wholly within the construction phase and will be within timescales in which climate effects in comparison to the present-day climate will not have taken place. Soils will be returned to the same standard of soil quality as before construction.

4.3.6 Consideration of the effects of the Proposed Development on agricultural soils during the operation phase are scoped out, as identified in Chapter 7: Agricultural land and soils.

Risk assessment for in-combination climate impacts to agriculture and soils

4.3.7 Given the above, it is not considered that there will be climate effects in-combination with effects due to the Proposed Development on agriculture and soils, and therefore no risk assessment has been carried out.

Air quality

4.3.8 In-combination effects relating to air quality may arise from changes in air dispersal of the emissions from the energy plant (Gas to Grid or CHP and boiler plant) and traffic fumes due to future changes in local atmospheric conditions, and localised changes in atmospheric chemistry during future extreme summer temperatures. This may lead to changes to effects on air quality receptors as outlined in Chapter 6: Air Quality.

4.3.9 There are uncertainties relating future atmospheric conditions that mean that reliable assessment can't be made on future air quality risks in relation to climate change. There are also likely to be future variables in environmental permitting, in the design capabilities of CHP and boiler plant technology and upgrades during the operation phase, and in the types of transportation fuels used and traffic emissions generated as the century progresses.

4.3.10 Risks relating to air quality changes due to climate change will be managed though environmental permitting regulations and upgrades as necessary to the Gas to Grid or CHP and boiler plant during the operational phase of the Proposed Development. Capacity is available within the design to allow for future equipment upgrades as required to comply with permitting requirements.

4.3.11 Risks relating to traffic emissions due to climate change will be managed through Anglian Water travel and fleet vehicle policies, in response to broader national changes in vehicle fuel types and modes of travel.

Risk assessment for in-combination climate impacts to agriculture and soils

4.3.12 Given the above, it is considered that a reliable assessment on the in-combination impacts on air quality cannot be undertaken at this time. Air quality will be monitored in accordance with Chapter 6: Air Quality during the operation phase and plant and equipment upgraded as required to meet permitting requirements.

Biodiversity

4.3.13 Climate change may effect the long-term efficacy of biodiversity mitigation as well as an effect on ecological networks and habitats across the ecology study area as defined in Chapter 8: Biodiversity.

4.3.14 This section considers the effects of climate change on the proposed biodiversity mitigation design as part of the Proposed Development and the effects on biodiversity within the Ecology study area due to climate change.

General climate and biodiversity in-combination trends

4.3.15 Climate change effects in the region in general are likely to include a change in the spatial range and variety of species, with a potential for a greater prevalence of species from southern England and also invasive aquatic and terrestrial species. Some species currently present in the region may become extinct locally. Climate effects may include longer growing seasons, an earlier spring, and fewer species hibernating or migrating overseas for the winter. Drought conditions may occur more frequently leading to water stress, vegetation dieback and potentially changing flowering, seed generation and leaf drop seasons. The availability of food and habitats within an ecosystem may change or become scarce, which may have a disproportionate effect on seasonally dependent species such as migratory bird or pollinators. There is potential for pathogens and diseases that would typically be suppressed by cold winters to become more resilient or pervasive.

Primary and tertiary mitigation at the Proposed Development

4.3.16 Primary and tertiary biodiversity mitigations primarily comprise diversity within habitat creation plus specific measures outlined below. The exact response of ecosystems to climate change are uncertain however a diversity of habitats and species mixes will provide resilience for biodiversity in the area, through the provision of multiple food and shelter options for animals, fish and insects as different plant species either survive and flourish long term or fail due to climate changes.

Specific in-combination climate impacts on mitigation habitats

4.3.17 The following climate effects on specific habitats to be created as part of biodiversity mitigation.

Increased winter rainfall and heavy rainfall events: biodiversity mitigation habitats

4.3.18 Seasonal ponds: the ponds may be affected by changes to the inflow of surface water runoff with a result of overtopping during projected future wetter winters. In addition to this, the ponds may encounter scour during intense summer and winter rainstorm events resulting in damage to bank vegetation. Greater future overland flows and soil scour or erosion may generate a higher level of sediment in the pond water, smothering vegetation and the eggs of aquatic species.

4.3.19 Secondary mitigation includes management of surface water flows, including from the ponds into surrounding land / into watercourses and the landscaped area, to be included within The Applicant's asset management plan.

Reduced summer rainfall and increased drought conditions: biodiversity mitigation habitats

4.3.20 Seasonal ponds: the ponds have been designed to naturally dry up in the summer, however it may be that projected future hotter, drier summers may affect the species range that can tolerate longer or more intense periods of heat and drought. Primary mitigation includes a diversity of aquatic planting for the ponds and design to enable retention of water for a longer period during the spring.

4.3.21 Calcareous grassland: Hotter, drier summers may create vegetation dieback, however this effect should be limited as calcareous species favour well drained, drier soils. Embedded mitigation for this habitat comprises a diversity of calcareous grassland species.

4.3.22 Bee banks and other bee and wasp habitats: bee habitats may be affected by drier summer soils, however this may be both a positive and negative effect, with drier bee banks as the preferred habitat for mining bees, but less availability of wet mud required for nesting bees. Primary mitigation for bee habitats includes the creation of the seasonal ponds as rainwater retention features to retain summer rainfall to create temporary water sources through hot summers.

4.3.23 Water vole ditch network: changes in water levels to wetter winters and drier summers may affect the habitat of the water vole ditch network being created, in particular increasing the risk of ditches drying out. Primary mitigation includes designing the ditches to be created sufficiently deep and allowing for the installation of weir boards when required to retain water during future drier summer months.

Reduced summer and rainfall and increased winter rainfall: tree planting

4.3.24 The Landscape Section 4.3.53 outlines the climate risks to the tree planting around the perimeter of the Proposed Development as well as other primary as well as secondary mitigations. Primary mitigation primarily comprises a species diversity in tree planting, to include drought-tolerant species, and secondary mitigation to be included within the LERMP includes consideration around how future wooded areas and new planting will be watered.

Offsite impacts

4.3.25 Chapter 8: Biodiversity has considered the impacts to offsite ecology receptors, principally designated ecology sites. Climate change is likely to affect designation ecology sites in proximity to the Proposed Development, however the effects of Proposed Development during the operation phase are not considered likely to contribute or exacerbate climate effects on these sites.

Risk assessment for in-combination climate impacts to biodiversity

4.3.26 Risk ratings for in-combination climate impacts to biodiversity have not been assigned due to the levels of uncertainty around the response of species and habitats to climate change on a regional scale. It is likely that adverse effects will occur due to changes in temperatures and rainfall patterns and as such other, secondary mitigation has been outlined below.

Secondary mitigation or enhancement

4.3.27 The Applicant’s Biodiversity Strategy (Anglian Water Services, Biodiversity Strategy, 2019) outlines that “The resilience of wildlife to climate change will be enhanced through good habitat management, introducing microclimate variability and improving connectivity at a landscape scale.”

4.3.28 The management of the biodiversity mitigation to be created within the Proposed Development will be managed as part of the LERMP (Appendix 8.14, App Doc Ref 5.4.8.14) during the initial 30 years of the operation phase, as detailed in Section 4.3.62. Beyond that the effects of climate change will be managed through The Applicant’s asset management plan, in line with biodiversity strategies and management plans to be written and updated in subsequent decades through the remainder of the operational phase, within the context of the observed effects and projected effects on climate change on the wider geographical area.

4.3.29 No specific actions or monitoring is identified as secondary mitigation in relation to climate change.

Community

4.3.30 This section considers impacts to community receptors due to the Proposed Development in-combination with climate change during the operational phase.

4.3.31 Potential impacts to the community due to the Proposed Development primarily relate to odour, air quality and visual impact. The potential for elevated odour risks due to changing climate conditions is considered in Section 4.3.67. Effects relating to Air Quality and Landscape and Visual Impacts assessments in relation to climate change are outlined in Sections 4.3.8 and 4.3.52 respectively. Risks to health with respect to the community and the workforce at the Proposed Development are outlined in Section 4.3.33.

Risk assessment for in-combination climate impacts to workforce health

4.3.32 Given the consideration of impacts as part of other in-combination effects, no specific risks to community due to in-combination climate impacts are considered within this section.

Health

4.3.33 This section considers the effects of climate change on the health of the community and the workforce at the Proposed Development during the operational phase.

Increased winter rainfall and heavy rainfall events: community health

4.3.34 The risks of impacts to the water quality of the River Cam are considered within the Chapter 20: Water Resources, both from low flows and also storm flows, which in turn may affect the health of recreational river users such as canoeists, who may accidentally ingest river water. The climate risks to the water quality of the River Cam are summarised in Section 4.3.74, taking into consideration effects on water quality due to changing summer and winter rainfall patterns.

Increased winter rainfall and heavy rainfall events: workforce safe access and egress

4.3.35 Climate change may pose an increased risk of surface water flooding that could restrict access to the Proposed Development, including limiting or blocking access along the sole access road. This could have consequences of creating hazardous conditions for staff, including those attending as part of emergency response or carrying out repairs at the Proposed Development during extreme weather events. This could also limit emergency access for on-site staff in the event of injury during hazardous weather.

4.3.36 The safety of routes that staff would travel in attending site in extreme weather events have not been considered within this EIA however the need for them to attend and travel to site in hazardous conditions, such as storms, heavy rainfall, high winds, flooding or severe heatwaves, has been reduced through the provision remote access and communications mechanisms and the inclusion automatic shut-off of key systems. Allowing staff to travel after hazardous conditions have passed will mitigate the risks to their health and safety.

4.3.37 In addition to this, the proximity of the Proposed Development to the strategic highway network, which is likely to be well maintained and less prone to flooding or blockage by fallen trees, will reduce the hazardous travel routes to and from the WWTW during extreme weather events.

Higher average and maximum summer temperatures: workforce heat stress

4.3.38 Higher average summer temperatures will increase the level of discomfort for staff attending the site for routine maintenance, repairs and renewals or upgrades of equipment at the Proposed Development.

4.3.39 High summer maximum temperatures will pose health and safety risks to staff relating to heat stress / heat stroke, which may additionally create safety risks to systems should staff judgement be impaired by heat stress.

4.3.40 In-combination with risks to staff due to heat, regional water scarcity due to climate change has the potential to affect the availability of potable water for offices, staff and welfare facilities at the Proposed Development.

4.3.41 Tertiary mitigation included within the design considerations under CDM Regulations include the ease of replacement of equipment parts, which will in turn allow for quicker repairs or maintenance during the operation phase, reducing the exposure time of the workforce to hotter conditions.

4.3.42 Primary mitigation includes areas of shade and cool ventilated buildings, both at the Gateway building offices at the entrance to the WWTW and within the workshop midway across the WWTW. These will act as cool refuges to allow the workforce relief from extreme temperatures, and to allow individuals experiencing heat stroke symptoms a place to cool down.

Risk assessment for in-combination climate impacts to workforce health

4.3.43 A risk assessment has been carried out for in-combination climate impacts to workforce health as there is a reasonable level of certainty over human health and safety responses to extreme weather events.

Magnitude of impact

4.3.44 Increased average summer temperatures and higher summer maximum temperatures are projected to lead to frequent heatwaves for several days at a time, however primary mitigation reduces the exposure of staff to sustained high temperatures. Increased storm and flood risk, including in the wider Anglian region that pose a risk to the workforce have also been reduced due to primary mitigation such as remote access to systems. The result in a **minor** magnitude of impact.

Sensitivity of receptor

4.3.45 The sensitivity of the workforce to extreme weather is considered to be **high** due to risks associated with high temperatures such as heat stroke, and risks of injury during storms and floods, including in travelling to the Proposed Development.

Significance of effect

4.3.46 The impact on the workforce due to an increased frequency of extreme weather events, including storms, flooding and heatwaves due to climate change is considered to be **adverse, moderate,** and **significant**.

Secondary mitigation or enhancement

4.3.47 Secondary mitigation will aid health and safety considerations during the operational phase through consideration of the safety of staff required to attend site during extreme weather events.

4.3.48 Secondary mitigation measures that will be outlined within The Applicant's asset management plan will include remote monitoring systems that will reduce the requirement of staff to visit the sites during heatwaves.

4.3.49 The Applicant's asset management plan will include business continuity plans for abnormal operational conditions such as those resulting from extreme weather events, to include considerations such as:

- monitoring of the temperature of welfare facilities and the provision of cooling equipment as required;
- consideration of industry best practice around working in high temperatures, including guidance available from the Health & Safety Executive;
- programming of maintenance or equipment renewal works outside of typical periods of extreme weather such as peak summer temperatures or heavy rains as applicable to the works planned;
- the timing of regular, routine visits at cooler times of the day;
- contingency planning for emergency attendance at site, with consideration given to safe staff travel requirements during extreme weather events (for example staff routes at risk of flooding, or distances to travel to site);
- provision of Personal Protection Equipment (PPE), water and shaded areas to staff;
- consideration of safety critical activities that may be affected by extreme weather events and consequence of limitations in staff ability to respond;
- use of early warning systems including Met Office weather forecasts and Environment Agency flood warnings to inform disaster management processes;
- monitoring of flood response of the Proposed WWTW and health and safety of the workforce during these events, including near misses; and
- consideration of working practices and lessons learned relevant to the local area from the construction phase.

4.3.50 Taking into account secondary mitigation measures will reduce risks to staff health and safety during increased extreme weather events due to climate change, though the residual risks cannot be wholly eliminated. The residual risk is considered to be **adverse, minor,** and **not significant**.

Residual effect

4.3.51 The residual effect is **adverse, minor** and not significant.

Landscape and visual impact

4.3.52 This section considers the risks of climate change to landscaped areas of the Proposed Development, including the bund and the wooded area to be planted, and also the risks of changes to the visual impact and screening of the site due to climate conditions.

Reduced summer rainfall and increased drought conditions: landscaping and tree planting

4.3.53 Trees planted as visual screening along and on the landscaped bund may be affected by projected hotter, drier summers, which will create water stress for tree species over longer or more intense periods than encountered under the present-day conditions.

4.3.54 The landscape specification includes a diversity of tree species, and the exclusion of species such as beech that do not tolerate droughts well. These will be planted within the construction phase and will be semi-mature to mature by the time climate effects are felt.

4.3.55 Future vegetation and landscape management of the site may be affected by increased drought conditions that affect the wider region and may on occasion place restrictions on the use of clean water for landscape management (i.e. drought restrictions). This could in particular affect future newly planted trees as part of ongoing maintenance and replacement, especially in their first years of growth when they are more susceptible to drought conditions.

4.3.56 Vegetation dieback due to future reduced summer rainfall and drought conditions may have an impact upon local landscape and visual outline of the site to receptors in the local community, as identified in the Chapter 15: Landscape.

4.3.57 Primary mitigation comprises a diversity in tree species, including drought tolerant species and design allowing for the transfer of rainwater collected within the footprint of the proposed WWTP via a series of surface water drains (or a mixture of infiltration and land drains / swales) to the drainage network in the landscaped area, as outlined within the Drainage Strategy (Appendix 20.12, App Doc Ref 5.4.20.12).

Warmer, wetter winters: pests and diseases

4.3.58 Pests and diseases that affect tree species may increase and change under a combination of warm winters and hot summers, in particular under more humid conditions and in areas of dense planting. This will have a similar effect on the landscape and visual impact as drought and will similarly be managed through primary mitigation of a diversity of tree species to be planted.

Increased winter heavy rainfall events and summer drought conditions: erosion of soils

4.3.59 Climate change may lead to an increased risk of erosion of soils, including in landscaped areas of the site. This may occur during intense rainfall events during the winter and also through desiccation and wind erosion of soils in hotter drier summers, in particular in areas of vegetation dieback. The vegetated areas of landscaping, in particular ground-cover planting and grasses, will be established by the time climate change effects start to be felt, reducing the likelihood of exposed bare soils to wind or water erosion.

4.3.60 Risks due to surface water runoff are considered in Section 4.3.74. Risks of vegetation dieback and soil desiccation are assessed and managed though recommendations for secondary mitigation and monitoring detailed above.

Risk assessment for in-combination climate impacts to landscape

4.3.61 A risk assessment of climate change on the landscape and visual impacts have not been carried out due to the levels of uncertainty over the response to the tree species to future climate conditions, as well as the response by associated biodiversity (including pests and diseases) that may affect tree species.

Secondary mitigation or enhancement

4.3.62 The LERMP (Appendix 8.14, App Doc Ref 5.4.8.14) for the Proposed Development will be an adaptive management plan for the first 30 years post-construction, which will be reviewed every 5 years. Activities or adaptations to the management and maintenance regime will respond to the results of monitoring and changes and a result of climate change. It will include the monitoring of species that thrive or suffer from water stress locally, with additional tree replanting tailored accordingly. Consideration will be given to species that will support biodiversity trends observed at in the local area, including in situations where non-native drought resilient species are considered as part of future landscape planting.

4.3.63 Areas of low vegetation growth, including grassed areas, will be monitored for vegetation dieback and drought tolerant species chosen to regrow in exposed areas of soil. This will be managed to avoid soil desiccation while avoiding additional water demands for landscape management.

Land quality

4.3.64 In-combination climate impacts with respect to land quality may arise from erosion and scour of contaminated soils below or at the ground surface during the operation phase due to increased intensity and volume of rainfall events.

4.3.65 Chapter 14: Land Quality has identified no significant contaminated land risks at the site. Uncontaminated naturally occurring materials sourced from the excavation of the tunnels and subsurface works will be used for the creation of the landscaped bund.

Risk assessment for in-combination climate impacts to land quality

4.3.66 Given the lack of contaminated land risks or contaminated soils, it is considered that there are no risks due to in-combination climate effects on land quality.

Odour

4.3.67 The effect of climate change on odour from the Proposed Development is uncertain, however higher average and maximum summer temperatures may increase the risk of odour nuisance. Changes in odour generation have the potential to affect receptors both within the Proposed WWTW and in the local community.

4.3.68 Chapter 18: Odour considers the impacts of climate change on future emissions and modelling has included an assessment using summer 2019 observed odour emissions, a year in which the average Summer 2019 temperature was 18°C, 7°C warmer than average, with a maximum recorded temperature of 38°C in July. The odour modelling was assessed using these parameters for the duration of the whole year to assess emissions during different weather conditions. This method has been considered as conservative and is further detailed within Chapter 18: Odour.

4.3.69 Primary mitigation includes inclusion of specific odour control technology which will be selected at the detail design stage and will consider design options for future higher temperatures such as introduction of additional cooling, or the use of more activated carbon to increase odour removal. Chapter 18: Odour notes that climate change is not expected to alter future baseline odour emissions, however capacity has been included within the design to allow for the installation of additional equipment to manage future increases in turbulence, aeration and odour emissions, as outlined within the Preliminary Odour Management Plan (Appendix 18.4, App Doc Ref 5.4.18.4).

4.3.70 The Proposed Development design also allows for increased capacity for odour treatment should be this be required.

Risk assessment for in-combination climate impacts to odour

4.3.71 Risks of climate change to odour have not been carried out due to the levels of uncertainty over the effects of climate change on localised atmospheric conditions and odour generation.

Secondary mitigation or enhancement

4.3.72 The Applicant’s asset management plan will outline monitoring of changes to odour emissions during the operation phase and amendments or upgrades to be made to the Odour Control Unit as required, to meet environmental permitting requirements.

4.3.73 The Odour Control Unit will additionally be upgraded with appropriate industry available plant and equipment as required, as this develops during the operation phase, as determined through odour monitoring.

Water resources

4.3.74 This section considers the impacts to the River Cam and Bannold Drain due to climate change, both with regard to water quality and flooding. It considers:

- increased risks of scour at the outfall
- potential changes in water quality in receiving watercourses due to climate change
- climate effects on flood flows
- climate effects on storm flows

4.3.75 These risks relate to assessments carried out as part of Chapter 20: Water Resources and in turn relate to modelling and design carried out to manage scour, fluvial flooding, waste water network flows, storm water management and low flows. Risk assessments of climate effects are included in Chapter 20: Water Resources, with a summary within this section as appropriate.

4.3.76 Chapter 20: Water Resources identifies that the final effluent discharge from the proposed new outfall on water quality for the River Cam is expected to have a significant moderate beneficial effect on River Cam water quality.

4.3.77 Fluvial flood modelling of the River Cam water levels has been undertaken (Appendix 20.5: Fluvial Model Report (App Doc Ref 5.4.20.5)) to understand how the treated effluent and storm water discharges from the outfall to the river could affect flood levels. This involved mathematical modelling of river flows and levels to complete an initial assessment of this increased risk. The model indicates that in a 1 in 100 year flood event, with an 20% allowance for climate change, there would be a less than 7mm increase in water levels in the River Cam leading to a negligible change in the potential area of inundation across the floodplain.

Increased winter rainfall and heavy rainfall events: River Cam water quality

4.3.78 Higher flows entering the waste water waste water network due to increased future winter rainfall could cause an increase in storm flows and spill frequency and intensity into the River Cam[7] from the Proposed WWTW when compared to the storm flows and spill frequency under present-day climate conditions.

4.3.79 As outlined in Section 4.2.113, the design of the stormwater systems includes uplifts to accommodate increased rainfall volumes due to climate change that would increase storm water received at the Proposed WWTW. The Proposed Development design includes storm water storage and treatment to accommodate these volumes and includes capacity to add additional storm after tanks if required during the operation phase.

[7] Note: any increase in projected precipitation is not a linear link to the flows expected to be experienced in the sewers and therefore receive at the Proposed Development.

4.3.80 The Water Resources assessment includes an assessment of the impacts of storm water management and discharge to the River Cam, and includes the allowance for climate change.

Increased winter rainfall and heavy rainfall events: River Cam scouring

4.3.81 Increased winter rainfall volumes and intensities, or intense summer rainfall events, across the catchment due to climate change are likely to lead to higher storm water flows within the waste water network, and consequently greater volumes of storm water being managed within the Proposed WWTP and discharged into the River Cam. This poses a greater risk of scouring of the River Cam bed and banks due to the flows of water from the outfall. The Water Resources assessment identifies tertiary mitigations including that Water Framework Directive (WFD) compliant river bank and river bed protection to prevent scour, will be included in the design. The outfall requirements will be subject to agreement with the Environment Agency, and will be to CIRIA guidelines (CIRIA, 2019). Computational Fluid Dynamics (CFD) modelling will be carried out at detailed design to minimise final effluent discharge impacts on the river, including scour risk. The CFD modelling will include a 20% climate change allowance in line with Environment Agency guidelines.

Reduced summer rainfall: River Cam water quality

4.3.82 Reduced water quality due to climate change could occur due to lower future summer rainfall within the catchment leading to either lower summer river levels within the River Cam, which would affect the dilution of treated effluent discharged to the river, and/or the reduction in effluent flows resulting in a more concentrated discharge.

4.3.83 The risks associated with lower effluent flows on wastewater processes within the Proposed Development are addressed within Section 2.8.11.

4.3.84 Reduced water quality could affect biodiversity within the River Cam, river users, and downstream water quality. It would additionally lead to failure to comply with water quality requirements within environmental permitting during low flows.

4.3.85 The Water Resources assessment identifies that overall, a minor beneficial effect on water quality is expected as a result of the Proposed Development and continued regulatory compliance in line with Environment Agency permit conditions. Regulatory compliance monitoring (UK Government, 2021) and Environment Agency ongoing assessment of permit conditions will prevent deterioration of water quality within the River Cam, as compared to the theoretical indicative permitted scenario.

4.3.86 Permit conditions are, therefore, likely to vary over time in response to changes in effluent discharge and river flow, including changes arising from population growth, water usage, climatic or environmental factors and phasing of development. The proposed WWTP has been designed to be flexible and accommodate changes based on regulatory requirements.

Risk assessment for in-combination climate impacts to the River Cam

4.3.87 A risk assessment has been carried out for the in-combination climate impacts to the River Cam as there is a reasonable level of certainty in climate projections and assessed impacts to water resources.

Magnitude of impact

4.3.88 The magnitude of the in-combination climate impact on the River Cam is considered as the increased level of impact due to climate change, namely increased intensity and volume of extreme rainfall events, when compared to the assessments carried out within Chapter 20: Water Resources. Given that appropriate climate uplifts (as described in Section 3.3) have been incorporated into the surface water drainage design, storm water assessments and design, outfall modelling, and waste water network model, it is considered that there is **negligible** additional magnitude to consider as part of the assessments within this chapter.

Sensitivity of receptor

4.3.89 The River Cam is considered within the Chapter 20: Water Resources to have **high** sensitivity, and this is not assumed to change due to climate change.

Significance of effect

4.3.90 Given the appropriate incorporation of climate change into the assessments in Chapter 20: Water Resources, the significant of in-combination climate impacts is **negligible,** and **not significant**.

Secondary mitigation or enhancement

4.3.91 None identified

Residual effect

4.3.92 The residual effect remains as **negligible** and is not significant.

Monitoring

4.3.93 Monitoring required in relation to in-combination climate impacts is included under associated technical chapters, including that relating to water quality, odour and air quality permits. No secondary monitoring specific to climate change is included.

4.3.94 Monitoring of changing climate projections that may affect flows and emission from the Proposed WWTW will be carried out as part of the process of specifying upgrades and renewals of plant and equipment through The Applicant's asset management plan. This will reflect the projections as they vary due to the evolution of climate science and management of carbon emissions.

4.3.95 In-combination climate impacts to the health of the workforce will be monitored through The Applicant's asset management plan, including:

- monitoring of the temperature of welfare facilities and the provision of cooling equipment as required

- monitoring of the flood response of the proposed WWTP and the health and safety of the workforce during these events
- use of early warning systems including Met Office weather forecasts and Environment Agency flood warnings to inform disaster management processes

4.3.96 Details of monitoring activities to be included within The Applicant's Asset Management Plan are included within Appendix 9.1, App Doc Ref 5.4.9.1.

4.4 Decommissioning

4.4.1 The decommissioning of the existing Cambridge WWTP is outside of the scope of this Climate Resilience assessment.

4.4.2 As the Proposed Development has no end date to its operation, decommissioning is not considered.

4.5 Cumulative effects

4.5.1 Cumulative effects are those arising from impacts of the proposed development in combination with impacts of other proposed or consented development projects that are not yet built or operational. An assessment of cumulative effects for climate resilience has been completed and is reported in Chapter 22: Cumulative Effects Assessment.

4.5.2 For Climate Resilience there are no residual cumulative effects.

4.6 Inter-related effects

4.6.1 Inter-relationships are the impacts and associated effects of different aspects of the construction, operation of the Proposed Development and the decommissioning of the existing Cambridge WWTP on the same receptor. The assessment of inter-related effects for has been completed and is reported in Chapter 22: Cumulative Effects Assessment.

4.6.2 For Climate Resilience there are no identified residual inter-related effects.

5 Conclusion and Summary

5.1.1 This assessment of the effects, and their significance, of climate change as it applies to the infrastructure that forms the Proposed Development and also considers in-combination climate impacts on the wider environment and community.

5.1.2 The approach to the assessment has applied guidance outlined within the Institute of Environmental Management and Assessment (IEMA) EIA Guide to: Climate Change Resilience and Adaptation (2020).

5.1.3 The effects of climate change on the construction phase of the Proposed Development are not in scope for review. Climate vulnerabilities of the design focus on the operation phase as the effects of climate change compared to present-day will not have been felt during the construction phase. Construction weather resilience measures have, however, been included within this chapter, such as preparation and planning a response to adverse weather events.

5.1.4 The effects of climate change on the Proposed Development during operation would vary from negligible **to moderate adverse** prior to mitigation, which would be significant in the case of moderate and major adverse effects.

5.1.5 The potential impacts in operation are related to chronic damage and deterioration in asset quality or process performance, or acute damage, asset failure and flooding due to extreme weather. Impacts considered impacts to structures and equipment and to wastewater processes within the proposed WWTP due to highest future temperatures and changes in rainfall patterns. Combinations of future climate effects were also considered such as the effects on earthworks stability due to fluctuation between wet winters and dry summers.

5.1.6 Significant impacts identified were the impacts of climate change upon surface flood risk of the Proposed Development, reduction in the ability for anaerobic respiration during very high summer temperatures, and safety risks to workforce staff particularly during storms or heatwaves. Secondary mitigations include the use of an asset management plan, including mitigations listed in the Asset Management Plan (Appendix 9.1, App Doc Ref 5.4.9.1) and which are secured through a requirement within Schedule 2 of the DCO application. The asset management plan, including plans for operation phase workforce safety, asset maintenance and monitoring provides adequate mitigation of the effects of climate change to the Proposed Development.

5.1.7 In-combination climate impacts were also considered, including the difference climate change will make to the impacts of the Proposed Development on Air Quality, Agriculture and Soils, Community, Health, Landscape and Visual Impact, Land Quality, Odour, and Water Resources.

5.1.8 Many of these in-combination effects include levels of uncertainty, both due to the exact nature of climate change being dependent on carbon emissions, and uncertainties in the response to environmental aspects such as air quality and biodiversity species and networks.

5.1.9 Overall, following the application of all mitigation measures including secondary mitigation measures, the significance of effects of climate change would be negligible / minor adverse for the operation of the proposed Development and are not significant.

5.1.10 The effects of climate change on the decommissioning of the existing Cambridge WWTP are not in scope for review.

5.1.11 A summary of potential environmental effects, mitigation and monitoring is provided in Table 5-1. Table 5-2 sets out how mitigation would be secured.

Table 5-1: Summary of climate change effects

Description of Impact	Description of Effect	Primary and tertiary measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Initial classification of effect	Secondary mitigation	Residual effect significance	Proposed monitoring
Operation phase: Climate Impacts on the Proposed Development								
Built Infrastructure: buildings, structures, pipework, utilities supplies								
Higher summer temperatures: structural damage	Structural damage due to expansion and thermal loading of metallic features and concrete structures. More rapid deterioration of materials. Increased maintenance costs.	Materials specification to include future temperature ranges and maximums. Design basis temperature range is -10 to 40°C Thermal protection such as painting, shading or inclusion of natural ventilation / air conditioning options within buildings will be included within the detailed design Buildings and structures will be designed to the climate conditions projected at the end of their design life Addition of extra cooling features as necessary	Moderate	Low	Adverse Minor Not significant	Periodic inspection and repairs or replacement of damaged assets The applicant's asset management plan will include review projected climate change and amend the specification of structures and equipment accordingly on its renewal during the operational phase, taking into account the projected temperature changes during the equipment's design life	Adverse Minor Not significant	Periodic monitoring of structure conditions
Higher maximum summer temperatures and in-combination weather events: mechanical and electrical equipment failure	Overheating and fire risk of mechanical and electrical equipment at higher maximum temperatures leading to equipment and WWT process failure	Design basis temperature range is -10 to 40°C, in line with the 90th percentile maximum temperature range Remote and automatic shut-off of systems. Lightning protection.	Moderate	Low	Adverse Minor Not significant		Adverse Minor Not significant	Monitoring of condition during temperature extremes
Higher maximum summer temperatures: efficiency of boilers and CHP unit	Reduced operating efficiency of CHP and boiler units due to high ambient temperatures	Design basis temperature range is -10 to 40°C, in line with the 90th percentile maximum temperature range Ability for boiler temperature to be managed via the heating unit.	Moderate	Low	Adverse Minor Not significant	Applicant's asset management plan to include scheduling of maintenance and renewal works to improve efficiency of units	Adverse Minor Not significant	Monitoring of condition during temperature extremes.
Increased winter rainfall and heavy rainfall events: structural damage and flooding	Increased surface water flows leading to erosion of soils around structures Weakening and washout of the soil around culverts that support primary structural features	Surface water drainage design avoids damage to or water ingress into buildings and structures	Moderate	Low	Adverse Moderate Significant	Inspection, maintenance and repair Keeping drainage infrastructure clear Management plans and business continuity plans for extreme weather conditions	Adverse Minor Not Significant	Periodic monitoring of structure conditions Monitoring the response of the Proposed WWTW surface water drainage system to intense rainfall events and recording

Description of Impact	Description of Effect	Primary and tertiary measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Initial classification of effect	Secondary mitigation	Residual effect significance	Proposed monitoring
	Infrastructure damage and reduced design life Water ingress or egress from structures Increased likelihood of pipework failure when transferring waste water Damage to and flooding of the access road and hardstanding					Upgrade of the surface water drainage with larger pipe diameters and storage towards the end of the century.		occurrences of surface water flooding
Increased winter rainfall and higher fluvial flows: damage to the outfall structure	Increased river flows leading to erosion of soils around the outfall and damage to the structure	Design of the outfall has reduced the risk of scour in modelled fluvial flows	Minor	Medium	Adverse Minor Not Significant	Inspection, maintenance and repair	Adverse Minor Not Significant	Periodic monitoring of structure conditions
Greater seasonal range between wetter winters and drier summers: ground movement	Ground movement and subsidence as soils wet and then dry out and shrink, leading to damage to buried pipes and foundations	Buried infrastructure at depth. Use of flexible HDPE pipe.	Moderate	Low	Adverse Minor Not Significant	Inspection, maintenance and repair	Adverse Minor Not Significant	Periodic monitoring of structure conditions
Increased seasonal winter rainfall and heavy rainfall events	Greater catchment soil erosion leading to pipework siltation of surface water drainage network and waste water network.	Screening and grit handling at the terminal pumping station	Minor	Low	Adverse Negligible Not significant	Inspection and maintenance regime to keep pipes clear and operating effectively.	Adverse Negligible Not significant	Proactive inspection and maintenance to keep pipework clear
Waste water processes								
Higher maximum summer temperatures and lower summer rainfall: septicity in process plant and tunnels	Increased septicity at higher maximum temperatures within Proposed WWT process plant, tunnels/pipelines and shaft	Modelling of waste water flows to avoid septicity Additional capacity and the ability for the final effluent flow to be recycled and rerouted back to the inlet works in order to introduce cooling	Minor	Medium	Adverse Minor Not significant	Inspection and maintenance regime to keep pipes clear and operating effectively.	Adverse Minor Not significant	Monitoring of process plant activity and of temperatures
Higher summer temperatures: anaerobic digestion efficiency	Decrease in anaerobic digestion efficiency at higher average and maximum temperatures	Size of digesters, thermal insulation and additional cooling available provided by digester design.	Moderate	Low	Adverse Moderate Significant	Addition of extra cooling units around digesters and reduction of insulation	Adverse Minor Not significant	Monitoring of temperatures and addition of extra cooling if needed

Description of Impact	Description of Effect	Primary and tertiary measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Initial classification of effect	Secondary mitigation	Residual effect significance	Proposed monitoring
		Addition of extra cooling units around digesters and reduction of insulation						
Increased winter rainfall and heavy rainfall events: stormwater	Heavy rainfall causing waste water network to be overwhelmed. Flooding of foul water at inlet, or at upstream network locations	Storm water management designed to include allowances for future climate change Addition of additional pumping capacity	Minor	Medium	Adverse Minor Not significant	Storm response within The Applicant's asset management plan	Adverse Minor Not significant	Monitoring of response of storm water system in extreme rainfall
In-combination climate impacts								
No effects identified, impacts to agriculture during the operational phase are scoped out	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Changes in air dispersal of the emissions from the energy plant	Changes to effects on air quality receptors	Capacity within the design for equipment upgrades during the operation phase	n/a	n/a	n/a	Upgrade as necessary of the energy plant during operational phase in response to environmental permitting regulations	n/a	See Chapter 7: Air Quality
Increased winter rainfall and heavy rainfall events: biodiversity mitigation habitats	Overtopping and scour of seasonal ponds	Surface water run-off design	n/a	n/a	n/a	Maintenance, repair and replanting of seasonal ponds	n/a	Monitoring of erosion of pond habitat
Reduced summer rainfall and increased drought conditions: biodiversity mitigation habitats	Impact on species populations. Failure to sustain habitats created to deliver biodiversity net gain and species and habitat mitigation: Dieback of vegetation in seasonal ponds and calcareous grassland Limited mud for nesting bees Drying out of water vole ditch habitat	Diversity in planting species Creation of the seasonal ponds to retain rainwater in the summer Design to allow installation of weir boards in the water vole ditches	n/a	n/a	n/a	Installation of weir boards to manage water levels in ditches that are created as part of biodiversity mitigation	n/a	None specified in relation to climate resilience
Reduced summer and rainfall and increased winter rainfall: tree planting	Risks to effectiveness of tree planting and tree success rates due to changing climate conditions	Drought tolerant species selection	n/a	n/a	Considerations around how future wooded areas and	n/a	None specified in relation to climate	n/a

Description of Impact	Description of Effect	Primary and tertiary measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Initial classification of effect	Secondary mitigation	Residual effect significance	Proposed monitoring
					new planting will be watered			
Impacts to community due to climate change are considered in other in-combination climate impact sections (Air Quality, Landscape and Visual Impact, Odour, Water Quality)	n/a	n/a	n/a	n/a	n/a`	n/a	n/a	n/a
Increased winter rainfall and heavy rainfall events: community health	Risk to River Cam recreation users who accidently ingest water	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Increased winter rainfall and heavy rainfall events: workforce safe access and egress	Safety risks for staff attending site in extreme weather, risks within the site and travel to and from site, and access for emergency response	Remote access and monitoring systems. Proximity to the strategic highways network.	Minor	High	Adverse Moderate Significant	Operational phase management and business continuity plans for extreme weather events to consider staff safety and welfare and safe travel to site	Adverse Minor Not significant	Staff H&S risks during flood events
Higher average and maximum summer temperatures: workforce heat stress	Increased discomfort and health risks such as heat stroke to staff at higher maximum temperatures	Shade and cooled buildings/refuges. Ease of replacement of equipment. Remote access and monitoring systems.						Temperatures of welfare facilities
Reduced summer rainfall and increased drought conditions: landscaping and tree planting	Vegetation (tree) dieback affecting impacts upon local landscape and visual outline	Species diversity and choice of drought resilient tree species. Transfer of rainwater collected within the rotunda to the drainage network in the landscaped area	n/a	n/a	n/a	Landscape Management Plan to replace dieback of wooded area with tree species that thrive in future climates locally	n/a	Long term monitoring of tree dieback
Warmer, wetter winters leading to increases in pest and disease outbreaks	Changing climate conditions increasing the risk of pest and vector-borne disease spread in planted areas	Diversity in planting species	n/a	n/a	n/a	Landscape management	n/a	Long term monitoring of vegetation dieback
Increased winter heavy rainfall events and summer drought conditions: erosion of soils	Water erosion of soils due to surface runoff or wind erosion of exposed, desiccated soils	Surface water runoff design avoids erosion and scour Landscape management avoids exposed desiccated soils	n/a	n/a	n/a	Landscape management to identify soil erosion and vegetation management	n/a	Long term monitoring of vegetation dieback and soil erosion

Description of Impact	Description of Effect	Primary and tertiary measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Initial classification of effect	Secondary mitigation	Residual effect significance	Proposed monitoring
Erosion and scour of contaminated soils	No in-combination impacts identified.		n/a	n/a	n/a		n/a	
Higher average and maximum summer temperatures: odour	Increase in the risk of odour nuisance to receptors Increased odour at higher maximum temperatures	Capacity within the design to allow for the installation of additional odour mitigation in the Odour Management Unit	n/a	n/a	n/a	Monitoring odour emissions and upgrade plant and equipment if necessary, in response to nuisance.	n/a	n/a
Increased winter rainfall and heavy rainfall events: water quality Reduced summer rainfall: River Cam water quality	Higher receiving flows entering the waste water network causing increase in storm flows and spill frequency and intensity into the River Cam Summer droughts and reduced water levels leading to increased relative discharge concentrations	Storm water management designed to include allowances for future climate change. Regulatory compliance monitoring and Environment Agency ongoing assessment of permit conditions to avoid deterioration of water quality due to discharge consents.	Negligible	High	Negligible Not Significant	n/a	Negligible Not Significant Negligible	No climate specific monitoring requirements
Increased winter rainfall and heavy rainfall events: river scour	Localised scour of the River Cam due to increase in storm flow frequency	River bank and river bed protection is included within the outfall design. CFD modelling of discharge at the outfall includes consideration of scour impacts and includes a 20% climate change uplift.	Negligible	High	Negligible Not Significant	n/a	Negligible	

5.2 Securing mitigation

5.2.1 The delivery of mitigation will be controlled through the 'Development Consent Order (DCO) which:

- identifies parameters within which certain works activities will be located and constructed (e.g. maximum and minimum building dimensions (including below ground), or locational zones);
- sets requirements for construction, operation and maintenance of the Proposed Development to be undertaken in accordance with 'control plans / documents' (including those that are related to compliance with environmental permits); and
- sets requirements for the control of specific issues or works (e.g. time limits around the completion of the outfall construction)

5.2.2 Table 5-2 summarises all mitigation in relation to climate resilience, how these measures are secured, the party responsible for the implementation of the measure, when the measure would be delivered and any mechanisms to deliver the measure.

Table 5-2: Climate Resilience mitigation summary

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
Higher summer temperatures: structural damage	Adverse Minor Not significant	Materials specification to include future temperature ranges and maximums. Design basis temperature range is -10 to 40°C	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Approved detailed design prior to construction commencement
		Thermal protection such as painting, shading or inclusion of natural ventilation / air conditioning options within buildings will be included within the detailed design	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Approved detailed design prior to construction commencement
		Buildings and structures will be designed to the climate conditions projected at the end of their design life	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Approved detailed design prior to construction commencement
		Addition of extra cooling features as necessary	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Approved detailed design prior to construction commencement
		Periodic inspection and repairs or replacement of damaged assets	Secondary	A requirement within Schedule 2 requirements as outlined within Appendix 9.1, App Doc Ref 5.4.9.1	The Applicant	Prior to operation phase commencement	Approved Asset management prior to operation phase commencement
Higher maximum summer temperatures and in-combination weather events: mechanical and electrical equipment failure	Adverse Minor Not significant	Design basis temperature range is -10 to 40°C, in line with the 90th percentile maximum temperature range	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Remote and automatic shut-off of systems. Lightning protection.	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Approved detailed design prior to construction commencement
		Monitoring of condition during temperature extremes	Secondary	A requirement to prepare an AMP in accordance with the outline AMP (Application Doc Ref 5.2.9.2) secured through a requirement in the draft DCO (Application Doc Ref 2.1)	The Applicant	Prior to operation phase commencement	Approved Asset management prior to operation phase commencement
Higher maximum summer temperatures: efficiency of boilers and CHP unit	Adverse Minor Not significant	Design basis temperature range is -10 to 40°C, in line with the 90th percentile maximum temperature range	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Ability for boiler temperature to be managed via the heating unit.	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Applicant's asset management plan to include scheduling of maintenance and renewal works to improve efficiency of units	Secondary	A requirement to prepare an AMP in accordance with the outline AMP (Application Doc Ref 5.2.9.2) secured through a requirement in the draft DCO (Application Doc Ref 2.1)2	The Applicant	Prior to operation phase commencement	Approved Asset management prior to operation phase commencement
Increased winter rainfall and heavy rainfall events:	Adverse Minor	Surface water drainage design avoids damage to or water ingress into buildings and structures	Primary	Detailed surface water drainage design will comply with the Drainage Strategy (Appendix 20.12,	Appointed contractor(s)	Prior to construction of drainage system	Approved drainage design

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
structural damage and flooding	Not Significant			App Doc Ref 5.4.20.12). This includes the requirement for drainage to accord with requirements set out within The Environment Agency's Approach to Groundwater Protection, Feb 2018 (Version 1.2) secured through a requirement of the draft DCO (App Doc Ref 2.1)			
		Inspection, maintenance and repair	Secondary	Operational limits, management and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Approved Asset management prior to operation phase commencement
		Keeping drainage infrastructure clear	Secondary	A requirement within Schedule 2 special requirements as outlined within Appendix 9.1, App Doc Ref 5.4.9.1	The Applicant	Prior to operation phase commencement	Approved Asset management prior to operation phase commencement
		Management plans and business continuity plans for extreme weather conditions	Secondary	The Environmental Permit will include conditions requiring a written EMS which will includes management systems to cover pollution prevention and emergency responses.	The Applicant	Prior to operation phase commencement	Preparation of a written EMS to cover emergency preparedness to accord with the requirements of the Environmental Permit prior to operation phase commencement
		Upgrade of the surface water drainage with larger pipe diameters and storage towards the end of the century.	Primary	Detailed surface water drainage design will comply with the Drainage Strategy (Appendix 20.12, App Doc Ref 5.4.20.12). This includes the requirement for drainage to accord with requirements set out within The Environment Agency's Approach to Groundwater Protection, Feb 2018 (Version 1.2) secured through a requirement of the draft DCO (App Doc Ref 2.1)	Contractor	Prior to construction of drainage system	Approved drainage design
		Periodic monitoring of structure conditions	Secondary	A requirement within Schedule 2 requirements as outlined within Appendix 9.1, App Doc Ref 5.4.9.1.	The Applicant	Prior to operation phase commencement	Prior to operation phase commencement
		Monitoring the response of the Proposed WWTP surface water drainage system to intense rainfall events and recording occurrences of surface water flooding	Secondary	A requirement within Schedule 2 requirements as outlined within Appendix 9.1, App Doc Ref 5.4.9.1.	The Applicant	Prior to operation phase commencement	Prior to operation phase commencement
Increased winter rainfall and higher	Adverse	Design of the outfall has reduced the risk of scour in modelled fluvial flows	Primary	Conditions set out within a Environmental Permit that may be	Appointed contractor(s)	Prior to start of construction	Approved detailed design prior to construction commencement

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
fluvial flows: damage to the outfall structure	Minor Not Significant			required in relation to outfall design and construction.			
		Inspection, maintenance and repair	Secondary	Approval and implementation of a OMMP incorporating requirements within and Environmental Permit (flood risk activities) including fish rescue and dewatering controls associated with Environmental Permit (Discharge to surface water) secured through a requirement of the draft DCO (Application Doc Ref 2.1)	The Applicant	Prior to operation phase commencement	Approved OMMP for operation phase commencement
		Periodic monitoring of structure conditions	Secondary				
Greater seasonal range between wetter winters and drier summers: ground movement	Adverse Minor Not Significant	Buried infrastructure at depth.	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Use of flexible HDPE pipe.	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Inspection, maintenance and repair	Secondary	Operational limits, management and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Approved Asset management prior to operation phase commencement
		Periodic monitoring of structure conditions	Secondary	Operational limits, management and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Approved Asset management prior to operation phase commencement
Increased seasonal winter rainfall and heavy rainfall events	Adverse Negligible Not significant	Screening and grit handling at the terminal pumping station	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Inspection and maintenance regime to keep pipes clear and operating effectively.	Secondary	Operational limits, management and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Approved Asset management prior to operation phase commencement
Higher maximum summer temperatures and lower summer rainfall: septicity in process plant and tunnels	Adverse Minor Not significant	Increased septicity at higher maximum temperatures within Proposed WWT process plant, tunnels/pipelines and shaft	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Additional capacity and the ability for the final effluent flow to be recycled and rerouted back to the inlet works in order to introduce cooling	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Inspection and maintenance regime to keep pipes clear and operating effectively.	Secondary	Operational limits, management and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Approved Asset management prior to operation phase commencement

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
		Monitoring of process plant activity and of temperatures	Secondary	Operational limits and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Preparation of an operational monitoring programme as part of the written EMS to cover periodic monitoring activities to accord with the requirements of the Environmental Permit.
Higher summer temperatures: anaerobic digestion efficiency	Adverse Minor Not significant	Size of digesters, thermal insulation and additional cooling available provided by digester design.	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Addition of extra cooling units around digesters and reduction of insulation	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Monitoring of temperatures and addition of extra cooling if needed	Secondary	Operational limits and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Preparation of a an operational monitoring programme as part of the written EMS to cover periodic monitoring activities to accord with the requirements of the Environmental Permit.
Increased winter rainfall and heavy rainfall events: stormwater	Adverse Minor Not significant	Storm water management designed to include allowances for future climate change Surface water drainage design to include allowances for future climate change	Primary	Detailed surface water drainage design will comply with the Drainage Strategy (Appendix 20.12, App Doc Ref 5.4.20.12). This includes the requirement for drainage to accord with requirements set out within The Environment Agency's Approach to Groundwater Protection, Feb 2018 (Version 1.2) secured through a requirement of the draft DCO (App Doc Ref 2.1)	Contractor	Prior to construction of drainage system	Approved drainage design
		Addition of additional pumping capacity	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Storm response within The Applicant's asset management plan	Secondary	Operational limits and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Preparation of an operational monitoring programme as part of the written EMS to cover periodic monitoring activities to accord with the requirements of the Environmental Permit.
		Monitoring of response of storm water system in extreme rainfall	Secondary	Operational limits and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Preparation of a an operational monitoring programme as part of the written EMS to cover periodic monitoring activities to accord with the requirements of the Environmental Permit.

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
Changes in air dispersal of the emissions from the energy plant	n/a	Capacity within the design for equipment upgrades during the operation phase	Primary	Compliance with varied environmental permit	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Upgrade as necessary of the energy plant during operational phase in response to environmental permitting regulations	Secondary	Compliance with regulations	The Applicant	Prior to operation phase commencement	Prior to operation phase commencement
Increased winter rainfall and heavy rainfall events: biodiversity mitigation habitats	n/a	Surface water run-off design	Primary	Detailed surface water drainage design will comply with the Drainage Strategy (Appendix 20.12, App Doc Ref 5.4.20.12). This includes the requirement for drainage to accord with requirements set out within The Environment Agency's Approach to Groundwater Protection, Feb 2018 (Version 1.2) secured through a requirement of the draft DCO (App Doc Ref 2.1)	Contractor	Prior to construction of drainage system	Approved drainage design
		Maintenance, repair and replanting of seasonal ponds	Secondary	Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	The Applicant	Prior to operation phase commencement	Prior to operation phase commencement
Reduced summer rainfall and increased drought conditions: biodiversity mitigation habitats	n/a	Diversity of species in final planting specifications	Primary	LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1) Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
		Creation of the seasonal ponds to retain rainwater in the summer	Primary	LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1) Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	Applicant	Prior to commencement of operation	Approved detailed management and monitoring plan in line with requirements of the LERMP Table 5.1
		Design of new ditches to allow installation of weir boards in the water vole ditches	Primary	Agreed design through Natural England Licence, draft licence (Appendix 8.22, App Doc Ref 5.4.8.22)	Appointed contractor(s)	Prior to start of construction of ditches	Approved detailed design prior to construction commencement

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
		Installation of weir boards to manage water levels in ditches that are created as part of biodiversity mitigation	Secondary	Agreed design through Natural England Licence, draft licence (Appendix 8.22, App Doc Ref 5.4.8.22)	Appointed contractor(s)	Prior to start of construction of ditches	Approved detailed design prior to construction commencement
Reduced summer and rainfall and increased winter rainfall: tree planting	n/a	Drought tolerant species selection	Primary	Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	Applicant	Prior to commencement of operation	Approved detailed management and monitoring plan in line with requirements of the LERMP Table 5.1
		Adaptive management to consider how future wooded areas and new planting will be watered.	Secondary	Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	Applicant	Prior to commencement of operation	Approved detailed management and monitoring plan in line with requirements of the LERMP Table 5.1
workforce health and safety due to extreme weather conditions (safe access during storms and flood events, health and safe working conditions during high temperatures)	Adverse Minor Not significant	Remote access and monitoring systems. Proximity to the strategic highways network.	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of operation	Detailed design prior to commencement of operation
		Operational phase management and business continuity plans for extreme weather events to consider staff safety and welfare and safe travel to site	Secondary	Operational management and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Preparation of a an operational monitoring programme as part of the written EMS to cover periodic emergency preparedness and response to accord with the requirements of the Environmental Permit.
		Shade and cooled buildings/refuges. Ease of replacement of equipment. Remote access and monitoring systems.	Primary	A requirement within Schedule 1 and as set out in Works Plans	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement
Reduced summer rainfall and increased drought conditions: landscaping and tree planting	n/a	Species diversity and choice of drought resilient tree species.	Primary	Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	Applicant	Prior to commencement of operation	Approved detailed management and monitoring plan in line with requirements of the LERMP Table 5.1
		Transfer of rainwater collected within the earth bank to the drainage network in the landscaped area	Primary	Detailed surface water drainage design will comply with the Drainage Strategy (Appendix 20.12, App Doc Ref 5.4.20.12). This includes the requirement for drainage to accord with requirements set out within The Environment Agency's Approach to	Appointed contractor(s)	Prior to start of construction	Detailed design prior to construction commencement

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
				Groundwater Protection, Feb 2018 (Version 1.2) secured through a requirement of the draft DCO (App Doc Ref 2.1)			
		Landscape Management Plan to replace dieback of wooded area with tree species that thrive in future climates locally	Secondary	Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	Applicant	Prior to commencement of operation	Approved detailed management and monitoring plan in line with requirements of the LERMP Table 5.1
Warmer, wetter winters leading to increases in pest and disease outbreaks	n/a	Diversity in planting species	Primary	Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	Applicant	Prior to commencement of operation	Approved detailed management and monitoring plan in line with requirements of the LERMP Table 5.1
		Landscape management	Secondary	Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	Applicant	Prior to commencement of operation	Approved detailed management and monitoring plan in line with requirements of the LERMP Table 5.1
Increased winter heavy rainfall events and summer drought conditions: erosion of soils	n/a	Surface water runoff design avoids erosion and scour	Primary	Detailed surface water drainage design will comply with the Drainage Strategy (Appendix 20.12, App Doc Ref 5.4.20.12). This includes the requirement for drainage to accord with requirements set out within The Environment Agency's Approach to Groundwater Protection, Feb 2018 (Version 1.2) secured through a requirement of the draft DCO (App Doc Ref 2.1)	Appointed contractor(s)	Detailed design	Detailed design prior to construction commencement
		Landscape management design avoids exposed desiccated soils	Primary	Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	Applicant	Prior to commencement of operation	Detailed design prior to construction commencement
		Landscape management to identify soil erosion and vegetation management	Secondary	Approval and implementation of a detailed management and monitoring plan secured to comply with LERMP secured through a requirement of the draft DCO (App Doc Ref 2.1)	Applicant	Prior to commencement of operation	Approved detailed management and monitoring plan in line with requirements of the LERMP Table 5.1

Description of impact	Residual Effect	Mitigation measure	Mitigation type	Secured by	Responsible party	Timing on the provision of the measure	Trigger for the discharge of any related requirement
Higher average and maximum summer temperatures: odour	n/a	Capacity within the design to allow for the installation of additional odour mitigation in the Odour Management Unit	Primary	A requirement within Schedule 1 and as set out in Works Plans	The Applicant	Detailed design	Detailed design prior to construction commencement
		Monitoring odour emissions and upgrade plant and equipment if necessary, in response to nuisance	Secondary	Operational limits and monitoring obligations secured through Environmental Permit	The Applicant	Prior to operation phase commencement	Approved OMP prior to operation phase commencement
Increased winter rainfall and heavy rainfall events: water quality Reduced summer rainfall: River Cam water quality	Negligible Not Significant Negligible	Storm water management designed to include allowances for future climate change.	Primary	Detailed surface water drainage design will comply with the Drainage Strategy (Appendix 20.12, App Doc Ref 5.4.20.12). This includes the requirement for drainage to accord with requirements set out within The Environment Agency's Approach to Groundwater Protection, Feb 2018 (Version 1.2) secured through a requirement of the draft DCO (App Doc Ref 2.1)	Appointed contractor(s)	Detailed design	Detailed design prior to construction commencement
		Regulatory compliance monitoring and Environment Agency ongoing assessment of permit conditions to avoid deterioration of water quality due to discharge consents.	Primary	WRC and STC will have suitable treatment technology and processes and operate in accordance with the relevant emission limit values for the plant which will be specified within a site-specific Environmental Permit.	The Applicant	Detailed design	Detailed design prior to construction commencement
Increased winter rainfall and heavy rainfall events: river scour	n/a	River bank and river bed protection is included within the outfall design. CFD modelling of discharge at the outfall includes consideration of scour impacts and includes a 20% climate change uplift	Primary	Conditions set out within a Environmental Permit that may be required in relation to outfall design and construction.	Appointed contractor(s)	Prior to start of construction	Approved detailed design prior to construction commencement
				Approval and implementation of a OMMP incorporating requirements within and Environmental Permit (flood risk activities) including fish rescue and dewatering controls associated with Environmental Permit (Discharge to surface water) secured through a requirement of the draft DCO (App Doc Ref 2.1)	The Applicant	Prior to operation phase commencement	Approved OMMP for operation phase commencement

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