Cottam Solar Project

Preliminary Environmental Information Report:

Chapter 10: Hydrology, Flood Risk and Drainage

Prepared by: Delta-Simons

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Cottam
SOLAR PROJECT

Contents

Issue Sheet

Report Prepared for: Cottam Solar Project Ltd.

Preliminary Environmental Information Report:

Chapter 10: Hydrology, Flood Risk and Drainage

Prepared by:

Name: Joshua Rigby

Title: Associate

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10 Hydrology, Flood Risk and Drainage

10.1 Introduction

10.1.1 The Hydrology, Flood Risk and Drainage chapter of the PEIR considers the likely significant environmental effects of the Scheme on the local hydrology during its construction, operation and decommissioning phases. For the purposes of this assessment, the term 'hydrology' includes risks associated with surface water and drainage and further includes an assessment of flood risk from all sources of flooding, namely:

- Tidal (flood risk from the sea)
- Fluvial
- Surface water
- Groundwater
- Artificial Sources (sewers, reservoirs and canals)

10.1.2 The Site is over 1 hectare in size and therefore requires a Flood Risk Assessment to support the planning application in line with Chapter 14 of the NPPF guidance. Surface water management is also a key consideration at the Site with regards to both surface water and water quality control.

10.1.3 Given the scale of this development and its separation into multiple parcels individual parcel assessments have been undertaken, these are included as separate appendices. The appendices form part of a covering assessment which will draw together the findings from the individual parcels that make up the Site.

10.1.4 This document is supported by the following appendices:

- **Appendix 10.1**: Flood Risk Screening Assessment – Cottam 1 (North)
- **Appendix 10.2**: Flood Risk Screening Assessment – Cottam 1 (South)
- **Appendix 10.3**: Flood Risk Screening Assessment – Cottam 1 (West)
- **Appendix 10.4**: Flood Risk Screening Assessment – Cottam 2
- **Appendix 10.5**: Flood Risk Screening Assessment – Cottam 3a
- **Appendix 10.6**: Flood Risk Screening Assessment – Cottam 3b

10.2 Policy and Legislation Context

10.2.1 Policy and legislation specifically relevant to this topic area is outlined below.

National Policy

10.2.2 Guidance on the issues to be assessed for renewable energy developments has been obtained through reference to the Overarching National Policy Statement (NPS) for Energy (EN-1, DECC, 2011a), and the NPS for Electricity Networks Infrastructure (EN-5, DECC, 2011c).

10.2.3 The following paragraphs from NPS EN-1 are considered relevant:

- Applicants for new energy infrastructure must consider the potential impacts of climate change and adopt appropriate mitigation or adaption measures for the lifetime of the proposed infrastructure (paragraph 4.8.6).
- NPS EN-1 sets out the minimum requirements for a flood risk assessment (paragraph 5.7.5) and that they should:
    - "be proportionate to the risk and appropriate to the scale, nature and location of the project;
    - consider the risk of flooding arising from the project in addition to the risk of flooding to the project;
    - take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made;
    - be undertaken by competent people, as early as possible in the process of preparing the proposal;
    - consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure;
    - consider the vulnerability of those using the site, including arrangements for safe access;
    - consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made;

- consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes;
- include the assessment of the remaining (known as 'residual') risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project;
- consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems;
- consider if there is a need to be safe and remain operational during a worst case flood event over the development's lifetime; and
- be supported by appropriate data and information, including historical information on previous events."

- The policy states consultation on assessment methodologies should be undertaken at early stage with the Environment Agency (paragraph 5.7.8)
- States that the applicant should undertake an assessment of the existing status of, and impacts of the proposed project on water quality, water resources and physical modifications to the water environment (paragraph 5.15.2)
- Sets out requirements for the environmental statement relating to water quality, existing water resources, physical characteristics and impacts on WFD source protection zones (paragraph 5.15.3)

10.2.4 NPS EN-5 requires that applicants set out to what extent the Scheme is expected to be vulnerable, and as appropriate, how it would be resilient to flooding, particularly for substations (paragraph 2.4.1)

National Legislation

10.2.5 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 implement the Water Framework Directive 2000/60/EC (WFD). The WFD establishes a framework for community action in the field of water policy. The WFD seeks to enhance the status of aquatic ecosystems, promotes sustainable water use and contributes to mitigating the effects of flood and drought. It is a requirement of the WFD that member states classify major rivers and their tributaries in terms of their ecological status with reference to biological, chemical and hydro-morphological quality indicators. The requirements of the WFD continue to apply following the UK leaving the European Union, through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

10.2.6 The Groundwater (England and Wales) Regulations 2009 (now revoked) and Groundwater (Water Framework Directive) (England) Direction 2014 initially transposed the Groundwater Daughter Directive 2006/118/EC. The former addresses the protection of groundwater against pollution caused by certain dangerous substances and places an obligation to prevent pollution of groundwater by substances including hydrocarbons and control the introduction of named metals. The Daughter Directive requirements have been transposed into UK law by the Environmental Permitting (England and Wales) Regulations 2016. The "Daughter Directive" to the WFD establishes specific measures as provided for in the WFD to prevent and control groundwater pollution. It defines criteria for the assessment of good groundwater chemical status

10.2.7 The Flood and Water Management Act (2010) (England and Wales) clarifies responsibilities for land drainage and flood risk management and transfers some key responsibilities to local authorities. The Act intends to provide better, more comprehensive management of flood risk for people, homes and businesses. In particular, it encourages the uptake of sustainable drainage systems by removing the automatic right to connect to sewers and providing for unitary and county councils to adopt Sustainable Drainage Systems (SuDS) for new developments and redevelopments.

10.2.8 The Water Resources Act 1991 (and Land Drainage bylaws) (England and Wales) requires the prior written consent of the Environment Agency (EA) for any works or structures in, over, under or within 8 metres of any watercourse designated as a 'Main River'. Main Rivers are classified watercourses under the jurisdiction of the EA. Section 109 of the Water Resources Act 1991 (titled "Structures in, over or under a main river" has been repealed. Previously under Section 85 it is an offence to cause or knowingly permit poisonous, noxious, or polluting matter, or any solid waste matter to enter controlled waters (which include rivers), however this was repealed as part of the Environmental Permitting (England and Wales) Regulations 2010 and replaced by regulation 38(1) of the Environmental Permitting (England and Wales) Regulations 2016, which notes that it is an offence to cause or knowingly permit a water discharge activity or groundwater activity without an environmental permit.

10.2.9 The consenting regime for discharges to controlled waters is set out in the Environmental Permitting (England and Wales) Regulations 2016.

10.2.10 The Nitrate Pollution Prevention Regulations 2015 (applicable in England), aim to reduce nitrate concentrations from agriculture entering water systems through measures which include the following:

- A requirement to designate Nitrate Vulnerable Zones (NVZs);
- A requirement to plan nitrogen applications on agricultural land;

- The setting of limits on nitrogen fertiliser applications;
- The establishment of closed periods for spreading; and
- Controls on the application and storage of organic manure.

10.2.11 The EA is responsible for assessing farmers' compliance with measures in NVZs.

10.2.12 The Land Drainage Act 1991 (England and Wales) places responsibility for maintaining flows in watercourses on landowners.

National Planning Policy

10.2.13 The revised National Planning Policy Framework (NPPF) was last updated on 20th July 2021 (superseding the original NPPF published in 2012 which superseded the Planning Policy Statement 25 (PPS25)) along with previous updates in 2018 and 2019. It is supported by the National Planning Practice Guidance (NPPG), which is a 'live' document.

10.2.14 The NPPF seeks to ensure that climate change is considered for long term factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape. New development should therefore be planned to avoid increased vulnerability to the range of effects arising from climate change. Where new development is brought forward in areas which are vulnerable to the range of effects arising from climate change, care should be taken to ensure that flood risk can be managed through sustainable adaptation measures.

10.2.15 In relation to flood risk, inappropriate development in areas at high risk of flooding should be avoided by directing development away from areas at the highest risk, but where development is necessary, the development should be made safe for its lifetime without increasing flood risk elsewhere.

10.2.16 NPPF states that a Site-specific Flood Risk Assessment (FRA) is required for the following scenarios:

- Proposals of 1 hectare or greater in Flood Zone 1;
- All proposals for new development in Flood Zones 2 and 3;
- Proposals in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the EA); and
- Any Scheme or change of use to a more vulnerable use, on land in Flood Zone 1 which may be subject to other sources of flooding.

10.2.17 The majority of the Scheme will be located within the administrative boundary of West Lindsey District Council and Lincolnshire County Council. The grid connection at the former Cottam Power Station and a part of the cable search corridor are located within the jurisdiction of Bassetlaw District Council and Nottinghamshire County Council.

Local Planning Policy

West Lindsey District Council

10.2.18 The West Lindsey Local Plan (First Review) was adopted on 19th June 2006 and 'saved' under the regulations until 18th June 2009 pending the preparation of a replacement Local Plan.

10.2.19 The Central Lincolnshire Plan formally replaced the West Lindsey Local Plan (First Review) on 24 April 2017. The Central Lincolnshire Local Plan, adopted April 2017, contains the following policies in relation to flood risk and drainage:

Policy LP14: Managing Water Resources and Flood Risk

All development proposals will be considered against the NPPF, including application of the sequential and, if necessary, the exception test.

Through appropriate consultation and option appraisal, development proposals should demonstrate:

a. *That they are informed by and take account of the best available information from all sources of flood risk and by site specific flood risk assessments where appropriate;*

b. *That there is no unacceptable increased risk of flooding to the development site or to existing properties;*

c. *That the development will be safe during its lifetime, does not affect the integrity of existing flood defences and any necessary flood mitigation measures have been agreed with the relevant bodies;*

d. *That the adoption, ongoing maintenance and management of any mitigation measures have been considered and any necessary agreements are in place;*

e. *How proposals have taken a positive approach to reducing overall flood risk and have considered the potential to contribute towards solutions for the wider area; and*

f. *That they have incorporated Sustainable Drainage Systems (SuDS) in to the proposals unless they can be shown to be impractical.*

Protecting the Water Environment

Development proposals that are likely to impact on surface or ground water should consider the requirements of the Water Framework Directive.

Development proposals should demonstrate:

g. That water is available to support the development proposed;

h. That development contributes positively to the water environment and its ecology where possible and does not adversely affect surface and ground water in line with the requirements of the Water Framework Directive;

i. That development with the potential to pose a risk to groundwater resources is not located in sensitive location to meet the requirements of the Water Framework Directive;

j. They meet the Building Regulation water efficiency standard of 110 litres per occupier per day;

k. How Sustainable Drainage Systems (SuDS) to deliver improvements to water quality, the water environment and where possible to improve amenity and biodiversity have been incorporated into the proposal unless they can be shown to be impractical;

l. That relevant site investigations, risk assessments and necessary mitigation measures for source protection zones around boreholes, wells, springs and water courses have been agreed with the relevant bodies (e.g the Environment Agency and relevant water companies);

m. That adequate foul water treatment and disposal already exists or can be provided in time to serve the development;

n. That no surface water connections are made to the foul system;

o. That surface water connections to the combined or surface water system are only made in exceptional circumstances where it can be demonstrated that there are no feasible alternatives (this applies to new developments and redevelopments) and where there is no detriment to existing users;

p. That no combined sewer overflows are created in areas served by combined sewers, and that foul and surface water flows are separated;

q. That suitable access is safeguarded for the maintenance of water resources, flood defences and drainage infrastructure; and

r. That adequate provision is made to safeguard the future maintenance of water bodies to which surface water is discharged, preferably by an appropriate authority (e.g. Environment Agency, Internal Drainage Board, Water Company, the Canal and River Trust or local council).

Bassetlaw District Council

10.2.20 The Bassetlaw Core Strategy was adopted 2011.

Policy DM12: Flood Risk, Sewerage and Drainage

A. Flood Risk

Proposals for the development of new units in Flood Zones 2, 3a and 3b that are not defined by national planning guidance as being suitable for these zones will not be supported while development sites remain available in sequentially superior locations across the district. Reference should be made to the Council's Strategic Flood Risk Assessment when making assessments about likely suitability. Site specific Flood Risk Assessments will be required for all developments in flood risk areas, even where flood defences exist, as defined on the Proposals Map.

Where suitable redevelopment opportunities arise, the Council will require, in liaison with the Environment Agency, the opening up of culverts, notably in Worksop and Retford, in order to reduce the blocking of flood flow routes. Particular support will be given to the Flood Alleviation Scheme for Retford Beck.

B. Sewerage and Drainage

Proposals for new development (other than minor extensions) will only be supported where it is demonstrated to the Council's satisfaction that the proposed development will not exacerbate existing land drainage and sewerage problems in these areas.

All new development (other than minor extensions) will be required to incorporate Sustainable Drainage Systems (SuDS) and provide details of adoption, ongoing maintenance and management. Proposals will be required to provide reasoned justification for not using SuDS techniques, where ground conditions and other key factors show them to be technically feasible.

Preference will be given to systems that contribute to the conservation and enhancement of biodiversity and green infrastructure in the district.

Lincolnshire County Council

10.2.21 The Lincolnshire County Council 'Sustainable Drainage Design and Evaluation Guide' was produced to facilitate the best possible SuDS design. It is primarily intended for

use by developers, designers and consultants who are seeking guidance on the Lead Local Flood Authority (LLFA) standards for the design of sustainable surface water drainage in Lincolnshire.

CIRIA SuDS Manual

10.2.22 The CIRIA SuDS Manual, C753 (CIRIA, 2015) provides best practice guidance on the planning, design, construction, operation and maintenance of Sustainable Drainage Systems (SuDS).

10.3 Assessment Methodology and Significance Criteria

10.3.1 This PEIR chapter is based on the proposed Cottam Solar Project EIA Scoping Opinion issued by PINS 9th March 2022, which is the most recent scoping opinion adopted. The scoping response is set out in Table 10.1 below:

Table 10.1: Consultation Table

Consultee and Date	Matter	Scoping / Consultee Responses
The Planning Inspectorate, Scoping Opinion, March 2022	Hydrological receptors	Scoping Report paragraphs 9.3.2 and 9.3.3 state that a hydrological assessment will be undertaken to establish local catchments and overland flow routes and significance will be informed by the valuation of watercourses. No reference is made to other water features e.g. ponds although they are located at both West Burton 2 and 3 sites (Scoping Report paragraph 8.2.24). These are not identified in Appendix 9 which only establishes the flood risk baseline, and location of, watercourses. The ES assessment should identify and locate all water resources, including ponds, ditches, groundwater resources, wetlands etc. that are hydrologically linked to, and may be impacted by, the Scheme site, including the cable route and siting of the storage/substation components. If this is assessed in other Chapters, the ES should cross-reference accordingly.
The Planning Inspectorate, Scoping Opinion, March 2022	Climate change projections	Scoping Report paragraph 9.3.2 states that hydrological analysis will consider climate change but provides no further detail on how this will be considered in the ES

Consultee and Date	Matter	Scoping / Consultee Responses
		assessment, specifically on what projections will be applied and why. For clarity, relevant, up to date, climate change allowances as set out in the Planning Practice Guidance for flood risk and coastal change should be applied.
The Planning Inspectorate, Scoping Opinion, March 2022	Maintaining existing drainage patterns	Scoping Report paragraph 9.3.12 states that rainwater will be 'shed' to the ground as per the existing situation however, it is not explained whether the concentration of runoff from solar panel faces will impact on existing drainage patterns. The ES, Flood Risk Assessment and Drainage Strategy should explain whether the presence of solar panels will affect runoff rates and distribution, describing any significant effects that may arise.
Lincolnshire LLFA December 2021 – and ongoing discussions	General acceptability of development from a flood risk and drainage perspective	Scoping Report paragraph 9.3.12 states that rainwater will be 'shed' to the ground as per the existing situation however, it is not explained whether the concentration of runoff from solar panel faces will impact on existing drainage patterns. The ES, Flood Risk Assessment and Drainage Strategy should explain whether the presence of solar panels will affect runoff rates and distribution, describing any significant effects that may arise.
Nottinghamshire LLFA February 2022 - and ongoing discussions	General acceptability of development from a flood risk and drainage perspective	Scoping Report paragraph 9.3.12 states that rainwater will be 'shed' to the ground as per the existing situation however, it is not explained whether the concentration of runoff from solar panel faces will impact on existing drainage patterns. The ES, Flood Risk Assessment and Drainage Strategy should explain whether the presence of solar panels will affect runoff rates and distribution, describing any significant effects that may arise.
EA September 2021 - and ongoing discussions	General acceptability of development from a flood risk perspective	Scoping Report paragraphs 9.3.1 to 9.3.3 state that a hydrological assessment will be undertaken to establish local catchments and overland flow routes and significance will be informed by the valuation of watercourses. No reference is made to other

Consultee and Date	Matter	Scoping / Consultee Responses
		water features e.g. ponds although they are located at both West Burton 2 and 3 sites (Scoping Report paragraph 8.2.24). These are not identified in Appendix 9 which only establishes the flood risk baseline, and location of, watercourses. The ES assessment should identify and locate all water resources, including ponds, ditches, groundwater resources, wetlands etc. that are hydrologically linked to, and may be impacted by, the Scheme site, including the cable route and siting of the storage/substation components. If this is assessed in other Chapters, the ES should cross-reference accordingly.
Witham IDB Nov 2021 - and ongoing discussions	Hydrological receptors	Scoping Report paragraph 9.3.12 states that rainwater will be 'shed' to the ground as per the existing situation however, it is not explained whether the concentration of runoff from solar panel faces will impact on existing drainage patterns. The ES, Flood Risk Assessment and Drainage Strategy should explain whether the presence of solar panels will affect runoff rates and distribution, describing any significant effects that may arise.

10.3.2 A desktop analysis of the available data has been undertaken to inform this PEIR chapter. Further data is provided in the flood risk screening assessments provided at **Appendices 10.1 to 10.6**. The assessments have identified and assessed the risks of fluvial and surface water flooding to proposed scheme, as the main potential flood risks to this type of development.

10.3.3 Delta-Simons are currently undertaking a detailed Flood Risk Assessment and Drainage Strategy which will assess each parcel for each which will identify and assessed the risks of all forms of flooding to and from the proposed scheme and will:

- Identify and evaluate the likely significant environmental effects and receptors at risk of harm from a change in the hydrological environment.

- Undertake consultation with the Environment Agency, Lead Local Flood Authority, IDB and other stakeholders.
- Identify whether the proposed scheme is likely to be affected by current or future flooding from any source.
- Assess whether it will cause increased flood risk elsewhere.
- Assess whether the measures proposed to deal with these effects and risks are appropriate.
- Undertake a review of the Sequential Test and, if required, the Exception Test.
- Review whether sustainable Drainage Systems (SuDS) will be examined for mitigating the increases in site runoff. This will be determined in consultation with the Environment Agency and Lincolnshire County Council and Nottinghamshire as Lead Local Flood Authorities.

10.3.4 A hydrological assessment has been undertaken to establish local drainage catchments and overland flow routes in **Appendices 10.1 – 10.6**.

10.3.5 The Flood Risk Assessment and Drainage Strategy to be submitted with the DCO application will include a review and summary of relevant legislation and national, regional and local planning policy relevant to the water environment. Assessment in the form of a drainage assessment in accordance with the CIRIA guidance 'The SuDS Manual C753' will be undertaken by:

- Site visit and hydrological/drainage surveys;
- Baseline hydrological assessment, data acquisition and regulatory consultation;
- Hydrological analysis (considering climate change);
- Sustainable drainage system design; and
- Surface water quality risk assessment & pollution control review.

10.3.6 The supporting ES chapter will consider the likely significant environmental effects to the Site and the surrounding area over the lifetime of the development and propose appropriate mitigation measures if required. The assessment of the significance of impact will be informed by the valuation of the watercourse and the magnitude of impact. In line with the Design Manual for Roads and Bridges (DMRB) guidance, the magnitude of impact will be determined only for residual impacts following mitigation.

10.3.7 Flood risk and surface water drainage will be summarised in the ES in accordance with guidance in the DMRB Volume 11, Section 3, Part 10 (HD 45/09).

10.3.8 The ES chapter will summarise the findings and recommendations of the Drainage Strategy. Recommendations will be made for mitigation measures in order to minimise the potential effects of the Scheme on water quality and drainage. Any residual effects will be identified as well as the potential for relevant cumulative effects associated with any other developments nearby.

10.3.9 A Screening and Scoping WFD Assessment will be undertaken. The aim of this assessment would be to determine the potential for any non-compliance of the Scheme with WFD objectives for affected water bodies, using readily available information and site observations. This will include an examination of the potential construction, operation and decommissioning phase effects of the Scheme on relevant WFD biological, hydromorphological and physio-chemical parameters. Depending on the outcomes of the Screening and Scoping WFD Assessment, more detailed investigations and assessments may be required, which will be determined in consultation with the Environment Agency. If further assessment is required, this would be provided alongside the ES.

Approach and Method

10.3.10 As summarised in Tables 10.2, 10.3 and 10.4 magnitude is considered in relation to the potential impact on the receptor with magnitude defined in a range from Negligible to Major. The receptor sensitivity is defined as Low, Medium or High depending on the specific receptor character and its ability to tolerate change. The significance of the effect is defined in relation to both the magnitude of the impact and receptor significance. If the significance of the potential effect is 'Moderate Adverse' or higher, then mitigation measures may need to be considered.

Table 10.2: Sensitivity/Importance of the Identified Environmental Receptor

Sensitivity	Definition
High	WFD Classification – Good or High Site protected under EU or UK wildlife legislation (SAC, SPA, SSSI, Ramsar Site); European Designated salmonid fishery (or salmonid & cyprinid fishery); Important social or economic uses such as water supply, navigation or mineral extraction. Floodplain or defence protecting 1 or more residential properties or industrial premises from flooding.
Medium	WFD Classification: Moderate May be designated as a local wildlife Site. May support a small / limited population of protected species. Limited social or economic uses.

	Floodplain or defence protecting 10 or fewer industrial properties from flooding.
Low	WFD classification – Poor No nature conservation designations. Low aquatic fauna and flora biodiversity and no protected species. Minimal economic or social uses. Floodplain with limited constraints and a low probability of flooding of residential and industrial properties.

Table 10.3: Methodology for determining impact magnitude

Magnitude of Impact	Examples of Receptor
Major (adverse)	Loss of Protected Area. Pollution of potable sources of water abstraction. Deterioration of a water body leading to a failure to meet Good Ecological Status (GES) under the WFD and reduction in Class (or prevents the successful implementation of mitigation measures for heavily modified or artificial water bodies). Significant potential increase in peak flood level (1% annual probability).
Moderate (adverse)	Loss in production of fishery. Discharge of a polluting substance to a watercourse but insufficient to change its water quality status (WFD class) in the long term. No reduction in WFD class, but effect may prevent improvement (if not already at GES) or the successful implementation of mitigation measures for heavily modified or artificial water bodies. Moderate potential Increase in peak flood level (1% annual probability).
Minor (adverse)	Noticeable effect on features, or key attributes of features, on the Protected Areas Register. Measurable changes in attribute but of limited size and / or proportion, which does not lead to a reduction in WFD status or failure to improve. Minor potential increase in peak flood level (1% annual probability).
Negligible	No effect on features, or key attributes of features, on the Protected Areas Register. Discharges to watercourse but no significant loss in quality, fishery productivity or biodiversity. No effect on WFD classification or water body target. Negligible change in peak flood level (1% annual probability).
Beneficial	Improvement on features, or key attributes of features, on the Protected Areas Register. Improvement in fishery production or biodiversity. Improvement in WFD classification or water body target. Potential reduction in peak flood level (1% annual probability).

Table 10.4: Methodology for determining significance of effect

Sensitivity / Magnitude	High	Medium	Low
High	Major	Major/Moderate	Moderate
Medium	Major/Moderate	Moderate	Moderate/Minor
Low	Moderate	Moderate/Minor	Minor
Negligible	Moderate/Minor	Minor	Negligible
Neutral	Neutral	Neutral	Neutral

10.3.11 In considering the significance of the effect, account is taken of an effect's duration; reversibility and compatibility with relevant environmental policies and standards. Effects can be temporary or permanent. Temporary effects are largely associated with the construction phase and permanent effects are largely associated with the operational phase.

Assumptions and Limitations

10.3.12 The methodology for assessment of potential water resource and flood risk effects has incorporated the following assumptions:

- That the Scheme will be low impact with access roads and footways surfaced with permeable surfacing and therefore assumed to be effectively permeable;
- Any runoff from construction waste materials would be collected, contained and prevented from direct entry to local water courses;
- That all clean roof drainage would be discharged directly to the nearest surface water drainage feature;
- Analysis of flood extents is reliant on the accuracy of the published EA Flood Map for Planning and EA flood data. No new hydraulic modelling has been undertaken as part of this study;
- Given the Scheme is anticipated to be unmanned, with infrequent attendance for maintenance, on-Site welfare facilities will be limited or non-existent. Therefore, no foul water discharge from the Scheme and no mains connected foul water drainage systems are likely to be necessary; and
- Cable routes will be installed below the surface and will pass beneath local watercourses ensuring they are resilient to all forms of flood risk.

10.3.13 The flood risk from fluvial (Main Rivers) and coastal flooding is assessed through the use of the EA Flood Maps (flood risk from rivers or the sea). This map defines three zones of different flood risk, the third of which is subdivided into two categories:

- Zone 1 "Low probability of flooding" – This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%);
- Zone 2 "Medium probability of flooding" – This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year;
- Zone 3a "High probability of flooding" – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year; and
- Zone 3b "Functional floodplain" – A sub-part of Zone 3, this zone comprises land where water has to flow or be stored in times of flood. This zone is not normally included within the national Flood Map for Planning and is calculated where necessary using detailed hydraulic modelling.

10.4 Baseline Conditions

10.4.1 The baseline conditions for each of the Sites has been detailed in the reports included at **Appendices 10.1 – 10.6**. Mapping is included. In addition, the baseline conditions in respect of the cable corridors, relating to hydrology, flood risk and drainage is provided below.

10.4.2 The risk of tidal / fluvial flooding has been interpreted from the Environment Agency's (EA) online Flood Map for Planning[1], from Site specific hydraulic modelling provided by the EA where available and the EA Long Term Flood Risk Map (Surface Water) where site specific modelling is not available. The risk of surface water flooding has been assessed from the EA Long Term Flood Risk Map (Surface Water)[2].

10.4.3 The Site is situated within both the Anglian and Humber River Basin Management Plan (RBMP) areas. Within the Anglian RBMP the Site is further situated within Witham Management Catchment and within the Humber RBMP the Site is Lower Trent and Erewash Management Catchment. Local land drainage feed into local watercourses several of which are WFD surface waterbodies.

10.4.4 As described in Chapter 4, the Scheme comprises three Sites named Cottam 1 to 3. At present, the final cable route is yet to be determined and there are 'search areas' for the potential cable route. Only a narrow width within these corridors will be required for the cable route and its construction.

[1] https://flood-map-for-planning.service.gov.uk/
[2] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

10.4.5 Cottam 1 consists of three parcels (North, South and West) and therefore, the assessment of each parcel has been undertaken separately. Furthermore Cottam 1 North and West are further divided into three further parcels each, as described in the appendices.

Cottam 1 (North)

10.4.1 The EA's Flood Risk Map for Planning indicates that the eastern and western boundaries of Parcel 1 are within the extents of Flood Zone 3. A minor extent of the north-western corner of Parcel 2 is located in Flood Zone 3. Parcel 3 is covered by the extents of Flood Zone 3 in the predominantly in the west and in the southern corner.

10.4.2 Flood Zone 3 defined as land assessed as having a 1 in 100 or greater >1% Annual Exceedance Probability annual probability of river flooding.

10.4.3 Fluvial risk across the Parcels within the Site is associated with a series of land drains and an Ordinary Watercourse to the west of Parcel 3 which is discharges into the River Till (Main River – responsibility of the EA to maintain) approximately 1.7 km south-west of the Site.

10.4.4 In the absence of site-specific modelled flood data, the 0.1% annual probability surface water flood scenario can be used as a proxy for the 1% Annual Exceedance Probability (AEP) plus Climate Change (CC) fluvial event. A map depicting flood depths associated with the 0.1% Annual Probability is included as Annex E in Appendix 10.1. No flooding with a depth greater than 0.9 m is present across any of the Site parcels. Flooding with a depth between 0.6 – 0.9 m is present along the western boundary of Parcel 1 and the north-western corner of parcel 2.

10.4.5 The EA's Long-Term Flood Risk Map indicates that Surface Water flooding with a High Risk (>3.3% Annual Probability) of occurrence is present across the Site.

10.4.6 Parcel 1 has High Risk areas associated with some land drains that cross the Parcel is the east and a topographical low point in the west. Parcels 2 and 3 have High Risk areas associated with the route of the River Till. There are multiple flow paths in the surrounding area that flow towards the Site

Cottam 1 (South)

10.4.7 The EA's Flood Risk Map for Planning indicates that the northern, western and a minor portion of the south-eastern extent of the Site are within Flood Zone 3.

10.4.8 Fluvial risk across the Site is associated with the River Till which flows southwards through the Site, the risk extents along some land drains in the north of the Site. The South Spinney/Beck Spinney is an Ordinary Watercourse (responsibility of the LLFA to maintain) and runs along the part of the south-eastern Site boundary.

10.4.9 The EA's Spatial Flood Defences dataset indicates that formal EA Flood Defences are present along the length of the River Till that runs through the Site. The defences are shown as 'embankments' on the dataset which upon inspection of Google Streetview appear to be raised grassy banks. The Standard of Protection (SoP) of the defence is shown as up to the 1 in 10-year event. The upstream crest level of the defence is stated as 7.62 m AOD and the downstream crest level as 7.20 m AOD.

10.4.10 The EA have provided depth grid date for the Defended 1% AEP + 20% Climate Change (CC) scenario and 0.1% AEP + 20% CC scenario taken from the Upper Witham Lincoln 2015 Model.

10.4.11 During the 1% AEP + CC scenario, flows are shown to overtop the right bank of the River Till and cover a minor portion of the Site in the south. The vast majority of the on-Site flooding is shown to be below 0.6 m however there are some minor areas shown to hold depths above 0.9 m, therefore development should be avoided in such areas. It should be noted that there appears to be a modelling error in the south-west corner of the Site where a 'clear' zone of no flood risk is shown. On comparison to LiDAR data, the elevation levels of the land in the flood free zone are not raised above the surrounding land, therefore there is no indication that flows would not reach this area. It should be assumed that flows would also cover this portion of the Site.

10.4.12 During the 0.1% AEP + CC scenario, the majority of the Site remains flood free however a greater proportion of the Site is shown to hold flooding with a depth greater than 0.9 m.

10.4.13 The EA's Long-Term Flood Risk Map indicates that Surface Water flooding with a High Risk (>3.3% Annual Probability) of occurrence is present across the western and eastern extents of the Site. The surface water extents shown on the EA Flood Map concur with the course of the watercourses that run through the west of the Site and along the eastern periphery.

Cottam 1 (West)

10.4.14 The EA's Flood Risk Map for Planning indicates that Parcels 2 and 3 are partially located within Flood Zones 2 and 3 associated with the River which flows in a south-easterly direction through Parcels 2 and 3.

10.4.15 The EA's Spatial Flood Defences dataset indicates that formal EA Flood Defences are present along the length of the River Till that runs through the Site. The defences are shown as 'embankments' on the dataset which upon inspection of Google Streetview appear to be raised grassy banks. The Standard of Protection (SoP) of the defence is shown as up to the 1 in 10-year event. The upstream crest level of the defence is stated as 10.45 m AOD and the downstream crest level as 8.41 m AOD.

10.4.16 The EA have provided depth grid date for the Defended 1% AEP + 20% Climate Change (CC) scenario and 0.1% AEP + 20% CC scenario taken from the Upper Witham Lincoln 2015 Model.

10.4.17 During the 1% AEP + CC scenario, the vast majority of the Site is shown to remain flood free. A minor portion of flooding is shown to encroach the south-eastern corner of the Site however depths are shown to remain below 0.5 m.

10.4.18 During the 0.1% AEP + CC scenario, a minor portion of Parcel 1 is encroached by flooding however the depths are shown to remain below 0.4 m. Flooding is shown on both side of the River Till within the centre of Parcel 2, with some areas indicated to have flooding reaching depths above 0.9 m. The majority of the northern Parcel 3 is shown to be flooded however the depths are shown to be below 0.7 across the entire parcel. The eastern extent of the southern Parcel 3 is shown to be impacted, with maximum flood depths above 0.9 m in the eastern area of the parcel that bounds the River Till.

10.4.19 The EA's Long-Term Flood Risk Map indicates that Surface Water flooding with a High Risk (>3.3% Annual Probability) of occurrence is present across the Site. Parcel 1 has High Risk areas associated with some land drains that cross the Parcel is the east and a topographical low point in the west. Parcels 2 and 3 have High Risk areas associated with the route of the River Till. There are multiple flow paths in the surrounding area that flow towards the Site.

Cottam 2

10.4.20 The EA's Flood Risk Map for Planning indicates that the north and eastern boundary of the Site are encircled by Flood Zone 3. The EA's Spatial Flood Defences Dataset indicates that there are no flood defences present within the vicinity of the Site.

10.4.21 The EA's Long-Term Flood Risk Map indicates that Surface Water flooding with a High Risk (>3.3% Annual Probability) of occurrence is present across the boundaries of the Site, predominantly surrounding the north, east and west. The Site shows little surface water risk within the boundaries, aside from a small parcel within the centre of the site which is shown to be a Medium Risk (1% - 3.3%).

Cottam 3a

10.4.22 The EA's Flood Risk Map for Planning indicates that the Site is located wholly within Flood Zones 1.

10.4.23 The EA's Long-Term Flood Risk Map indicates that the majority of the Site is at Very Low to Low (<0.1 - 1%) risk of Surface Water flooding. Isolated areas of the Site are at Medium to High Risk (1 - 3.3< % Annual Probability), notably on the north-eastern boundary of the Site for approximately 1 km. This forms a Surface Water flow path,

running along the boundary and away from the Site northwards. Other isolated areas of Medium to High Risk on the Site are associated with minor topographic depressions which infill during rainfall events.

Cottam 3b

10.4.24 The EA's Flood Risk Map for Planning indicates that the Site is located wholly within Flood Zones 1.

10.4.25 The EA 'Flood Risk from Surface Water' map (Figure 2) indicates that the Site is largely at Very Low risk (<0.1% annual probability) of surface water flooding. However, there are some small areas throughout the Site which are at Low to High risk (0.1 - ≥ 3.3% annual probability) of surface water flooding; these areas are generally confined to the north-east and south-western extents

Cable Routes

10.4.26 The proposed cable routes cross watercourses and therefore pass through Flood Zones 1, 2 and 3 on the EA's Flood Risk Map for Planning.

10.5 Identification and Evaluation of Likely Significant Environmental Effects

10.5.1 The likely significant effects of the Scheme during decommissioning are likely to be similar to those encountered during the construction phase. Therefore, those effects considered for construction below are similarly expected during the decommissioning phase.

10.5.2 The unmitigated likely significant effects are reported below with mitigation considered in Section 10.8.

Construction

Effects on Flood Risk and Drainage

Mud and Debris Blockages

10.5.3 There is the potential for mud and debris arising from the construction works to enter the existing surface water / land drainage system, causing blockages and restricting flow. This could result in localised flooding on Site, especially after heavy or prolonged rainfall resulting in a potential risk to people and property. As the Site is at present predominantly agricultural the initial effect is considered to be limited. However, as the multi parcel development progresses and the area of development increases this potential construction effects will become an increasing consideration.

10.5.4 The sensitivity of construction workers and equipment to mud and debris blockages is considered to be **Medium**. The potential for mud and debris to block drainage networks is considered to have an effect of **Low Adverse** magnitude on flooding to the Site itself and surrounding area which would result in flood risk to construction workers and equipment at the Site. The significance of effect is **Moderate Adverse.**

Temporary Increase in Impermeable Area and Compaction of Soils

10.5.5 Temporary increase in impermeable area during construction has the potential to increase flooding both on and off site. Temporary hardstanding or compacted areas could result in rapid surface water runoff to local watercourses or cause an increase in overland flow. As the Site is Greenfield at present there is potential for overland flows to be created and for localised flooding to occur. Increased, un-regulated discharges into local watercourses could also increase the risk of flooding downstream.

10.5.6 The effects would be temporary and short term. The sensitivity of construction workers and equipment is considered to be **Medium** with the temporary effects considered to have an effect of **Medium Adverse** magnitude to people working within - and property at - the Site as it could occur at a time of high flood risk (e.g. during a large storm event). The significance of effect is **Moderate Adverse.**

10.5.7 Construction of access tracks and movement of construction traffic, in the absence of construction good practice, can lead to compaction of the soil. This can reduce soil permeability, potentially leading to increased run-off rates and increased erosion. The superficial geology underlying the Development is generally of low permeability and is in agricultural use, so the effects of compaction would not result in a substantial increase in runoff from existing conditions.

10.5.8 In order to maintain the current level or improve the drainage, it is necessary to ensure that construction methods do not seriously disrupt the established drainage network and that no areas are surcharged, either by water discharge or spoil.

10.5.9 Maintenance of existing drainage infrastructure is critical to avoid compaction of soils, therefore all existing land drainage network, will be maintained. Existing access tracks have been used in the design where practicable, further reducing the potential for soil compaction.

10.5.10 The effects would be temporary and short term. The sensitivity of construction workers and equipment is considered to be **Medium** with the temporary effects considered to have an effect of **Medium Adverse** magnitude to people working within - and property at - the Site as it could occur at a time of high flood risk (e.g. during a large storm event). The significance of effect is **Moderate Adverse.**

Effects on Water Resources

Silt-laden Runoff

10.5.11 During the construction phases of the Scheme, there are a number of activities which have the potential to negatively affect the local water environment. Activities such as potential dewatering of excavations, concreting, earthworks, and use of heavy plant can lead to significant quantities of silty runoff that may also be contaminated with oil, fuel and/or other construction materials, all of which have potential to cause pollution of the water environment and negatively affect the ecology it supports. Pollutants could be mobilised to watercourses or infiltrate to ground.

10.5.12 The Scheme is likely to involve construction of temporary access tracks to the Scheme. Access roads are expected to be constructed with compacted self-binding aggregate fill materials. Shallow excavation of vegetation and soils would be necessary for placement of road surfaces. Access roads would form long linear features that, in the event of rainfall, could provide temporary drainage routes for surface water during the construction phase of the development. With the potential for soil erosion and consequent liberation of sediment from shallow road excavations it would be necessary to ensure that pollution prevention measures within the Site are adequate to prevent migration of silt to surface watercourses and groundwater bodies.

10.5.13 The sensitivity of surface water and groundwater bodies to silt contamination is considered to be **Medium**. Without mitigation, potential effects are considered of a **Medium** magnitude. The significance of the effect is **Moderate Adverse** on a temporary short-term basis.

Spillages, Leakages and Pollutants

10.5.14 During construction, fuel, hydraulic fluids, solvents, grouts, paints and detergents and other potentially polluting substances will be stored and / or used on the Site. Leaks and spillages of these substances could pollute groundwater bodies through infiltration as well as the surface watercourses within the Site and those nearby if their use is not carefully controlled and spillages enter existing flow pathways. To allow such substances to enter a watercourse could be in breach of regulation 38(1) of the Environmental Permitting (England and Wales) Regulations 2016, therefore, measures to control the storage, handling and disposal of such substances will need to be in place prior to and during construction. The construction compound locations have not been determined, nor has it been confirmed at this stage whether concrete will be batched off-site. Therefore, it has been assumed that these could be sited next to existing flow pathways,

10.5.15 The sensitivity of surface water and groundwater bodies to spillages, leakages and pollutants is considered to be **Medium**. Without mitigation measures spillages of chemicals/fuel stored and or used on the Site could cause short term, temporary effects of a **Medium** magnitude on the local watercourses (medium importance). The significance of effect is **Moderate Adverse** on a temporary short-term basis.

Inappropriate Wastewater Disposal from Welfare Facilities

10.5.16 In the absence of nearby public foul water sewers to which foul water from welfare facilities could be connected, a suitably sized self-contained unit will be installed on the Site that will be maintained by a specialist Contractor.

10.5.17 The sensitivity of surface water to inappropriate wastewater disposal from welfare facilities is considered to be **Medium**. Construction foul water will not be discharged into a watercourse under any circumstances and therefore the magnitude of impact and significance of this effect is considered to be **Negligible.**

Operation

Effects on Flood Risk and Drainage

Increase in Permanent Impermeable Area

10.5.18 Given the nature of the Scheme, the increase in permanent impermeable area on the Site will be negligible, however equipment such as the proposed substations and battery storage areas will generate increased surface water runoff when compared to the current use of the Site. This could potentially increase localised pluvial flooding on the Site, as well as increase flood risk to people and property in the immediate surrounding area and downstream.

10.5.19 The sensitivity of people and property is considered **Medium.** Whilst the effects would be temporary and short term, this is considered to have an effect of **Medium Adverse** magnitude to people and property as it could occur at time of high flood risk (e.g. during a large storm event). The significance of effect is **Major Adverse.**

Increase in Discharge to Local Watercourse

10.5.20 An increase in the volume of water discharged to local watercourses as a result of increased hardstanding area has the potential to increase the flood risk to areas downstream of the Scheme.

10.5.21 The sensitivity of people and property is considered **Medium.** Whilst the effects would be temporary and short term, this is considered to have an effect of **Medium Adverse** magnitude to people and property (considered to be up to very high importance) occurring at time of high flood risk (e.g. during a large storm event). The significance of effect is **Major Adverse**.

Summary

10.5.22 During construction there are a number of potential effects on surface water which require mitigation to reduce the residual effect to **Negligible or Minor** which are discussed below. During operation, the risk to the receptors will be mitigated through implementation the embedded drainage discussed further below.

Operation

Effects on Water Resources

Diffuse Pollution Contained in Urban Runoff

10.5.23 The operation of the Scheme may negatively affect the local water environment. Urban runoff from the Site, along with the associated infrastructure, could contain diffuse urban pollutants such as hydrocarbons, heavy metals, and nutrients as well as debris and silt which could ultimately be discharged to the nearby watercourses via surface water runoff or infiltrate to ground. Without mitigation this could have a moderate adverse effect on water quality.

10.5.24 The sensitivity of surface water and groundwater bodies are therefore considered **Medium.** This is considered to have an effect of **Medium Adverse** magnitude on downstream watercourses. The significance of effect is **Moderate Adverse** for the local watercourses – including those within the Site - which is considered permanent if left unmitigated.

Increase in Highway Routine Runoff

10.5.25 Traffic on existing roads to and from the Site will increase albeit negligibly as a result of the Scheme. Any increase in traffic flows could lead to the introduction of new sources (or changed discharges) of highway runoff into receiving watercourses. Surface water runoff from roads can contain pollutants such as hydrocarbons, heavy metals and inert particulates which can cause chronic pollution of the water environment if allowed to enter watercourses without the appropriate treatment.

10.5.26 Without mitigation this could have a **Low Adverse** effect on water quality, the sensitivity of surface water is therefore considered **Medium.** This is considered to have an effect of **Low Adverse** magnitude on downstream watercourses. The significance of effect is **Minor Adverse** for the local watercourses which is considered permanent if left unmitigated.

Increase in Highway Spillage Risk

10.5.27 Spillages of pollutants (e.g. oil) on highways can be transported to watercourses via runoff, where they could impact upon ecological life, or infiltrate to ground.

10.5.28 The receptors at risk are surface watercourses and groundwater bodies which are considered to be of **Medium** Sensitivity. Without mitigation the increase in highway spillage risk is considered to have an effect of a **Low Adverse** magnitude. The significance of effect is **Minor Adverse** which is considered permanent if left unmitigated. Mitigation should form part of the civil engineering design going forward.

Increased Demand on Water Supply

10.5.29 Due to the nature of the Scheme, there is no significant demand for water. This is not directly considered to be a surface water quality effect, as it is unlikely that any required water would be sourced from local surface waters, and it is presumed that the Scheme would not proceed unless potable water was available from elsewhere. Anglian Water should be consulted regarding potable supply to the Scheme where necessary. Water consumption for any future Site users should be minimised through water efficiency measures.

10.5.30 The receptors at risk are surface water which are considered a **Low** sensitivity. The increased demand on water supply from the Scheme is considered to have an effect of **Negligible magnitude** (i.e. to locations where potable water supply is obtained from). The significance of effect is therefore **Negligible.**

Disposal of Surface and Foul Water from the Site

10.5.31 Access to the solar PV array during construction and operation will be taken from grassed /permeable tracks and existing farm tracks accessed from the wider highway network, limiting the requirement for new hardstanding.

10.5.32 The sensitivity on surface water is therefore considered **Medium.** This is considered to have an effect of **Medium Adverse** magnitude on downstream watercourses. The significance of effect is **Moderate Adverse** for the receiving watercourses which is considered permanent if left unmitigated.

10.5.33 Currently there is no existing foul network on the Site or adjacent. Due to the nature of the Scheme no welfare facilities are proposed and there will be no foul drainage network associated with the Site.

Table 10.5: Flood Risk and Drainage summary of likely significant effects and receptors at risk if left unmitigated

Likely Significant Effect	Receptor(s)
Construction Phase	
Mud and Debris Blockages	Flood risk to future people or property at the Site and surrounding areas. Construction workers and construction equipment
Temporary Increase in Impermeable Area	Flood risk to future people or property at the Site and surrounding areas. Construction workers and construction equipment
Compaction of Soils	Flood risk to future people or property at the Site and surrounding areas. Construction workers and construction equipment
Operational Phase	
Increase in Permanent Impermeable Area	Flood risk to future people or property at the Site and surrounding areas.
Increase in Discharge to Local Watercourses.	Flood risk to future people or property at the Site and surrounding areas.

Table 10.6: Water Resources summary of likely significant effects and receptors at risk if left unmitigated.

Likely Significant Effect	Receptor(s)
Construction Phase	
Silt-laden Runoff	Local watercourses including those within and adjacent to the Site, groundwater bodies
Spillages, Leakages and Pollutants	Local watercourses including those within and adjacent to the Site, groundwater bodies
Inappropriate Wastewater Disposal from Welfare Facilities	Local watercourses including those within and adjacent to the Site
Operational Phase	
Diffuse Pollution Contained in Urban Runoff	Local watercourses including those within and adjacent to the Site, groundwater bodies
Increase in Highway Routine Runoff	Local watercourses including those within and adjacent to the Site
Increase in Highway Spillage Risk	Local watercourses including those within and adjacent to the Site, groundwater bodies
Increased Demand on Water Supply	Surrounding area

Disposal of Surface and Foul Water from the Site	Local watercourses including those within and adjacent to the Site

Summary

10.5.34 During construction there are a number of potential effects on surface water which require mitigation to reduce the residual effect to **Negligible** which are discussed below. During operation, the risk to the receptors will be mitigated through implementation of the embedded drainage discussed below.

10.6 In-combination Effects

10.6.1 There are considered to be no cumulative effects from inter-topic relationships following respective mitigation that would cumulatively impact the Site.

10.7 Cumulative Effects

10.7.1 In summary, the type of 'cumulative' effects which will be assessed are:

The combined effects of the Scheme with other significant and relevant committed proposals within the vicinity of the Scheme.

10.7.2 A 'long list' of potential cumulative development sites is provided in **Appendix 2.2** and the more substantial developments are shown on the plan at **Appendix 2.3**. Of particular relevance to any cumulative assessment is the West Burton Solar Project and Gate Burton Solar Project (both NSIP schemes). Overall, all local developments will have to work to the same planning policy and ensure that there is no increase in flood risk on or off-site as a result of the scheme's, so they remain safe for the lifetime of the developments.

10.7.3 A comprehensive CEMP will also be required for this development (as for other developments) to ensure there are no adverse impacts on local water resources and water quality. Therefore, the cumulative impact is considered **Negligible**.

10.8 Mitigation Measures

Embedded Development Design

10.8.1 8m Easements have been established around all watercourses, including Main Rivers, Ordinary Watercourses and IDB assets.

10.8.2 Beyond this, the separation of construction ground-works from drainage ditches has been maximised, particularly from the IDB maintained ditches onsite.

10.8.3 Existing access tracks, where possible, will be retained, limiting the requirement to develop new access which can disturb soils and lead to compaction. Where new access tracks are required, they have been designed to avoid crossing drainage ditches, where possible.

10.8.4 The CEMP describes water management measures to control surface water run-off and drain hardstanding and other structures during the construction and operation of the Development. This will form part of a Pollution Prevention Plan (PPP) to be implemented for the Development.

10.8.5 The easements embedded into the design for watercourses, in conjunction with the CEMP, will avoid potential effects on the local receptors.

10.8.6 It is also noted that, currently, the fields within the Core Study Area are typically used for arable farming and are ploughed to within a closer distance of the ditches than the separations proposed for the Scheme. The "with Development" scenario is therefore likely to be better in terms of drainage than the baseline scenario. The "with Development" scenario also does not include application of nitrates to the land, which is carried out periodically in the baseline scenario, and this will lead to further improvements in water quality in the "with Development" scenario compared to the baseline scenario.

10.8.7 Access to the site during construction and operation will be taken from permeable and existing farm tracks accessed from the local highway network. This limits the potential for increased surface water runoff rates and sedimentation effects during construction.

10.8.8 With regards to flood risk, the individual parcels which make up the Site have been assessed on the best available data for each parcel. Based on the assessed flood risk the following embedded design has been implemented:

- Critical infrastructure within the Development (the substations and battery storage compounds) have been sequentially located within Zone 1, an area with a "Low probability of flooding" and therefore in land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%); and

- Non-flood sensitive infrastructure forming the wider development (PV arrays, cabling, inverters and transformer stations) have been sequentially located outside the 1 in 100 plus climate change annual probability extent (1% +CC) or where this is not possible restricted to areas which experience less than 1 m depth of flooding during the same event. Solar PV arrays are constructed on legs which place the panel 1.7 m above the ground ensuring that the potential for damage is minimised.

Mitigation by Design associated with Flood Risk and Drainage

Permanent Increase in Impermeable Area

10.8.9 Given the nature of the Scheme, the increase in permanent impermeable area on the Site will be negligible, however equipment such as the proposed substations and battery storage areas will generate increased surface water runoff when compared to the current undeveloped nature of the Site. There can be no off-site detriment in terms of surface water runoff rates and volumes and therefore it is proposed to maintain the predevelopment surface water regime post development. This will be achieved through:

- Utilising permeable surfacing (Type 2 aggregate) for the Site access, ensuring that surface water is retained where it falls and is allowed to infiltrate to subsoils as per the existing situation.
- Installation of linear infiltration trenches around Critical infrastructure (the substations and battery storage compounds) or any other required hardstanding such as concrete bases. Infiltration trenches will ensure that any surface water generated by hardstanding is retained adjacent to the infrastructure, allowing it to infiltrate to subsoils as per the existing situation.
- The solar panels have the potential to concentrate rainfall under the leeward edge of the panels themselves. Research in the United States by Cook & McCuen[3], suggested this increase would not be significant however, there is a potential increase in silt ladened runoff. With the implementation of suitable planting (such as a wildflower or grass mix) the underlying ground cover is strengthened and is unlikely to generate surface water runoff rates beyond the baseline scenario.

10.8.10 Following implementation of the proposed mitigation the residual effect is considered to be **Negligible.** The arrangements for adoption should be investigated at an early stage and proposals agreed acceptable by the LPA.

Increase in Discharge to Local Watercourses

10.8.11 Maintaining the existing surface water run-off regime by utilising permeable surfacing for the Site access, linear infiltration trenches around any proposed infrastructure (substations and batteries) and wildflower planting at the leeward edge of solar panels will ensure that the Scheme is unlikely to generate surface water runoff rates beyond the baseline scenario.

[3] "Hydrologic Response of Solar Farms." J. Hydrol. Eng., 18(5), 536–541. 2013

10.8.12 The management train of any proposed SuDS will be designed appropriately so as not to exacerbate surface water risk from the Site. Suitability of the SuDS components will be determined in the detailed drainage design for the Scheme.

10.8.13 Following implementation of the proposed mitigation the residual effect is considered to be **Negligible.**

Mitigation by Design associated with Water Resources

Diffuse Pollution in Urban Runoff

10.8.14 Generally, the Scheme is likely to have a very-low pollution risk and so the management train should normally have one or two treatment stages. Generally, two treatment stages for run-off from access and one treatment stage for run-off from roofs are required, subject to agreement of the approving authority.

10.8.15 Where practical, at detailed design stage it is recommended that runoff from equipment and access tracks will be directed to permeable SuDS features with contributions being made from permeable surfacing, wildflower planting and linear infiltration trenches.

10.8.16 Inclusion of aforementioned features should in general provide sufficient treatment. Where some attenuation is provided in a below ground system, additional treatment may need to be provided by a suitably sized separator.

10.8.17 Future maintenance of the SuDS scheme should pass to a management company. Clear future finance arrangement should be in place for the future maintenance. An overview of possible SuDS features and possible future maintenance will be provided in the Flood Risk Assessment and Drainage Strategy for the development.

10.8.18 Following the implementation of mitigation measures the residual effect is considered to be **Negligible**.

Increase in Highway Routine Runoff / Spillage Risk

10.8.19 No mitigation is required beyond what is proposed in **Chapter 14 Transport**. Mitigation may include adaptations porous surfacing or similar; this would be confirmed at detailed design.

10.8.20 The residual effect is considered **Negligible**.

Disposal of Surface Water and Foul Water from the Site

10.8.21 Maintaining the existing surface water run-off regime by utilising permeable surfacing for the Site access, linear infiltration trenches around any proposed infrastructure (substations and batteries) and wildflower planting at the leeward

edge of solar panels will ensure that the Scheme is unlikely to generate surface water runoff rates beyond the baseline scenario.

10.8.22 The topography within the majority of the Site is relatively flat, meaning rainfall will tend to stay local to where it falls rather than running-off. In order to combat the effects of the concentration of water at the leeward edge of the solar panels, the area under the leeward edge should be seeded with a suitable grass / flower mix, to prevent drilling. With the implementation of suitable planting (such as a wildflower or grass mix) the ground cover is unlikely to generate surface water runoff rates beyond the baseline scenario.

10.8.23 No welfare facilities are proposed and there is no demand for Foul water generated on the Site.

10.8.24 Following the implementation of mitigation measures the residual effect is considered to be **Negligible**.

10.8.25 Mitigation measures are summarised in Table 10.6 below.

Additional Mitigation associated with Flood Risk and Drainage

Mud and Debris Blockages

10.8.26 Where necessary a temporary drainage network will be installed prior to the commencement of construction and a robust maintenance plan, confirmed through a Construction Environmental Management Plan (CEMP), should be maintained throughout the duration of construction works on the Site.

10.8.27 Following the implementation of mitigation measures the residual effect of mud and debris entering the surface water / land drainage system is considered **Negligible**.

Temporary Increase in Impermeable Area and Compaction of Soils

10.8.28 Construction mitigation guidance should be adhered to, for example ensuring that the impermeable area on the Site is increased as little as possible and where necessary installing a temporary surface water drainage system during construction. This effect should lessen as the Scheme progresses and the overall impermeable area increases with surface water drainage networks installed to deal with this effect.

10.8.29 The residual effect, following the implementation of a temporary construction drainage network, is considered to be Negligible.

Blockages of Drainage Networks

10.8.30 The drainage systems will be designed to good practice standards detailed within the CIRIA SuDS manual C753 and the implementation of a robust maintenance plan will aid in ensuring that the risk of flooding as a result of blockages is reduced. A third-party management and maintenance team would likely be established to maintain the features throughout the lifetime of the Scheme.

10.8.31 Following the implementation of mitigation measures the residual effect is considered to be **Negligible**.

Additional Mitigation associated with Water Resources

Silt-laden Runoff

10.8.32 The following mitigation measures can be utilised for silt management and control:

- Works that are likely to generate silt-laden runoff (e.g. earthworks and excavations) will be done preferentially during the drier months of the year;
- During the construction phase easements of 10 m should be preserved adjacent to all receptors to ensure that there is a sufficient buffer from the sensitive receptor to the construction stages of development;
- Site compounds and stockpiles will be located as far as possible (ideally at least 30 m) away from receptors;
- A drainage system will be developed to prevent silt-laden runoff from entering surface water drains, watercourses and ponds without treatment (e.g. earth bunds, silt fences, straw bales, or proprietary treatment) under any circumstances;
- Earth stockpiles will be seeded as soon as possible, covered with geotextile mats or surrounding by a bund;
- Mud will be controlled at entry and exits to the Site using wheel washes and / or road sweepers;
- Tools and plant will be washed out and cleaned in designated areas within Site compound where runoff can be isolated for treatment before discharge to watercourse under appropriate consent;
- Debris and other material will be prevented from entering receptors; and
- Construction SuDS (such as temporary attenuation) to be used during construction if necessary.

10.8.33 Following the implementation of mitigation measures the residual effect is considered to be **Negligible**.

Spillages and Leaks of Pollutants

10.8.34 To allow chemicals, fuels/oils and other such substances to enter a water body could be in breach of regulation 38(1) of the Environmental Permitting (England and Wales) Regulations 2016. As such measures to control the storage, handling and disposal of these substances will need to be put in place prior to and during construction. The following key mitigation measures relating to the control of spillages and leaks should be included a CEMP.

- Fuel will be stored and used in accordance with the Control of Substances Hazardous to Health Regulations 2002, and the Control of Pollution (Oil Storage) (England) Regulations 2001;
- Fuel and other potentially polluting chemicals are to be stored in a secure impermeable and bunded area;
- Refuelling of plant to take place off the Site if possible, or only in a designated area at the Site compound ideally at least 20 m from receptors;
- Any plant / machinery / vehicles will be regularly inspected and maintained to ensure they are in good working order and clean for use in a sensitive environment. This maintenance is to take place off the Site if possible or only at designated areas in the Site compound;
- All fixed plant used on the Site to be self-bunded;
- Mobile plant to be in good working order, kept clean and fitted with drip trays where appropriate;
- An Emergency Response Plan will be prepared and included in the CEMP. Spill kits and oil absorbent material to be carried by mobile plant and located at vulnerable locations on the Site. Construction workers will receive spill response training;
- The Site is to be kept secure to prevent vandalism that could lead to a pollution incident;
- Construction waste / debris are to be prevented from entering any water body;
- Surface water drains on roads, other watercourse crossings or the core scheme compound area will be identified and where there is a risk that silt laden runoff could enter them, they will be protected (e.g. covers or sand bags); and

- Concrete wash water will be adequately contained and removed from the Site.

10.8.35 Following the implementation of the mitigation measures the residual effect is considered to be **Negligible**.

10.8.36 Mitigation measures are summarised in Table 10.7 below.

Table 10.7: Mitigation

Ref	Measure to avoid, reduce or manage any adverse effects and/or to deliver beneficial effects	How measure would be secured		
		By Design	By S.106	By Requirement
	Maintaining the existing surface water run-off regime by utilising permeable surfacing for the Site access, linear infiltration trenches around any proposed infrastructure (substations and batteries) and wildflower planting at the leeward edge of solar panels	X		
	Where necessary install temporary drainage network prior to the commencement of construction and robust maintenance plan should be maintained throughout the duration of construction works on the Site.			X
	Any proposed drainage features such as permeable surfacing, infiltration trenches and wildflower planting should be designed to good practice standards and a robust maintenance plan should be implemented.	X		X
	Include silt management and control measures in the CEMP.			X
	Ensure measures to control the storage, handling and disposal of pollutants are put in place prior to and during construction included in the CEMP.			X

10.9 Residual Effects

10.9.1 With the embedded design measures described above and those within the CEMP, all identified potential effects have been assessed as being of negligible significance, and therefore not significant in terms of the EIA Regulations.

10.9.2 No further mitigation is proposed.