GREEN HILL
SOLAR FARM

Green Hill Solar Farm
EN010170

Environmental Statement
Appendix 10.1: Flood Risk Assessment and Drainage Strategy
Revision B

Prepared by: Arthian

Date: February 2026

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APFP Regulation 5(2)(e)

Schedule of Changes

Revision	Section Reference	Description of Changes	Reason for Revision
A	[cover]	Updated to Revision A	As required for submission at Deadline 1.
	[throughout]	Updates to document references	As required for submission at Deadline 1.
	Paragraph 3.1.4	Commitment to Hydraulic Modelling Report at Deadline 2.	In response to Relevant Representations received by the Environment Agency
	Paragraph 5.3.9	Confirmation that no connection to AW foul or surface-water infrastructure is proposed.	In response to Relevant Representations received by the Environment Agency
B	[cover]	Updated to Revision B	As required for submission at Deadline 5.
	[throughout]	Updates to document references	As required for submission at Deadline 5.
	Section 5.3	Updates to clarify the design principles associated with the BESS drainage system.	In response to ongoing discussions with the Environment Agency
	Section 5.5	Updated to clarify the approach to welfare and foul water discharge at sites.	In response to ongoing discussions with the Environment Agency

Arthian

Appendix 10.1: Flood Risk Assessment and Drainage Strategy – Covering Report

Prepared by: [redacted]

Green Hill Solar Farm Ltd

Site: Green Hill Solar Farm Scheme

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Quality Assurance

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6.0	Sixth Issue following updates made in response to ongoing discussions with the Environment Agency.	23/02/2026	LA	JR	JR

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Reference of Terms

Annual Exceedance Probability (AEP)

The AEP is the chance or probability of a natural hazard event (usually a rainfall or flooding event) occurring annually and is usually expressed as a percentage.

Aquifers

- Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
- Secondary A Aquifers are ‘permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers’.
- Secondary B Aquifers are ‘predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers’.
- Secondary Undifferentiated Aquifers are assigned in ‘cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type’.
- Unproductive Strata are ‘rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow’.

Canal Failure

Canal failure can occur due to high-intensity rainfall or structural failure and can be dangerous due to the rapid release of large volumes of water. It is typically limited to raised canal reaches and can result in a rapid peak in flow followed by a gradual reduction.

Climate Change (CC)

A change in global or regional climate patterns. For flood risk, CC are assessed in terms of allowances which are predictions of anticipated change for peak river flow, peak rainfall intensity, sea level rise and offshore wind speed and extreme wave height. CC scenario data exists across different epochs (time periods) to determine the needs for climate resilience measures. CC data is requested as part of an EAPD request. If a separate ESG Flood Risk and CC Assessment is needed, additional CC data will be required.

Environment Agency (EA) and EA Product Data (EAPD)

The EA is the lead organisation for providing flood and coastal risk management and warnings of flooding from Main Rivers and on the coast. For sites within or in close elevational proximity to Flood Zone 2 or Flood Zone 3, EAPD is ordered to obtain more detailed flood risk data such as flood depths, breach and overtopping mapping and fluvial/tidal risks associated with CC.

Fluvial Flooding

Fluvial flooding typically occurs when a river’s capacity is exceeded, and the excess water overtops the riverbanks. It can also occur when the watercourse has a high level downstream, perhaps due to structures or blockage, thus limiting conveyance. This creates a backup of water which can overtop the banks. Typical flooding issues occur when the natural floodplain has been urbanised and the river has been confined. EA mapping 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.

Groundwater Flooding

Groundwater flooding is caused by the emergence of water from beneath the ground at either point or diffuse locations when the natural level of the water table rises above ground level. This can result in deep and long-lasting flooding of low-lying or below-ground infrastructure such as underpasses and basements. Groundwater flooding can cause significant damage to property, especially in urban areas, and can pose further risks to the environment and ground stability.

Sewer Flooding

Flooding from sewers primarily occurs when flow entering a system exceeds available capacity or if the network capacity has been reduced through blockage or collapse. In the case of surface water sewers that discharge to watercourses, the same effect can be caused as a result of high-water levels in the receiving watercourse. As a result, water can begin to surcharge the sewer network, emerging at ground level through gullies and manholes and potentially causing flooding to highways and properties. If this occurs flooding can represent a significant hazard to human health due to the potential for contaminants in flood water.

Source Protection Zones

Source Protection Zones (SPZs) are areas of land through which water infiltrates into a groundwater borehole, well or spring that is used for public drinking water supply. These zones show the risk of contamination from potential pollution. SPZ’s have been created as public facing boundaries where discrete groundwater bodies within SPZ’s have been dissolved on zone number where common boundaries and overlaps have been removed. SPZs are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.

- Zone 1 (Inner Protection Zone) is defined by a travel time of 50-days or less from any point within the zone at, or below, the water table. Additionally, the zone has as a minimum a 50-metre radius.
- Zone 2: (Outer Protection Zone) - This zone is defined by the 400-day travel time from a point below the water table. Additionally, this zone has a minimum radius of 250 or 500 metres, depending on the size of the abstraction.
- Zone 3: (Total catchment) - This zone is defined as the total area needed to support the abstraction or discharge from the protected groundwater source. A further Zone 4, or ‘Zone of Special Interest’ was previously defined for some groundwater sources.

Surface Water Runoff

Surface water runoff is defined as water flowing over the ground that has not yet entered a drainage channel or similar. It usually occurs because of an intense period of rainfall which exceeds the infiltration capacity of the ground. Typically, runoff occurs on sloping land or where the ground surface is relatively impermeable. The ground can be impermeable either naturally due to the soil type or geology, or due to development which places impervious material over the ground surface (e.g. paving and roads).

Tidal Flooding

Tidal flooding is caused by high tides coinciding with a low-pressure storm system which raises sea and tidal water levels, overwhelming coastal and river defences. This may be made worse by gale-force winds blowing the raised body of water up tidal river basins some distance from the coast, due to floodwater being forced up the tidal reaches of rivers and estuaries. Such flooding may become more frequent in future years due to rising sea levels.

Reservoirs Failure

Reservoir failure can be a particularly dangerous form of flooding as it results in the sudden release of large volumes of water that can travel at high velocity, causing deep and widespread flooding. The likelihood of this occurring is low as large reservoirs are managed in accordance with the Reservoirs Act 1975. The EA's online reservoir inundation map illustrates the maximum flood extents that could occur in the event of a reservoir.

1. Introduction

1.1 Project Understanding

1.1.1 On the Environment Agency (EA) Flood Map for Planning, the Scheme is largely shown to be located wholly within Flood Zone 1 on the EA Flood Map for Planning (updated in March 2025)[i], however Sites A, D, E, F, G, the BESS Site and the Cable Route Corridor (CRC) are shown to be partially encroached by Flood Zone 3. These areas of encroachment are limited in extent and generally confined to peripheral field margins or low-lying boundary areas. The Scheme is in excess of 1 hectare and therefore the application requires a Flood Risk Assessment and Sustainable Drainage Strategy is required to support the Development Consent Order (DCO) application in line with the National Policy Statements (NPS) EN-1, EN3-3 and EN-5 for Energy[ii].

1.1.2 The Scheme comprises a number of Fields which make up the "Site" or "Sites" described as Green Hill A, A.2, B, C, D, E, F, G for the solar arrays, grid connection infrastructure and energy storage (BESS); and the Cable Route Corridor.

1.1.3 Where a Site is made up of multiple Fields these have been labelled as "Field [X]" in accordance with field numbering plans. It should be noted that the assessments of these Sites will be based on the Filed Boundaries and not the overall Site Boundary. The Scheme comprises of the following Fields where assessments of each area have been undertaken:

- Green Hill A is subdivided into 29 smaller Fields (AF1 to AF29);
- Green Hill A.2 is subdivided into 4 smaller Fields (A2F1 to A2F4);
- Green Hill B is subdivided into 5 smaller Fields (BF1 to BF5);
- Green HillC is subdivided into 10 smaller Fields (CF1 to CF10);
- Green Hill D is subdivided into 4 smaller Fields (DF1 to DF4);
- Green Hill E is subdivided into 34 smaller Fields (EF1 to EF34);
- Green Hill F is subdivided into 33 smaller Fields (FF1 to FF33);
- Green Hill G is subdivided into 23 smaller Fields (GF1 to GF12 and GO1 to GO6); and
- Green Hill BESS is subdivided into 2 smaller Fields (BESS 1 and 2).

1.1.4 The proposed substation parameters for each Site are described below, however, final electrical design will be finalised at the detailed design stage post submission and therefore there are two options at Green Hill E.

- Green Hill A = 132kV
- Green Hill A.2 = 33kV
- Green Hill B = 132kV
- Green Hill C = 400kV
- Green Hill D = 33kV

- Green Hill E = 132kV or 33kV
- Green Hill F = 132kV
- Green Hill G = 132kV
- Green Hill BESS = 400kV

1.1.5 The aim of this report is to assess the potential flood risk to the Scheme, the impact of the Scheme on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified risk. This report has been prepared in accordance with the guidance contained in the Overarching National Policy Statement for Energy (NPS EN-1)[iii] revised in February 2025, the National Planning Policy Framework (NPPF)[iv] revised in December 2024, and the National Planning Practice Guidance (NPPG) Flood Risk and Coastal Change[v].

1.1.6 West Northamptonshire Council, North Northamptonshire Council and Milton Keynes City Council as Lead Local Flood Authorities (LLFA) are the statutory consultees for major planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a Sustainable Drainage Strategy. The aim of the Sustainable Drainage Strategy is to identify water management measures, including Sustainable Drainage Systems (SuDS), to provide surface water runoff reduction and treatment.

1.1.7 The Scheme will be located within the administrative boundaries of West Northamptonshire Council, North Northamptonshire Council and Milton Keynes City Council. For details of how the Scheme accords with the policies relevant to these Councils, please see section 2.0 for Relevant Planning Policy and Guidance.

1.1.8 The Scheme is not located within one of Natural England's designated nutrient neutrality catchment areas[vi] and therefore nutrient budget calculations will not be required for the Scheme, as risks to designated sites are considered unlikely where Sites are located outside of the catchment areas. As a result, nutrient loading has not been considered within the assessment.

1.1.9 This report takes into account the following national and local policies:

- Overarching National Policy Statement for Energy (EN-1) (2023);
- National Policy Statement for Renewable Energy Infrastructure (EN-3) (2023);
- National Policy Statement for Electricity Networks Infrastructure (EN-5) (2023);
- National Planning Policy Framework (NPPF) (2024);
- National Planning Practice Guidance (NPPG) (2022);
- CIRIA Guidance: The SuDS Manual (C753) (2017)[vii]; and
- West Northamptonshire Council[viii], North Northamptonshire Council[ix] and the City of Milton Keynes Local Development and Planning Policies[x].

1.1.10 Two of the Host Authorities have emerging Local Plans:

- Emerging North Northamptonshire Local Plan (Issues and Scope Consultation March 2022); and

- Emerging West Northamptonshire Local Plan (Regulation 18 draft approved March 2024).

Sources of Information

1.1.11 The following sources of information have been reviewed and assessed for the purpose of this FRA:

- EA online flood maps[xi];
- British Geological Society (BGS) Interactive Map[xii];
- MAGIC Interactive Map[xiii];
- Northamptonshire Council Preliminary Flood Risk Assessment (2011 PFRA) (Covering Green Hill A–F and BESS)[xiv];
- Milton Keynes Council Preliminary Flood Risk Assessment (2011 PFRA) (Covering Green Hill G)[xv];
- Northamptonshire Local Flood Risk Management Strategy (2016 LFRMS) (Covering Green Hill C-F)[xvi];
- Milton Keynes Local Flood Risk Management Strategy (2016 LFRMS) (Covering Green Hill G)[xvii];
- Wellingborough Level 1 Strategic Flood Risk Assessment (2017 SFRA) (Covering Green Hill C-F)[xviii];
- West Northamptonshire Part 1 Strategic Flood Risk Assessment (2019 SFRA) (Covering Green Hill A-B)[xix]; and
- Milton Keynes City Council Strategic Flood Risk Assessment (2024 SFRA) (Covering Green Hill G)[xx].

2. Relevant Planning Policy and Guidance

2.1 Introduction

2.1.1 The aim of this section of the report is to discuss the main aspects of the local and national planning policies that are relevant to the Scheme on the Site and relevant guidance and legislation.

2.2 Assessment of Flood Risk

Overarching NPS for Energy (EN-1)

2.2.1 NPS EN-1, paragraph 5.8.13, requires Site-specific flood risk assessments for all energy projects located in Flood Zones 2 and 3 in England. For projects located in Flood Zone 1, an assessment is required for all proposals that involve:

- *'sites of 1 hectare of more;*
- *land which has been identified by the EA as having critical drainage problems;*
- *land identified (for example in a local authority strategic flood risk assessment) as being at increased flood risk in future;*
- *land that may be subject to other sources of flooding (for example surface water); and*
- *where the EA or NRW, Lead Local Flood Authority, Internal Drainage Board or other body have indicated that there may be drainage problems.'*

2.2.2 Paragraph 5.8.15 provides the minimum requirements for flood risk assessments. 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, across a range of climate scenarios, 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 and exceedance;*
- *consider the vulnerability of those using the site, including arrangements for safe access and escape;*
- *consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and include information on flood likelihood, speed-of-onset, depth, velocity, hazard, and duration;*
- *identify and secure opportunities to reduce the causes and impacts of flooding overall, making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management;*
- *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 these risks can be safely managed, ensuring people will not be exposed to hazardous flooding; 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. Information should include:*
    a) *Describe the existing surface water drainage arrangements for the site*
    b) *Set out (approximately) the existing rates and volumes of surface water run-off generated by the site. Detail the proposals for restricting discharge rates*
    c) *Set out proposals for managing and discharging surface water from the site using sustainable drainage systems and accounting for the predicted impacts of climate change. If sustainable drainage systems have been rejected, present clear evidence of why their inclusion would be inappropriate*
    d) *Demonstrate how the hierarchy of drainage options has been followed.*
    e) *Explain and justify why the types of SuDS220 and method of discharge have been selected and why they are considered appropriate.*
    f) *Explain how sustainable drainage systems have been integrated with other aspects of the development such as open space or green infrastructure, so as to ensure an efficient use of the site*
    g) *Describe the multifunctional benefits the sustainable drainage system will provide*
    h) *Set out which opportunities to reduce the causes and impacts of flooding have been identified and included as part of the proposed sustainable drainage system*
    i) *Explain how run-off from the completed development will be prevented from causing an impact elsewhere*
    j) *Explain how the sustainable drainage system been designed to facilitate maintenance and, where relevant, adoption. Set out plans for ensuring an acceptable standard of operation and maintenance throughout the lifetime of the development*
- *detail those measures that will be included to ensure the development will be safe and remain operational during a flooding event throughout the development's lifetime without increasing flood risk elsewhere;*
- *identify and secure opportunities to reduce the causes and impacts of flooding overall during the period of construction; and*
- *be supported by appropriate data and information, including historical information on previous events.'*

2.2.3 The main objectives of the FRA, taking into account NPS EN-1 above, are to:

- *'Consider all sources of flooding such as coastal, fluvial and surface water flooding. Ensure flood depths, velocity, hazard and duration have been considered;*
- *Establish the risk of flooding in relation to the Scheme;*
- *Consider the adverse and beneficial impacts of the Scheme;*
- *Establish safe access and egress and ensure the Scheme is operationally safe;*
- *Consider extreme events and how climate change may impact each Site and surrounding people/properties;*

- *Suggest appropriate flood mitigation measures for the Scheme; and*
- *Provide supporting data and detailed reports for the Scheme.'*

2.2.4 Paragraphs 5.8.6, 5.8.9 – 5.8.12, and 5.8.21 – 5.8.23 from the NPS EN-1 relevantly provide that:

2.2.5 Paragraph 5.8.6 – "The aims of planning policy on development and flood risk are to ensure that flood risk from all sources of flooding is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to steer new development to areas with the lowest risk of flooding."

2.2.6 Paragraph 5.8.9 – "If, following application of the Sequential Test, it is not possible, (taking into account wider sustainable development objectives), for the project to be located in areas of lower flood risk the Exception Test can be applied, as required by Annex 3 of the Planning Practice Guidance. The test provides a method of allowing necessary development to go ahead in situations where suitable sites at lower risk of flooding are not available."

2.2.7 Paragraph 5.8.10 – "The Exception Test is only appropriate for use where the Sequential Test alone cannot deliver an acceptable site. It would only be appropriate to move onto the Exception Test when the Sequential Test has identified reasonably available, lower risk sites appropriate for the proposed development where, accounting for wider sustainable development objectives, application of relevant policies would provide a clear reason for refusing development in any alternative locations identified. Examples could include alternative site(s) that are subject to national designations such as landscape, heritage and nature conservation designations, for example Areas of Outstanding Natural Beauty (AONBs), Sites of Special Scientific Interest SSSIs and World Heritage Sites (WHS) which would not usually be considered appropriate."

2.2.8 Paragraph 5.8.11 – "Both elements of the Exception Test will have to be satisfied for development to be consented. To pass the Exception Test it should be demonstrated that:

- *The project would provide wider sustainability benefits to the community that outweigh flood risk; and*
- *The project will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible will reduce flood risk overall."*

2.2.9 Paragraph 5.8.12 – "Development should be designed to ensure there is no increase in flood risk elsewhere, accounting for the predicted impacts of climate change throughout the lifetime of the development. There should be no net loss of floodplain storage, and any deflection or constriction of flood flow routes should be safely managed within the site. Mitigation measures should make as much use as possible of natural flood management techniques."

2.2.10 Paragraph 5.8.21 – "The Sequential Test ensures that a sequential, risk-based approach is followed to steer new development to areas with the lowest risk of flooding, taking all sources of flood risk and climate change into account. Where it is not possible to locate development in low-risk areas, the Sequential Test should go on to compare reasonably available sites with medium risk areas and then, only where there are no reasonably available sites in low and medium risk areas, within high-risk areas."

2.2.11 Paragraph 5.8.22 – "The technology specific NPSs set out some exceptions to the application of the Sequential Test. However, when seeking development consent on a site allocated in a development plan through the application of the Sequential Test, informed by a strategic flood risk assessment, applicants need not apply the Sequential Test, provided the proposed development is consistent with the use for which the site was allocated and there is no new flood risk information that would have affected the outcome of the test."

2.2.12 Paragraph 5.8.23 – "Consideration of alternative sites should take account of the policy on alternatives set out in Section 4.2 above. All projects should apply the Sequential Test to locating development within the site."

2.2.13 Paragraphs 5.8.24 – 5.8.35 relevantly provide guidance on mitigation and are summarised below:

2.2.14 Paragraph 5.8.24 – "To manage surface water flood risk, arrangements are required to manage impact on the water cycle and/or people/property".

2.2.15 Paragraph 5.8.25 – "Sustainable approaches to management include:

- *Rainwater recycling and drainage;*
- *Infiltration/soakaways;*
- *Filter strips and swales;*
- *Permeable surfacing; and*
- *Basins, ponds and tanks".*

2.2.16 Paragraph 5.8.26 – "Sites should cope with events that exceed design capacity".

2.2.17 Paragraph 5.8.27 – "Climate change should be considered for the developments lifetime, and the peak flow rates should be no greater than the rates prior to development, unless arrangements made".

2.2.18 Paragraph 5.8.28 – "Surface water storage and infiltration may be necessary to limit peak rate of discharge and total volume discharged".

2.2.19 Paragraph 5.8.29 – "Sequential test should be applied, and vulnerable aspects of the Site should be located in lower risk areas. Space should be utilised for multiple purposes such as amenity and biodiversity".

2.2.20 Paragraph 5.8.30 – "Where there is an increase in flood risk. Level-for-level compensation should be provided, and it should account for climate change over the lifetime design".

2.2.21 Paragraph 5.8.31 – "Where there is deflection of flood routes, these will be safely managed".

2.2.22 Paragraph 5.8.32 – "Where flood risk increases elsewhere, multifunctional SuDS, natural flood management and green infrastructure could be beneficial".

2.2.23 Paragraph 5.8.33 – "Warnings of floods are essential, and Flood Response Plans should be provided if needed".

2.2.24 Paragraph 5.8.34 – “Any emergency documents, flood warning and evacuation procedures should be in the FRA”.

2.2.25 Paragraph 5.8.35 – “Flood resistant/resilient materials should be adopted for minimum damage and recovery”.

NPS for Renewable Energy Infrastructure (EN-3)[xxi]

2.2.26 Paragraphs 2.10.84 – 2.10.88 relevantly provide that:

2.2.27 Paragraph 2.10.84 – “Where a Flood Risk Assessment has been carried out this must be submitted alongside the applicant's ES. This will need to consider the impact of drainage. As solar PV panels will drain to the existing ground, the impact will not, in general, be significant.”

2.2.28 Paragraph 2.10.85 – “Where access tracks need to be provided, permeable tracks should be used, and localised Sustainable Drainage Systems (SuDS), such as swales and infiltration trenches, should be used to control any run-off where recommended.”

2.2.29 Paragraph 2.10.86 – “Given the temporary nature of solar PV farms, sites should be configured or selected to avoid the need to impact on existing drainage systems and watercourses.”

2.2.30 Paragraph 2.10.87 – “Culverting existing watercourses/drainage ditches should be avoided.”

2.2.31 Paragraph 2.10.88 – “Where culverting for access is unavoidable, applicants should demonstrate that no reasonable alternatives exist and where necessary it will only be in place temporarily for the construction period.”

NPS for Electricity Networks Infrastructure (EN-5)[xxii]

2.2.32 Paragraphs 2.3.2 and 2.3.3 relevantly provide that:

2.2.33 “As climate change is likely to increase risks to the resilience of some of this infrastructure, from flooding for example, or in situations where it is located near the coast or an estuary or is underground, applicants should in particular set out to what extent the proposed development is expected to be vulnerable, and, as appropriate, how it has been designed to be resilient to:

- *flooding, particularly for substations that are vital to the network; and especially in light of changes to groundwater levels resulting from climate change;*
- *the effects of wind and storms on overhead lines;*
- *higher average temperatures leading to increased transmission losses;*
- *earth movement or subsidence caused by flooding or drought (for underground cables); and*
- *coastal erosion – for the landfall of offshore transmission cables and their associated substations in the inshore and coastal locations respectively.”*

2.2.34 Section 4.9 of EN-1 advises that the resilience of the project to the effects of climate change must be assessed in the Environmental Statement (ES) accompanying an application. For example, future increased risk of flooding would be covered in any flood risk assessment (see Sections 5.8 in EN-1).

Planning Practice Guidance accompanying the National Planning Policy Framework (NPPF) and Planning Practice Guidance

2.2.35 The Planning Practice Guidance: Flood Risk and Coastal Change (PPG) that accompanies the NPPF is referred to by NPS EN-1 as providing further guidance for carrying out a Flood Risk Assessment.

Flood Risk

2.2.36 The assessment of flood risk is based on the definitions of flood zones in Table 2-1 of the PPG, and these zones shown on the EA Flood Map (flood risk from rivers or the sea):

- 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%). This land is shown as 'clear' on the Flood Map;
- 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. This land is shown in light blue on the Flood Map;
- 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. This land is shown in dark blue on the Flood Map; 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 distinguished from Flood Zone 3a on the Flood Map, but is calculated where necessary using detailed hydraulic modelling.

2.2.37 NPS EN-1 requires that developers consider the flood risk to the development from all sources of flooding, which include surface water, groundwater, Ordinary Watercourses, artificial drainage systems, canals and reservoirs.

Vulnerability Classification

2.2.38 Annex 3 of the NPPF, referred to by the flood risk and coastal change guidance, classifies the Flood Risk Vulnerability of various land uses. Solar farm developments are specifically identified and are classified as 'Essential Infrastructure.' Development of each classification is permitted, not permitted, or permitted only if the Exception Test is passed, as set out in Table 2 of the Annex.

Table 1: Flood Risk Vulnerability Classification (from Table 2 of Annex 3 of the NPPF)

Flood Zones	Flood Risk Vulnerability Classification Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water-Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓

Zone 3a	Exception Test required	✗	Exception Test required	✓	✓
Zone 3b	Exception Test required	✗	✗	✗	✓

✓ development is permitted

✗ development is not permitted

2.2.39 'Essential Infrastructure' development is considered appropriate within Flood Zones 1 and 2 and, provided the Exception Test is satisfied, for development within Flood Zone 3.

Sequential Test

2.2.40 Paragraph 023 (Reference ID: 7-023-20220825) of the Planning Practice Guidance: Flood Risk and Coastal Change, states that the sequential approach directs development to areas with the lowest flood risk, prioritising areas with little or no risk, such as Flood Zone 1, and avoiding higher-risk areas wherever possible. This includes considering all types of flooding, such as surface water. The "Sequential Test" ensures that new developments are located in areas with the lowest probability of flooding, and only where there are no reasonable alternative sites available can areas with a higher risk of flooding be considered, subject to passing the Exception Test. Even if flood risk assessments demonstrate that a development can be made safe, the sequential test must still be satisfied to ensure sustainable development and avoid promoting unsuitable sites.

Exception Test

2.2.41 EN-1 confirms, at paragraph 5.8.10. that the Exception Test is only appropriate for use where the Sequential Test alone cannot deliver an acceptable Site. This may be because the alternative sites identified are subject to national designations such as Areas of Outstanding Natural Beauty, meaning they would not usually be considered appropriate. The Exception Test determines whether the benefits of the Scheme will outweigh the potential flood risk. Paragraph 5.8.11 advises that both elements of the Exception Test have to be satisfied for development to be consented. To pass the Exception Test, it should be demonstrated that:

- the project would provide wider sustainability benefits to the community that outweigh flood risk; and
- the project will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

2.2.42 The reports included as Appendices 10.2 - 10.11 that support this covering report provide Site specific flood risk assessments for each of the Sites and Cable Route Corridor and, where relevant, identify the mitigation measures which required to ensure that the developments remain safe for their lifetime, avoid increasing flood risk elsewhere, and may reduce flood risk overall. The Sequential and Exception Tests are considered further in Section 3.0.

2.3 Local Policy

2.3.1 The Order Limits of the Scheme are located within across the North Northamptonshire Council, West Northamptonshire Council and Milton Keynes City Council areas. It is noted that two of the Host

Authorities have emerging Local Plans: the North Northamptonshire Local Plan (Issues and Scope Consultation March 2022) and the West Northamptonshire Local Plan (Regulation 18 draft approved March 2024).

2.3.2 The existing North Northamptonshire Council Joint Core Strategy (adopted July 2016) contains the following policies relating to flood risk and drainage:

"Policy 5- Water Environment, Resources and Flood Risk Management

Development should contribute towards reducing the risk of flooding and to the protection and improvement of the quality of the water environment. This will be achieved through the following criteria:

a) Development should, wherever possible, be avoided in high and medium flood risk areas through the application of a sequential approach considering all forms of flooding for the identification of sites and also the layout of development within site boundaries;

b) Development should meet a minimum 1% (1 in 100) annual probability standard of flood protection with allowances for climate change unless local studies indicate a higher annual probability, both in relation to development and the measures required to reduce the impact of any additional run off generated by that development to demonstrate that there is no increased risk of flooding to existing, surrounding properties;

c) Development should be designed from the outset to incorporate Sustainable Drainage Systems wherever practicable, to reduce flood risk, improve water quality and promote environmental benefits;

d) Where appropriate, development should, subject to viability and feasibility, contribute to flood risk management in North Northamptonshire."

2.3.3 The existing West Northamptonshire Council Joint Core Strategy (adopted December 2014) contains the following policies relating to flood risk and drainage:

"Policy BN7 – Flood Risk

Development proposals will comply with flood risk assessment and management requirements set out in the national planning policy framework and planning practice guidance and the west Northamptonshire strategic flood risk assessments to address current and future flood risks with appropriate climate change allowance.

A sequential approach will be applied to all proposals for development in order to direct development to areas at the lowest probability of flooding unless it has met the requirements of the sequential test and the exception test as set out within Table 6.

All new development, including regeneration proposals, will need to demonstrate that there is no increased risk of flooding to existing properties, and proposed development is (or can be) safe and shall seek to improve existing flood risk management.

All proposals for development of 1 hectare or above in flood zone 1 and for development in 2, 3a or 3b must be accompanied by a flood risk assessment that sets out the mitigation measures for the site and agreed with the relevant authority.

A flood risk assessment must also accompany proposals where it may be subject to other sources, and form, of flooding or where other bodies have indicated that there may be drainage problems.

In order to meet the exception test development must:

1) Demonstrate that the development provides wider sustainability benefits to the community that outweigh the flood risk; and

2) Be accompanied by a site specific flood risk assessment that demonstrates that the development will be safe for its lifetime without increasing flood risk elsewhere and where possible, reduce flood risk overall

The design standard for the upper Nene catchment (through Northampton and within the Nene catchment upstream of Northampton) is the 0.5% probability (1 in 200 chance of occurring in any year) event plus climate change. Surface water should be provided up to this standard.'

Northamptonshire County Council has identified that all development should be accompanied by a Sustainable Drainage Strategy.

Flow across the site must be diverted away from buildings and main access-egress routes. Any infiltration storage features should be capable of half emptying within 24 hours of the rainfall event. The risk of high groundwater levels must be accounted for in the design of infiltration drainage."

2.3.4 Milton Keynes City Council Local Plan contains the following policies relating to flood risk and drainage:

"<u>Policy FR1: Managing Flood Risk:</u>

A. All new development must incorporate a surface water drainage system with acceptable flood control and demonstrate that water supply, foul sewerage and sewage treatment capacity is available or can be made available in time to serve the development. Suitable access is safeguarded for the maintenance of water supply and drainage infrastructure.

B. Plan:MK will seek to steer all new development towards areas with the lowest probability of flooding.

C. Development within areas of flood risk from any source of flooding, will only be acceptable if it is clearly demonstrated that it is appropriate at that location, and that there are no suitable available alternative sites at a lower flood risk.

D. Development proposed in an area at risk of flooding will be required:

> *1. To be supported by a site specific Flood Risk Assessment (FRA) (subject to the triggers set out below);*
>
> *2. To take into account all forms of flooding including, but not limited to: fluvial, groundwater, surface water and reservoir flooding;*
>
> *3. To provide a safe access and egress route for future users of the development; and*

E. A site specific FRA will be required for:

> *1. All sites of 1ha or more in Flood Zone 1;*
>
> *2. All sites within Flood Zone 2 or 3;*

3. All sites highlighted as being at high risk from surface water flooding, or which are located within a Critical Drainage Catchment (CDC), as identified in the Milton Keynes Surface Water Management Plan. In this case the FRA will be required to demonstrate that the development will not increase the flood risk to the CDC and where possible will provide an improvement to the existing situation.

F. The FRA should include an assessment of flood risk to and from the proposed development, and demonstrate how the development will be safe, will not increase flood risk elsewhere and where possible will reduce flood risk overall in accordance with the NPPF and PPG."

Policy FR2 Sustainable Drainage Systems (SuDS) and Integrated Flood Risk Management:

"A. Plan:MK advocates the continuation of a strategic, integrated approach to managing flood risk which seeks the management of surface water to be planned at the largest appropriate scale for the new development and incorporated into the site at the earliest opportunity in the design process.

B. New development is required to incorporate SuDS; in line with national policy and guidance and, which meet the requirements set out in national standards and the Council's relevant local guidance. It is expected that:

1. Flood risk management and SuDS will be provided at a strategic scale and in an integrated manner, wherever possible;

2. SuDS will be designed with an allowance for climate change and the potential impact it may have over the lifetime of the proposed development;

3. Development will ensure no adverse impact on the functions and setting of a watercourse and its associated corridor;

4. Development should avoid building over or culverting watercourses, encourage the removal of existing culverts and seek opportunities to create wetlands and wet grasslands and woodlands and restore natural river flows and floodplains"

Policy FR3: Protecting and Enhancing Watercourses:

"A. All new development must be set back at a distance of at least 8 metres from any main rivers, at least 9 metres from all other ordinary watercourses, or at an appropriate width as agreed by the Environment Agency, Lead Local Flood Authority or Internal Drainage Board, in order to provide an adequate undeveloped buffer zone. Development that restricts future de-culverting of waterways should be avoided.

B. The Council will resist proposals that would adversely affect the natural functioning of main rivers, ordinary watercourses and wet or dry balancing lakes, this includes through the culverting of open channels, unless for access purposes."

2.4 Climate Change

2.4.1 NPS EN-1 confirms the need to factor the effects of climate change into any Flood Risk Assessment. Paragraph 4.10.13 advises that the latest UK Climate Projections and associated research and expert guidance (such as the EA's 'Flood Risk Assessments: Climate Change Allowances' Guidance (February 2016; last updated May 2022) should be used to ensure appropriate mitigation or adaptation measures are identified to cover the estimated lifetime of the Scheme. The EA Guidance provides climate change allowances (predictions of anticipated change), and those relevant to the Scheme are the allowances for:

- Peak river flow; and
- Peak rainfall intensity.

2.4.2 Peak river flow allowances show the anticipated changes to peak flow by management catchment. Management catchments are sub-catchments of river basin districts. The range of allowances is based on percentiles. A percentile describes the proportion of possible scenarios that fall below an allowance level. The 50th percentile is the point at which half of the possible scenarios for peak flow fall below it, and half fall above it.

2.4.3 The:

- Central allowance is based on the 50th percentile;
- Higher central allowance is based on the 70th percentile; and
- Upper end allowance is based on the 95th percentile.

2.4.4 An allowance based on the 50th percentile is exceeded by 50% of the projections in the range. At the 70th percentile it is exceeded by 30%. At the 95th percentile it is exceeded by 5%.

2.4.5 The EA Guidance states that Essential Infrastructure Developments should utilise the Higher Central Allowance. However, NPS EN-1 Paragraph 4.10.11 states that 'where it is appropriate to apply a credible maximum scenario, the upper end allowance should be utilised'. Given that the credible maximum scenario applies to NSIPs, the NPS therefore requires that the Scheme uses the credible maximum scenario to remain resilient.

2.4.6 Green Hill A, B, C, D, E, F and BESS are located in the Nene Management Catchment, whilst Green Hill G is located in the Upper and Bedford Ouse Management Catchment. The CRC is located across the same Catchment areas. **Table 2** provides the Upper Allowances for the Management Catchments which the Sites are located across.

Table 2: Peak River Flow - Upper Allowances (2050's and 2080's epoch)

District	Management Catchment	Upper Allowance	
		2050's	2080's
Anglian	Nene	17%	36%
Anglian	Upper and Bedford Ouse	30%	58%

2.4.7 The Guidance further confirms that the appropriate allowance to assess off-Site impacts is the central allowance, where the affected area contains essential infrastructure, the higher central allowance should be used.

2.4.8 For peak rainfall intensity, the peak rainfall allowances map shows the anticipated changes in peak rainfall intensity. These changes are to be used for sit-scale applications, such as drainage design, and for surface water flood mapping in small catchments of less than 5 square kilometres (500 hectares).

Table 3: Peak Rainfall - Upper Allowances (2050's and 2080's epoch)

District	Management Catchment	Central Allowance		Upper Allowance	
		2050's	2080's	2050's	2080's
Anglian	Nene	20%	40%	20%	40%
Anglian	Upper and Bedford Ouse	35%	40%	35%	40%

2.4.9 Climate change allowances have been integrated into our assessment as follows:

- For the main rivers where data has been provided by the Environment Agency (EA), we have applied the relevant peak river flow allowances. These assessments vary depending on the available data, and detailed analysis can be found in the fluvial sections of the supporting Appendices;
- For un-modelled watercourses where EA data is unavailable, we have used the EA's Surface Water Flood Map as a proxy. Although this dataset represents present-day conditions, to ensure a robust assessment, we have applied the appropriate peak river flow allowances using the Manning's open channel flow equation. This method is considered suitable given the rural nature of the catchment area and the type of development;
- In instances where Site-specific hydraulic modelling has been carried out, such as at the Battery Energy Storage System (BESS) Site, we have incorporated the appropriate climate change allowances to generate the model outputs; and
- Site-specific drainage strategies have been produced for the BESS Site and Site C, which includes a 400 kV substation and an optional BESS component. For these Sites, surface water runoff rates and the required attenuation volumes have been calculated using the EA's peak rainfall intensity allowances to ensure compliance with climate change scenarios.

3. Assessment of Flood Risk

3.1.1 The aim of this report is to assess the potential flood risk to the Scheme, the impact of the Scheme on flood risk elsewhere, and the proposed measures which will be embedded to mitigate the identified risk.

Methodology

3.1.2 This report outlines a generalised methodology for assessing flood risk, recognising that different forms of flooding require tailored approaches. The methodologies applied vary depending on the type of flood risk, available data, and local conditions. These include assessments of fluvial, surface water, groundwater, and other relevant flood risks. Detailed methodologies used for each source of flood risk are provided in the relevant sections of the Appendices, ensuring a comprehensive and Site-specific assessment.

3.1.3 Site specific assessments of flood risk have been provided in Appendices 10.2 - 10.11.

3.1.4 A standalone Hydraulic Modelling Report will be submitted at Deadline 2 to document the detailed model build, calibration and sensitivity testing undertaken in response to Environment Agency Lot 2 comments (EA-018 to EA-047). This will confirm flood-storage and flood-extent results for Green Hill D and F and verify that the conclusions of this Flood Risk Assessment and Drainage Strategy remain valid. Any refinements arising from the modelling or detailed design, including confirmation of impermeable drainage systems at the Battery Energy Storage System (BESS) compound, will be incorporated at detailed design stage and secured through Requirement 11 of the draft DCO. In the event the refinements indicate the need for a connection to Anglian Water assets, consultation will be carried out with Anglian Water to inform the detailed drainage strategy to be submitted for approval under Requirement 11 of the draft DCO.

3.1.5 A summary of the assessed flood risk to the Sites is provided as **Table 4** below.

Table 4: Summary of Flood Risk for each Site:

Site	Summary of Flood Risk
Cable Route Corridor	The risk to the Site from all sources of flooding is **Negligible to Low.**
Green Hill A	The risk to the Site from all sources of flooding is **Negligible to Low.**
Green Hill A.2	The risk to the Site from all sources of flooding is **Negligible to Low.**
Green Hill B	The risk to the Site from all sources of flooding is **Negligible to Low.**
Green Hill C	The risk to the Site from all sources of flooding is **Negligible to Low.**
Green Hill D	The risk to the Site from all sources of flooding is **Negligible to Low.**
Green Hill E	The risk to the Site from all sources of flooding is **Negligible to Low.**
Green Hill F	The risk to the Site from all sources of flooding is **Negligible to Low.**
Green Hill G	The risk to the Site from all sources of flooding is **Negligible to Low.**

Green Hill BESS	The risk to the Site from all sources of flooding is **Negligible to Low** for BESS. For BESS 1, the overall risk is low, although there are areas of **Moderate** fluvial flood risk in the eastern extents.

3.2 Embedded Mitigation

3.2.1 The following embedded mitigation measures for all phases of the Scheme have been incorporated into the scheme design, with detailed proposals and locations to be submitted with the DCO application. Accompanying management plans will be secured by DCO requirement. It should be noted that any site-specific mitigation required has been outlined in the respective site-specific Flood Risk Assessment and Drainage Strategies in the supporting appendices:

Flood Risk and Resilience

- Critical infrastructure within the Scheme (the conversion units, substations and energy storage compounds) are sequentially located within Flood Zone 1 and therefore in land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%) - this is detailed in the supporting **Outline Landscape and Ecological Management Plan (OLEMP) [EX5/GH7.4_D]**;
- Non-flood sensitive infrastructure forming the wider Scheme (PV arrays and cabling) will be sequentially located outside the 1 in 100 plus climate change annual probability extent (1% +CC) or where this is not practicable restricted to areas which experience less than 1 metres depth of flooding during the same event;
- Flexibility for either tracker or fixed panels has been included for in the draft DCO. Foundations are most likely to be galvanised steel poles driven into the ground. These will either be piles rammed directly into the ground or rammed into a pre-drilled hole, or a pillar attaching to a steel ground screw depending on ground conditions. The galvanised steel poles will be narrow in diameter and will remove negligible area from any floodplains (see baseline conditions assessment and Appendices 10.8 and 10.9);
- For both fixed and tracker panels, all sensitive and electrical equipment on the solar panel will be elevated by the legs (including the solar panel face itself) so that it is no less than 0.6 metres above the surrounding peak flood level;
- Tracker panel units will be mounted on raised frames (raised a minimum of 0.4 metres when on maximum rotation angle) and will therefore be raised above surrounding ground levels and fitted with a tracking system. During times of flooding, solar panels may be stowed by the tracking system algorithm onto a horizontal plane, to the minimum post height of 2.5 metres above ground level. This ensures that all sensitive and electrical equipment on the solar panel is raised to a minimum of 2.5 metres above ground level in the horizontal position;

Drainage and Surface Water Management

- A minimum 8 metres buffer has been maintained from all Main Rivers and Ordinary Watercourses in accordance with Environment Agency guidance. This buffer has been increased to 9 metres where required by local policy, including for Ordinary Watercourses within the jurisdiction of North and West Northamptonshire Councils and Milton Keynes City Council. There are no Internal Drainage Board (IDB) watercourses within the site;
- Linear infiltration trenches will be incorporated around isolated infrastructure (e.g. string inverters or cable jointing pillars) within panelled areas to manage surface water at source, mimic the

undeveloped state, and prevent lateral surface water migration.

- Where practical, runoff from equipment and access tracks will be directed to permeable SuDS features such as gravel-filled trenches or French drains, or similar passive drainage features appropriate to local conditions.
- The construction of the cable route will include several watercourse crossings which are described and mapped within Appendix 10.2. Many of these crossings minimise having any direct impact as they utilise existing crossings where possible. Where required, the relevant Land Drainage Consents and Flood Risk Activity Permits will be obtained.
- Access to the Scheme during construction, operation and decommissioning will be taken from new permeable or existing farm tracks accessed from the local highway network. This limits the potential for increased surface water runoff rates and sedimentation effects during construction / decommissioning;
- Existing access tracks, where practicable, 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 will be designed to avoid crossing drainage ditches, where practicable;

Water Quality and Pollution Control

- The **Outline Construction Environment Management Plan (OCEMP) [EX5/GH7.1_B]** accompanying the DCO application, describes water management measures to control surface water run-off and drain hardstanding and other structures during the construction, operation and decommissioning of the Scheme. This will form part of a Pollution Prevention Plan (PPP) to be implemented for the Scheme;
- In addition, a Water Management Plan (which will form part of a detailed OCEMP) will include details of pre-construction, during the construction phase and post-construction water quality monitoring. This will be based on a combination of visual observations and reviews of the Environment Agency's automatic water quality monitoring network;
- Where trenchless crossing techniques such as HDD are used, appropriate environmental controls will be implemented to manage the risk of drilling fluid escape. This includes procedures to detect and respond to potential breakouts. These measures will be secured through the final Construction Environmental Management Plan, based on the commitments set out in the **OCEMP [EX5/GH7.1_B]**;
- All service cabling should be designed and installed to be flood resilient / water compatible. This should be achieved in accordance with appropriate design standards and best practice guidance;
- Beyond this, the separation of construction/decommissioning groundworks will be kept as far from watercourses / drainage ditches as practicable.

Baseline Improvement Measures

- It is also noted that, currently, the fields within the ZoI 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 Scheme" scenario is therefore better in terms of drainage than the baseline scenario. The "with Scheme" 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 Scheme" scenario compared to the baseline scenario;
- The solar panels have the potential to concentrate rainfall under the leeward edge of the panels

themselves. Research in the United States by Cook and McCuen (Ref 10.16) suggested this increase would not be significant however, there is a potential increase in silt-laden 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. This is detailed in the supporting **OLEMP [EX5/GH7.4_D]**;

- All embedded mitigation measures set out above will be secured by DCO requirement, including through the **OCEMP [EX5/GH7.1_B]**, the **OLEMP [EX5/GH7.4_D]**, and the accompanying Water Management Plan.
- These embedded mitigation measures have been factored into the assessment of likely significant effects set out in the following sections. The assessments presented therefore reflect a "with embedded mitigation" scenario, in line with standard EIA practice.

3.3 Impact on off-Site Flood Risk

3.3.1 The solar panels will be mounted on frames and raised above ground level allowing flood water to flow freely underneath. Therefore, there will be no loss of floodplain volume as a result of the Scheme and no increase in flood risk elsewhere.

3.3.2 The supporting infrastructure is insignificant in size and will not increase flood risk elsewhere.

3.3.3 Surface water generated by the Scheme will require management in order to ensure there is no increase in surface water runoff rates and volumes are not increased. Surface Water management has been considered in Section 5.0 of this report.

4. Soil Management

4.1.1 Soil management measures are set out in the **Outline Soil Management Plan (OSMP) [APP-550].** Effective management is essential to maintain the natural drainage of the Site and avoid any increase in surface water flooding. The following section sets out the necessary measures required for the Scheme.

4.1.2 The nature of the development means that precipitation is intercepted by the solar panels. If the Site is inappropriately manged, there is potential for the local hydrology to be impacted, which could lead to an increase in surface water flow.

4.1.3 In the absence of Site management, integrated drainage systems could develop within the Site. An unmanaged drainage network could lead to the rate of infiltration being compromised and ultimately being bypassed, resulting in increased surface water flows passing to the wider fluvial network, potentially resulting in an increase of flooding off-Site.

4.1.4 There is no UK environmental guidance on managing runoff from solar panel installations. However, EN-3 Paragraph 2.10.85 states that SuDS such as swales and infiltration trenches should be incorporated. Additionally, Paragraph 2.10.87 states that Sites should avoid impacting existing drainage and/or culverts. Research undertaken in the United States (US) by Cook and McCuen[xxiii] recommend that the vegetation cover beneath the panels is well maintained or that a buffer strip be placed after the most down gradient row of panels.

4.1.5 The Maryland Department for the Environment Storm water Design Guidance for solar panel installations[1] recommends 'non-structural techniques like disconnecting impervious cover' to reduce runoff by promoting overland filtering and infiltration. The following must also be considered:

- Runoff must sheet flow onto and across vegetated areas to maintain the disconnection;
- Disconnecting impervious surfaces works best in undisturbed soils. To minimise disturbance and compaction, construction vehicles and equipment should avoid areas used for disconnection during installation of the solar panels. Where disturbance is unavoidable, post construction soil treatment (deep ploughing) to restore soil condition may be required; and
- Groundcover vegetation must be maintained in good condition in those areas receiving disconnected runoff. Typically this maintenance is no different than other lawn or landscaped areas. However, areas receiving runoff will be protected (e.g. planting shrubs or trees along the perimeter) from future compaction.

4.1.6 To minimise the potential impacts from soil compaction and changes in flow pathways a number of mitigation techniques have been suggested as follows. To meet soil protection guidance, DEFRA objectives of Construction Code of Practice for the Sustainable Use of Soils on Construction Sites are

[1] https://mde.maryland.gov/programs/water/StormwaterManagementProgram/Documents/ESDMEP%20Design%20Guidance%20Solar%20Panels.pdf

recommended.

4.1.7 Soil compaction will be limited during the construction phase by a number of measures;

- Using only light machinery to install the solar panels and low ground pressure vehicles to be used during extreme rainfall events;
- Where light machinery is unable to be utilised in areas such as the BESS, appropriate mitigations will be detailed in the **OCEMP [EX5/GH7.1_B]** to protect the soil from compaction;
- Where construction has resulted in soil compaction, the areas between panel rows would be tilled / scarified to an appropriate depth and then re-seeded with an appropriate vegetation cover; and
- Impacts to existing drainage and/or culverts will be avoided where reasonably practicable. If impacts to existing drainage and/or culverts is unavoidable, where possible, the system will be restored and improved.

4.1.8 Soil compaction will be limited during the operational phase by the following measures:

- During the initial establishment phase, the condition of planting and soil will be regularly monitored to ensure vegetation is establishing well, ground cover is maintained, and there are no early signs of compaction. Any issues will be addressed promptly through remedial measures.
- The presence of well-established vegetation across the site, including grassland and meadow planting, will help reduce runoff and prevent erosion. This supports the long-term maintenance of healthy soil structure. These measures are set out in the **OLEMP [EX5/GH7.4_D]**.
- Maintenance of infrastructure during operation will generally involve only light machinery, with access limited to established or permeable routes. This approach is consistent with the **OSMP [APP-550]**, which sets out how any temporary disturbance will be minimised and how ground conditions will be reinstated where necessary.

4.1.9 All access tracks will be made out of granular material and will therefore be permeable, reducing the potential increase in surface runoff, which is aligns with NPS EN-3 Paragraph 2.10.85.

5. Drainage Strategy

5.1 Introduction

5.1.1 In general, the Scheme currently comprises undeveloped, agricultural land with no formal, positive drainage network. Surface water runoff generated within the existing Site is anticipated to discharge into the surrounding land drainage network at an uncontrolled rate.

5.1.2 The Scheme measures in excess of 1 hectare in size and therefore a Sustainable Drainage Strategy is required to support the Development Consent Order (DCO) application in line National Policy Statement (NPS) for Energy. To provide context to the level of detail required for an effective SuDS strategy, EN- 1 Paragraph 5.8.15 indicates that types of SuDS should be explained and justified, along with the method of discharge and why they are appropriate. Additionally, this should be in line with the PPG and the government's non-statutory technical standards for SuDS.

5.1.3 The BRE Planning Guidance for the development of large scale ground mounted solar PV systems[xxiv] states:

"The Environment Agency has advised that, due to the size of solar PV farms, planning applications will be expected to be accompanied by a Flood Risk Assessment. This will need to consider the impact of drainage. As solar PV panels will drain to the existing ground, the impact will not in general be significant and therefore this should not be an onerous requirement."

5.1.4 All of the Sites which make up the Scheme will comprise natural ground cover post development albeit with the introduction of solar panels on raised frames and limited areas of hardstanding associated with substations and inverters. The Scheme will remain largely permeable following development. The below assessment, therefore, forms the Drainage Strategy for the vast majority of the Scheme with the proposed battery storage and their associated substations being assessed separately within Appendix 10.11 Annex J - Flood Risk Assessment and Drainage Strategy - BESS.

5.1.5 It is understood that the Upper Nene Valley Gravel Pits SPA is located downstream of the Scheme, the Drainage Strategies will ensure that the Scheme will not have a detrimental impact in terms of discharge rates and surface water quality.

5.2 Drainage Hierarchy

5.2.1 The recommended surface water drainage hierarchy (Paragraph 5.8.15 of the NPS EN-1 and Paragraph 056 (Ref ID: 7-056-20220825) of the PPG: Flood Risk and Coastal Change) is to utilise soakaway systems or infiltration as the preferred option, followed by discharging to an appropriate watercourse, followed by discharging to a public surface water sewer, and then a highway drain or other drainage system. If this is not feasible, the final option is to discharge to an existing combined sewer.

Surface Water Discharge to Soakaway

5.2.2 The first consideration for the disposal of surface water is infiltration (soakaways and permeable surfaces). The Scheme is undeveloped agricultural land and wholly permeable, informally draining to ground and in exceedance events in excess of the infiltration capacity, into the surrounding Land Drains. The vast majority of the Scheme will comprise natural ground cover post development albeit with the introduction of solar panels on raised frames and limited areas of hardstanding associate with substations and inverters. Any proposed access or surfacing will be permeable. The Scheme will therefore remain largely permeable following development, as per the existing situation.

Surface Water Discharge to Watercourse

5.2.3 Where soakaways are not suitable, a connection to watercourse is the next preferred option. The nearest watercourses are the land drains which flow through/along the boundaries of the Scheme.

5.2.4 Any surface water runoff in excess of the infiltration capacity of the ground may naturally drain into the surrounding land drains as per the existing scenario. As no new connections will be required, formal discharge consents will not be necessary from the LLFA or Internal Drainage Board (IDB).

Surface Water Discharge to Sewer

5.2.5 As described above, draining to ground is feasible as per the existing scenario and therefore a connection to the public surface water sewer is not required.

5.3 Surface Water Discharge

5.3.1 The Scheme will be free draining through perimeter gaps around all panels, there will be minimal increase in impermeable area meaning the proposals will not increase surface water risk elsewhere.

5.3.2 As a result of the construction of the solar panels, some rainfall will be intercepted by the surface of the solar panels before reaching ground level. Intercepted rainfall will either run down the face of the panels, due to the angle at which they are positioned, and drip onto the ground below or will be lost due to evaporation from the face of the panels.

5.3.3 Where rainwater drips onto the ground below, the energy of the flow from the surface of the panels is likely to be greater than that of the rainfall (especially where rainwater collects at the bottom edge of the solar array before dripping onto the ground below) which could result in the erosion of ground without appropriate mitigation. The erosion of the ground could then result in the formation of rivulets which could increase the speed of runoff throughout the Site.

5.3.4 In order to mitigate against potential erosion, the existing intensively managed agricultural land will be replaced by planted wildflower and grassland below the solar panels. The planted surface will act as a level spread / energy dissipater to promote low erosivity sheet flow during the operation of the solar farm. The vegetation will be managed and will either be mowed or used for sheep grazing.

5.3.5 The panels forming the solar array will not be tightly compacted and will not form one continuous surface. Small gaps will exist between each panel, which will allow water to drip onto the ground below from several locations rather than as concentrated runoff from the bottom edge. This spread of water dripping will reduce the potential for erosion to occur.

5.3.6 The access track will be designed to be permeable, thereby allowing surface water runoff to percolate into the ground below.

5.3.7 Smaller electrical infrastructure associated with the panels (excludes Substations and BESS) will be sited on concrete pads. The concrete bases will be surrounded by gravel filled filter trenches, constructed to limit the lateral flow of water away from the equipment and replace the loss of natural infiltration caused by the concrete bases themselves. Surface water would be stored within the gravel sub-base prior to infiltrating into the ground as per the existing situation.

5.3.8 For the proposed BESS Site and Green Hill C (which includes a 400kV Substation and optional BESS Site), we have undertaken Drainage Strategies to address the increase in hardstanding resulting from the facilities. For areas with increased hardstanding, the peak surface water discharge rate as calculated using the Revitalised Flood Hydrograph Model (ReFH2) method will be limited to the existing 1 in 2 year greenfield runoff rate, achieved through implementation of a flow control device (HydroBrake or orifice plate). This will result in a significant betterment of surface water runoff rates generated during a 1 in 2 year storm event at these Sites.

5.3.9 BESS drainage shall be treated as a discrete catchment, assessed separately from PV panel areas. Runoff from areas serving the BESS units and associated infrastructure shall be managed via an impermeable and isolatable drainage system with isolation located at the outfalls (or equivalent point of connection). This is a performance based commitment focused on impermeability where required, isolation capability and controlled management of runoff, including incident response and firewater, with the detailed configuration to be confirmed at detailed design stage with the EA, LLFA and other relevant consultees.

5.3.10 The BESS drainage system shall include an isolation mechanism at the outfalls (or equivalent point of connection) so that discharge from the BESS catchment can be prevented during an incident. Isolation shall be capable of automatic activation during an incident, with manual override provided as a secondary control. A manual closure or override shall also be provided as a secondary measure.

5.3.11 Following any incident, the BESS drainage system shall be inspected. Where contamination is possible, retained water and relevant drainage media shall be sampled and tested. Where contamination is identified, affected drainage components and subbase shall be cleaned where feasible, or removed and replaced where cleaning is not feasible. Operation shall not restart until remediation is complete and the drainage system is confirmed to be functioning as intended.

5.3.12 The lining strategy may apply to specific components and defined flow paths rather than the whole BESS compound. Where this approach is used, exceedance shall be managed deliberately so that flows are preferentially routed within the BESS envelope to the lined system when isolated, avoiding uncontrolled discharge to any watercourse or wider land drainage network.

5.3.13 When the BESS drainage system is isolated, the impermeable and isolatable drainage system shall provide sufficient storage to safely retain runoff and any firewater from the BESS serving areas for a reasonable worst case event, including firewater and concurrent rainfall, in accordance with the design criteria set out in the relevant Annex.

5.3.14 At this stage, no connection to Anglian Water foul or surface-water infrastructure is proposed or considered necessary for the BESS or substation compounds. Surface water from the wider Scheme will discharge to ground or adjacent watercourses and/or land drains as set out above, in the unlikely event that any localised connection is required at detailed design stage, consultation with Anglian Water will be undertaken to agree connection points, discharge parameters, and any necessary permits or consents pursuant to the protective provisions for Anglian Water in Part 5 of Schedule 15 to the DCO.

5.3.15 Based on the above, the Scheme is likely to provide betterment over the existing surface water runoff regime in line with NPS EN-1.

5.3.16 During construction of the proposed Scheme temporary construction lay-down areas will be provided. Temporary drainage measures will be implemented within the lay-down areas to ensure there is no increase in surface water runoff as a result of the construction compound. The OCEMP accompanying the DCO application, describes these measures during the construction phase, with further information included in **ES Chapter 10: Hydrology, Flood Risk and Drainage [EX5/GH6.2.10_B]**.

5.3.17 In addition, construction of the Scheme has the potential to result in the compaction of soils thereby reducing the soil's ability to accept surface water runoff. It is recommended that the movement of large vehicles is limited where possible to proposed access tracks in order to reduce the potential for soil compaction to occur. Vehicles will be fitted with low pressure tyres to further reduce the impact on the underlying soil.

5.3.18 The aforementioned techniques will discourage soil erosion within the Scheme, whilst maintaining the existing overland flow paths.

5.4 Event Exceedance

5.4.1 Any surface water runoff in excess of the infiltration capacity of the ground may naturally drain into the surrounding land drains as per the existing scenario.

5.5 Foul Water Discharge

5.5.1 Welfare at the Sites is limited to the substations. Given the remote nature of the Scheme and the substations within it, no readily accessible public sewers are understood to be available. Waste water associated with welfare facilities at the substations will be contained within sealed tanks or self-contained units, such as septic tanks, which will be emptied at defined intervals by a licensed waste contractor. No direct connection to public sewers is proposed. No discharge of foul water to any watercourse or drainage system shall occur. Waste carrier documentation shall be maintained.

6. Sequential and Exception Test

6.1.1 **Chapter 5: Alternatives and Design Evolution [APP-042]** of the ES provides an overview of the Site selection process that the Applicant has gone through, how the design has evolved and the alternatives that have been considered, to date. A Site Selection Report (Appendix B of the **Planning Statement [APP-559]**) which assesses the Site against other Potential Development Areas has been undertaken as part of the DCO application.

6.2 Sequential Test

6.2.1 The Sequential Test has been considered against each individual Site which forms the Scheme.

6.2.2 The solar panels will be mounted on raised frames above surrounding ground level allowing flood water to flow freely underneath. Where relevant, floodplain volume loss calculations have been undertaken to demonstrate that any panel supports located within the floodplain will have a negligible impact on floodplain storage capacity.

6.2.3 The Scheme is freely draining through perimeter gaps around all panels, allowing for infiltration as existing within the grassland/vegetation surrounding and beneath the panels. There will be minimal increase in impermeable area meaning the proposals will not increase surface water flood risk elsewhere.

6.2.4 Each individual Appendix, where relevant, has been further assessed either through using the Manning's open channel flow formula to quantify potential fluvial flood risk to the Site during a 1% AEP + Climate Change extent, or through hydraulic modelling which can be found within the specific Appendices. Sensitive electrical equipment, such as substations and conversion units, have been sequentially located outside of the areas identified within the flood risk extent where practicable. Associated infrastructure has been designed to be flood resilient.

6.3 Exception Test

6.3.1 The Exception Test is summarised in Section 2.2 above. In respect of Green Hill A to G, it is not necessary to apply or rely on the Exception Test, as the layout of each Site has been designed to place all infrastructure in locations that are not subject to flood risk in the worst-case scenario. The cable route corridor could be interpreted as crossing some areas at fluvial or surface water risk, however given that the cable route is ultimately to be placed sub-surface, impact on flood risk in these areas will be negligible. Arthian have also separately inputted into the supporting Site Selection Report (Appendix B of the **Planning Statement [REP4-012]** which assesses the Site against other Potential Development Areas, to determine the most sequentially preferable Site for development. The BESS Site has been assessed separately within **Appendix 10.11 Annex J - Flood Risk Assessment and Drainage Strategy – BESS [EX5/GH6.3.10.11_B]**, and the Sequential Test and Exception Test has been considered within that Appendix separately.

[i] Get flood risk information for planning in England - Flood map for planning - GOV.UK
[ii] National Policy Statements for energy infrastructure - GOV.UK
[iii] Overarching National Policy Statement for energy (EN-1) - GOV.UK
[iv] National Planning Policy Framework
[v] Flood risk and coastal change - GOV.UK
[vi] Nutrient Neutrality Catchments (England)
[vii] https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx
[viii] West Northamptonshire Joint Core Strategy Local Plan (Part 1) | West Northamptonshire Council
[ix] North Northamptonshire Local Plan | North Northamptonshire Council
[x] MK City Plan 2050 | Milton Keynes City Council
[xi] Get flood risk information for planning in England - Flood map for planning - GOV.UK
[xii] GeoIndex (onshore) - British Geological Survey
[xiii] MAGIC
[xiv] PFRA_Northamptonshire_County_Council_2017.pdf
[xv] PFRA_Milton_Keynes_Council_2017.pdf
[xvi] Local Flood Risk Management Strategy | West Northamptonshire Council
[xvii] milton-keynes.gov.uk/sites/default/files/2022-09/Milton Keynes%29_LFRMS_FINAL.pdf
[xviii] Planners and flood risk | North Northamptonshire Council
[xix] https://docslib.org/doc/2600158/west-northamptonshire-level-1-strategic-flood-risk-assessment
[xx] milton-keynes.gov.uk/sites/default/files/2024-07/Level_1_SFRA.pdf
[xxi] National Policy Statement for renewable energy infrastructure (EN-3) - GOV.UK
[xxii] National Policy Statement for electricity networks infrastructure (EN-5) - GOV.UK
[xxiii] https://ascelibrary.org/doi/10.1061/%28ASCE%29HE.1943-5584.0000530
[xxiv] KN5524_Planning_Guidance_reduced.pdf