Gate Burton Energy Park

Preliminary Environmental Information Report

Volume 3, Appendix 9-B: Flood Risk Assessment

June 2022

Gate Burton Energy Park Limited

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Quality information

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1. Introduction

1.1.1 This Flood Risk Assessment (FRA) forms an appendix to the Preliminary Environmental Information (PEI) Report for the Scheme. Further information on the Scheme is included within **PEI Report Volume 1, Chapter 2: The Scheme**.

1.1.2 This report considers the flood risk posed to, and from the Scheme from all sources of flooding in accordance with the National Policy Statement for Energy (NPS EN-1) (Ref 1), NPS EN-3 (Ref 2), NPS EN-5 (Ref 14) and the draft NPS EN-1 (Ref 3). Also the National Planning Policy Framework (NPPF) (Ref 4), supporting Planning Practice Guidance, and other relevant legislation and policy related to Development Consent Orders (DCOs). Further information on planning policy and guidance is detailed in **PEI Report Volume 3: Appendix 9-C**.

1.2 FRA Objectives

1.2.1 The minimum requirements for FRAs as outlined in the NPS EN-1 are to:

- 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 their purpose of 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 Scheme may affect drainage systems;
- Consider if there is a need to be safe and remain operational during a worst case flood event over the Scheme's lifetime; and
- Be supported by appropriate data and information, including historical information on previous events.

1.2.2 The principle objectives of the above are to:

- Identify potential forms of flooding including rivers, watercourses, surface water flooding, groundwater flooding, flooding from sewer systems and from artificial sources (canals, reservoirs);
- Establish the risk of flooding to the Scheme;
- Determine the effects of the development on flooding elsewhere either through displacement of floodwaters or increased runoff; and
- Suggest appropriate flood mitigation measures, including a strategy for disposal of surface water runoff following the principles of Sustainable Drainage Systems (SuDS).

1.3 Consultation

1.3.1 During the pre-application stages, the following stakeholders will be contacted to agree flood risk and drainage proposals:

- Lead Local Flood Authority;
- Anglian Water;
- Internal Drainage Board; and
- The Environment Agency.

1.3.2 In addition, near neighbours to the Scheme who have existing flood risk issues will be consulted to understand the flood source, issues and concerns in relation to the Scheme.

1.4 The Scheme

1.4.1 Gate Burton Energy Park (the Scheme) is a proposed solar farm which will generate renewable energy for exporting to the National Grid.

1.4.2 The Scheme will comprise the construction, operation, maintenance, and decommissioning of a solar photovoltaic (PV) electricity generating facility and energy storage facility with a total capacity exceeding 50 megawatts (MW) along with export connection to the National Grid. The Scheme will be located within the 'DCO Site' (as described below) and is the subject of the DCO Application. Further information on the Scheme is included within **PEI Report Volume 1, Chapter 2: The Scheme**.

2. Site Description

2.1 Location

2.1.1 The DCO Site comprises an area of 1,426ha which straddles the boundary between the counties of Nottinghamshire and Lincolnshire, within the districts of Bassetlaw and West Lindsey. The DCO Site comprises the Solar Energy and Storage Park and the Grid Connection Route. The rationale for selecting the DCO Site is described in **PEI Report Volume 1, Chapter 3: Alternatives and Design Evolution**. The maximum extent of land that is expected to be included within the DCO Application for the DCO Site, including the maximum areas of the Grid Connection Route, is shown on **PEI Report Volume 2: Figure 1-2**. It should be noted, this represents the current maximum (and where relevant, minimum) extent of land being considered and may be further refined at the ES stage.

2.1.2 The majority of the Solar and Energy Storage Park is located within Flood Zone 1 (less than 1 in 1,000 annual probability of river or sea flooding), however the north-east corner of the Solar and Energy Storage Park does cross an area of Flood Risk Zone 2 (between a 1 in 100 and 1 in 1,000 annual probability of river flooding) and Flood Zone 3 (1 in 100 or greater annual probability of river flooding) associated with Padmore drain (Ordinary watercourse) along Kexby Lane. Flood zones are illustrated on **PEI Report Volume 2: Figure 9-2**.

2.1.3 The majority of the Grid Connection Route is located in Flood Zone 3a with a small area located within Flood Zone 1 in the vicinity of Marton (illustrated on **PEI Report Volume 2: Figure 9-2**).

3. Legislation, Planning Policy and Guidance

3.1.1 National planning policy sets out the overarching policy framework and local planning policy sets out the flood risk planning requirements for the local area, both of which have to be adhered to. For this FRA, national guidance includes the National Policy Statement (NPS) for Energy (EN-1), Renewable Energy Infrastructure (EN-3), Electrical Networks Infrastructure (EN-5) and the NPPF and accompanying PPG, while local policy relates to the Local Development Plan. Further information on Legislation, Planning Policy and Guidance is detailed in **PEI Report Volume 3: Appendix 9-C**.

3.1 NPS EN-1

3.1.1 The overarching National Policy Statement for Energy (NPS EN-1) (Ref 1) sets out policy with regard to the development of nationally significant energy infrastructure projects. Specific policy relating to flood risk is set out within NPS EN-1 in Section 5.7. It is noted that the Government has recently completed (6th September – 29th November 2021) a consultation on revisions to energy NPSs and are therefore a material consideration. A review indicates that there are minor changes in relation to flood risk and these generally mirror with the requirements of NPPF (see Section 3.2 below).

3.1.2 NPS EN-1 states at paragraph 5.7.12 that the Infrastructure Planning Commission (IPC) (now, for the purposes of this application, the appointed Examining Authority with the Secretary of State for Business Energy and Industrial Strategy being the decision maker) should not recommend and consent development in Flood Zone 2 in England unless satisfied that the Sequential Test requirements have been met and that consent should not be granted for development in Flood Zone 3 unless it is satisfied that the Sequential and Exception Test requirements have been met. For the Sequential Test, it states at paragraph 5.7.13 the following:

"Preference should be given to locating projects in Flood Zone 1 in England or Zone A in Wales. If there is no reasonably available site in Flood Zone 1 or Zone A, then projects can be located in Flood Zone 2 or Zone B. If there is no reasonably available site in Flood Zones 1 or 2 or Zones A & B, then nationally significant energy infrastructure projects can be located in Flood Zone 3 or Zone C subject to the Exception Test."

3.1.3 NPS EN-1 (at paragraphs 5.7.14 and 5.7.15) also outlines the Sequential and Exception Tests to be followed:

"If, following application of the sequential test, it is not possible, consistent with wider sustainability objectives, for the project to be located in zones of lower probability of flooding than Flood Zone 3 or Zone C, the Exception Test can be applied. The test provides a method of managing flood risk while still allowing necessary development to occur.

The Exception Test is only appropriate for use where the sequential test alone cannot deliver an acceptable site, taking into account the need for

energy infrastructure to remain operational during floods. It may also be appropriate to use it where as a result of the alternative site(s) at lower risk of flooding being 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) it would not be appropriate to require the development to be located on the alternative site(s)."

3.1.4 At paragraphs 5.7.16 and 5.7.17 NPS EN-1 states:

"All three elements of the test will have to be passed for development to be consented. For the Exception Test to be passed:

i. It must be demonstrated that the project provides wider sustainability benefits to the community that outweigh flood risk;

ii. The project should be on developable, previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land subject to any exceptions set out in the technology-specific NPSs; and

iii. A FRA must demonstrate that the project will be safe, without increasing flood risk elsewhere subject to the exception below and, where possible, will reduce flood risk overall.

Exceptionally, where an increase in flood risk elsewhere cannot be avoided or wholly mitigated, the IPC may grant consent if it is satisfied that the increase in present and future flood risk can be mitigated to an acceptable level and taking account of the benefits of, including the need for, nationally significant energy infrastructure as set out in Part 3 above. In any such case the IPC should make clear how, in reaching its decision, it has weighed up the increased flood risk against the benefits of the project, taking account of the nature and degree of the risk, the future impacts on climate change, and advice provided by the EA and other relevant bodies."

3.1.5 Paragraph 5.7.23 of NPS EN-1 also requires a sequential approach to be applied to the layout and design of projects with more vulnerable uses being located on parts of the site at lower probability and residual risk of flooding by using Sustainable Drainage Systems (SuDS).

3.1.6 Paragraph 5.7.24 and 5.7.25 require *"Essential energy infrastructure which has to be located in flood risk areas should be designed to remain operational when floods occur"* and that *"the receipt of and response to warnings of floods is an essential element in the management of the residual risk of flooding".*

3.1.7 Paragraph 5.7.19 explains the range of sustainable approaches to surface water drainage management and paragraph 5.7.21 requires *"surface water drainage arrangements for any project to be such that the volumes and peak flow rates of surface water leaving the site are no greater than the rates prior to the proposed project, unless specific off-site arrangements are made and result in the same net effect"*

3.1.8 Paragraph 5.7.22 also states that it *"may be necessary to provide surface water storage and infiltration to limit and reduce both the peak rate of discharge from the site and the total volume discharged from the site. There*

may be circumstances where it is appropriate for infiltration facilities or attenuation storage to be provided outside the project site, if necessary through the use of a planning obligation".

3.1.9 The revised draft NPS for Renewable Energy Infrastructure (Draft NPS EN-3) includes a specific section on solar developments and the need for applicant assessments to consider the impact of drainage and runoff on existing drainage systems and watercourses.

3.1.10 National Policy Statement for Electricity Networks Infrastructure (EN-5) (NPS EN5) principally concerns high voltage long distance transmission and distribution infrastructure however also relates to electrical infrastructure such as cabling, solar stations and substations associated with nationally significant energy infrastructure projects.

3.1.11 Paragraph 2.4.1 of NPS EN-5 explains that as climate change is likely to increase risks to the resilience of electrical infrastructure it requires applicants to "*set out to what extent the proposed development is expected to be vulnerable, and, as appropriate, how it would be resilient to flooding, particularly for substations that are vital for the electricity transmission and distribution network*".

3.2 NPPF

3.2.1 Section 14 of the NPPF (Ref 3) and the associated PPG details current policy with respect to flood risk in England. Paragraph 167 (footnote 55) of the NPPF outlines that a site-specific FRA should be provided for all development located in Flood Zones 2 and 3; and for all sites that are greater than 1ha in Flood Zone 1.

3.2.2 NPPF flood risk policy is supported by the Planning Practice Guidance and Table 1 of the PPG defines the flood zones (Table 3-1).

Table 3-1: Flood Zones – Table 1 of PPG 2021

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3).
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map).
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map).
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in

Flood Zone	Definition
	agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map).

3.2.3 The NPPF considers the vulnerability of different types of development to flooding (Table 3-2). According to Annex 3 of the NPPF, the Scheme is classified as 'Essential Infrastructure'.

Table 3-2: Flood risk vulnerability classification – Adapted from Annex s of NPPF 2021

Development Type	Classification
Essential infrastructure	a. Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. b. Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. c. Wind turbines. d. Solar farms
Highly vulnerable	a. Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding. b. Emergency dispersal points. c. Basement dwellings. d. Caravans, mobile homes and park homes intended for permanent residential use. e. Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').
More vulnerable	a. Hospitals b. Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. c. Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. d. Non–residential uses for health services, nurseries and educational establishments.

Development Type	Classification	
	e.	Landfill* and sites used for waste management facilities for hazardous waste.
	f.	Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Less vulnerable	a.	Police, ambulance and fire stations which are not required to be operational during flooding.
	b.	Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
	c.	Land and buildings used for agriculture and forestry.
	d.	Waste treatment (except landfill* and hazardous waste facilities).
	e.	Minerals working and processing (except for sand and gravel working).
	f.	Water treatment works which do not need to remain operational during times of flood.
	g.	Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.
	h.	Car Parks
Water-compatible development	a.	Flood control infrastructure.
	b.	Water transmission infrastructure and pumping stations.
	c.	Sewage transmission infrastructure and pumping stations.
	d.	Sand and gravel working.
	e.	Docks, marinas and wharves.
	f.	Navigation facilities.
	g.	Ministry of Defence installations.
	h.	Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
	i.	Water-based recreation (excluding sleeping accommodation).
	j.	Lifeguard and coastguard stations.
	k.	Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
	l.	Essential ancillary sleeping or residential accommodation for staff required by uses in this

Development Type	Classification
	category, subject to a specific warning and evacuation plan.

* Landfill is as defined in Schedule 10 of the Environmental Permitting (England and Wales) Regulations 2010.

3.2.4 Table 3 of the PPG, which illustrates a matrix that identifies which vulnerability classifications are appropriate within each flood zone, confirms that 'Essential infrastructure' development is required to undertake an exception test when located in Flood Zone 3 as set out in Table 3-3 below.

Table 3-3: Flood Risk Vulnerability and Flood Zone Compatibility - Table 3 of the PPG 2021

Flood Zone	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓		✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception test required	✓	✓
Zone 3b*	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development appropriate

✗ Development should not be permitted

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

*** In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:**

- **remain operational and safe for users in times of flood;**
- **result in no net loss of floodplain storage;**
- **not impede water flows and not increase flood risk elsewhere.**

3.2.5 In order to pass the exception test, it should be demonstrated that:

- the development provides wider sustainability benefits to the community that outweigh the flood risk; and
- the development 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.

3.2.6 In Flood Zone 3a and 3b, Table 3.3 above indicates the requirements for infrastructure located within these Flood Zones.

3.2.7 The details of how the Scheme will meet the above criteria is detailed in Section 6.

3.3 Local Plan

3.3.1 The Scheme study area spans two counties (Lincolnshire and Nottinghamshire) and is located within the local planning authority areas of West Lindsey District Council (Lincolnshire) and Bassetlaw District Council (Nottinghamshire). The following local planning policy will also be taken into consideration:

Central Lincolnshire Local Plan (2017)

3.3.2 Central Lincolnshire Local Plan 2012 - 2036 (2017) (Ref 5) replaced the Local Plans of the City of Lincoln, West Lindsey District Council and North Kesteven District Council. It includes relevant policy for flood risk:

- Policy LP14 (Managing Water Resources and Flood Risk).

3.3.3 This includes wording on flood risk, sustainable drainage and protecting the water environment.

Bassetlaw District Council Core Strategy (2011)

3.3.4 Bassetlaw District Council Core Strategy (Ref 6) seeks to ensure that all new development reduce or mitigate flood risk; realise opportunities to utilise renewable and low carbon energy sources and/or infrastructure, alongside sustainable design and construction and make use of Sustainable Drainage Systems (SuDS). It includes relevant development management policy for flood risk:

- Policy DM12 (Flood Risk, Sewerage and Drainage).

Draft Bassetlaw Local Plan 2020 – 2037 (2021)

3.3.5 The Draft Bassetlaw Local Plan 2020 – 2037 (2021) (Ref 7) is currently going through consultation stages with a planned adoption in spring 2023. It includes relevant policy for flood risk and drainage that should be considered:

- Policy ST52 (Flood Risk and Drainage); and
- Policy ST53 (Protecting Water Quality and Management).

Lincolnshire County Council SuDS Guidance (2018)

3.3.6 In 2018, Lincolnshire County Council produced the ‘Sustainable Drainage Design and Evaluation Guide’ (Ref 8). This guide links the design of SuDS with the evaluation requirements of planning to facilitate consultation in order to achieve 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.

3.3.7 All major developments will be required to incorporate water management measures to reduce surface water runoff and ensure that it does not increase flood risk elsewhere by considering all sources of flood risk both to and from a proposed scheme. The principal method to do so should be the use of SuDS. Surface water runoff should be managed to ensure that there is no increase in surface water flow rate run off.

Strategic Flood Risk Assessment

3.3.8 Initial strategic flood guidance was provided by the Level 1 Strategic Flood Risk Assessment (SFRA) West Lindsey SFRA (2009) (Ref 9). The purpose of this study was to provide a reference and policy document to inform the West Lindsey Local Development Framework and to ensure that the District Council meets its obligations under Planning Policy Statement 25. The results of this study will enable the Council to apply the Sequential Test and, where relevant, the Exception Test throughout the District.

3.3.9 The Bassetlaw Level 1 SFRA (2019) (Ref 10) provides a comprehensive and robust evidence base to support the Bassetlaw District Council Local Plan. The document takes into account the most recent policy and legislation in the National Planning Policy Framework (2018) at the time of writing (2019)[1]. It collates and analyses the latest available information and data for current and future (i.e. climate change) flood risk from all sources, and how these may be mitigated. With the aim of providing evidence to support the application of the Sequential Test for the allocation of new development sites, to support the Council's preparation of the Local Plan.

Preliminary Flood Risk Assessment

3.3.10 Lincolnshire County Council (Ref 11) and Nottinghamshire County Council (Ref 12) are Lead Local Flood Authorities. Their Preliminary Flood Risk Assessments (PFRAs) present a high-level screening exercise to identify areas where flood risk is significant (known as Flood Risk Areas). The PFRA required the preparation and publication of a Preliminary Assessment Report (PAR) on past and future flooding, including consideration of the consequences of that flooding and the identification of Flood Risk Areas. The PFRAs cover the risk of flooding from local sources, namely Ordinary Watercourses, surface water (overland runoff) and groundwater. It does not consider directly flooding from Main Rivers, such as the River Trent.

[1] Note: there have been subsequent revisions to NPPF in 2021 - : National Planning Policy Framework (publishing.service.gov.uk)

4. Assessment of Flood Risk

4.1 Flood Risk from all sources

4.1.1 This section assesses the flood risk from the following sources against the maximum extent of land that is expected to be included within the subsequent DCO Application for the Scheme, including the maximum areas of the Grid Connection Route (see **PEI Report Volume 2: Figure 1-2**. These sources are:

- Fluvial;
- Tidal;
- Surface water;
- Sewers;
- Groundwater; and
- Artificial waterbodies.

4.1.2 The methodology used to assess the flood risk is detailed below:

- **Low:** where little risk is identified or any theoretical risk identified is classified as low within Local Authority SFRAs and/or EA flood risk mapping extents, with very low probability of flooding occurring;
- **Medium:** where risk is identified within Local Authority SFRA and/or EA flood risk mapping extents indicating a medium probability, but manageable flood risk with little to no mitigation required; and
- **High:** where modelled levels within Local Authority SFRA and/or EA flood risk mapping extents show risk to the Scheme as a high probability of flood risk and where mitigation needs to be considered and residual risks controlled.

4.1.3 Through the sequential process, the solar panels and BESS Compound will be located outside of Flood Zones 2 and 3 (Padmore Drain and minor tributaries), i.e., in Flood Zone 1. Infrastructure shown to be at flood risk is to be mitigated as discussed below.

4.1.4 Flood Risk mapping and EA flood risk guidance is presented in Section 5.

Climate Change

4.1.5 Peak river flow allowances are based on Water Framework Directive catchment areas. The Environment Agency Website ‘Climate change allowances for peak river flow in England’ has been consulted to check and confirm the revised climate change allowances for the catchment areas that cover the DCO site.

4.1.6 Climate change allowance relate to predicted percentage increase in peak river flows and peak rainfall that the Scheme design must consider.

4.1.7 The Scheme is covered by two management catchments with their own climate change allowances for river flows:

- The majority of the Solar Energy and Storage Park is within the Witham Management Catchment which has a 'Higher' allowance of 32% (2080s) (for Essential Infrastructure); and
- The majority of the Grid Connection Route is within the Lower Trent and Erewash Management Catchment which has a 'Higher' allowance of 39% (2080s).

4.1.8 For peak rainfall intensity, the Scheme is covered by the same two management catchments as for river flows. Based on the development lifetime of the Solar Energy and Storage Park being between 2061 and 2100, the central allowance for the 2070s epoch should be applied. This allowance for both management catchments is:

- 3.3% AEP – 25%
- 1% AEP – 25%

4.1.9 These peak rainfall allowances will be considered within the surface water drainage strategy for the lifetime of the development.

5. Flood Risk to Solar and Energy Storage Park

5.1 Overview

5.1.1 The NPPF requires that all potential sources of flooding that could affect the Scheme are considered. This section of the FRA assesses the flood risk posed to the site from: rivers and the sea, directly from rainfall on the ground surface, rising groundwater, overwhelmed sewers and drainage systems, from reservoirs, canals, lakes and other artificial flood sources.

5.1.2 Whilst developments are typically assessed as a whole site, this assessment is split into two separate elements due to the differing nature of these elements:

- Solar and Energy Storage Park; and
- Grid Connection Route.

5.1.3 This section assesses the flood risk posed to the site area for the Solar and Energy Storage Park.

5.2 Fluvial

5.2.1 As discussed in Section 2.1 the majority of the Solar and Energy Storage Park is located within Flood Zone 1, however the north-east corner of the Solar and Energy Storage Park does cross an area of Flood Risk Zone 2 and 3 associated with Padmore drain (Ordinary watercourse) along Kexby Lane where solar panels will be located but set back from the Flood Zone extents. Flood zones are illustrated on **PEI Report Volume 2: Figure 9-2**.

5.2.2 To the east of the Solar and Energy Storage Park area is a corridor of Flood Zone 3 that is associated with Padmoor Drain (1 in 100 or greater annual probability of river flooding (>1% AEP)), draining north to south towards the River Till.

5.2.3 Historic flood mapping and recorded flood outlines[2] for Gate Burton and the surrounding area show that there have been a number of flood events where fluvial/tidal influences have combined to inundate the River Trent valley and floodplain, with extents close to the western and southern part of the Solar and Energy Storage Park. These events were recorded in 1932, 1947, 1977 and 2000.

5.2.4 It is also noted that there are existing flood risk issues outside of the Solar and Energy Storage Park boundary in the vicinity of Kexby Lane and Willingham Road/Marton Road. The source of this flooding will be confirmed at the ES stage through liaison with residents.

[2] EA data services platform, historic flood outlines.

5.3 Tidal

5.3.1 As discussed in Section 2.1 the majority of the Solar and Energy Storage Park is located within Flood Zone 1 associated with fluvial sources. The tidal influence of the River Trent does not extend to the watercourses within the Solar and Energy Storage Park and therefore is not considered further for this element of the scheme.

5.4 Surface Water

5.4.1 Flooding from surface water runoff (or 'pluvial' flooding) is usually caused by intense rainfall that may only last a few hours and usually affects lower lying areas, often where the natural (or artificial) drainage system is unable to cope with the volume of water. Surface water flooding problems are inextricably linked to issues of poor drainage, or drainage blockage by debris, and sewer flooding. The Flood Map for Surface Water (illustrated on **PEI Report Volume 2: Figure 9-2**) is classified into four flood risk categories: Very Low (AEP of less than 0.1%), Low (AEP between 0.1% and 1%), Medium (AEP of between 1% and 3.33%) and High (AEP of greater than 3.33%) in accordance with Environment Agency criteria.

5.4.2 From a review of the Environment Agency's Flood Map for Surface Water, the majority of the Solar and Energy Storage Park is considered to be at 'Very Low' risk of surface water flooding (illustrated on **PEI Report Volume 2: Figure 9-2**). This means that each year this area has a chance of flooding of less than 0.1%.

5.4.3 The mapping shows the main overland pluvial flow paths that propagate through and across the Solar and Energy Storage Park. These flow paths follow the topography with ponding in low lying areas (illustrated on **PEI Report Volume 2: Figure 9-2**). Padmore drain, the western side of the railway line embankment and the southern fields draining from the Scheme boundary show the greatest extent of surface water flooding.

5.4.4 The water depth associated with both the high and medium risk scenarios is shallow (300-900mm max) and very localised, with the low risk (chance of flooding of between 0.1% and 1%) scenario depths only exceeding 900mm in only a very limited area, as shown on Plate 1 below.

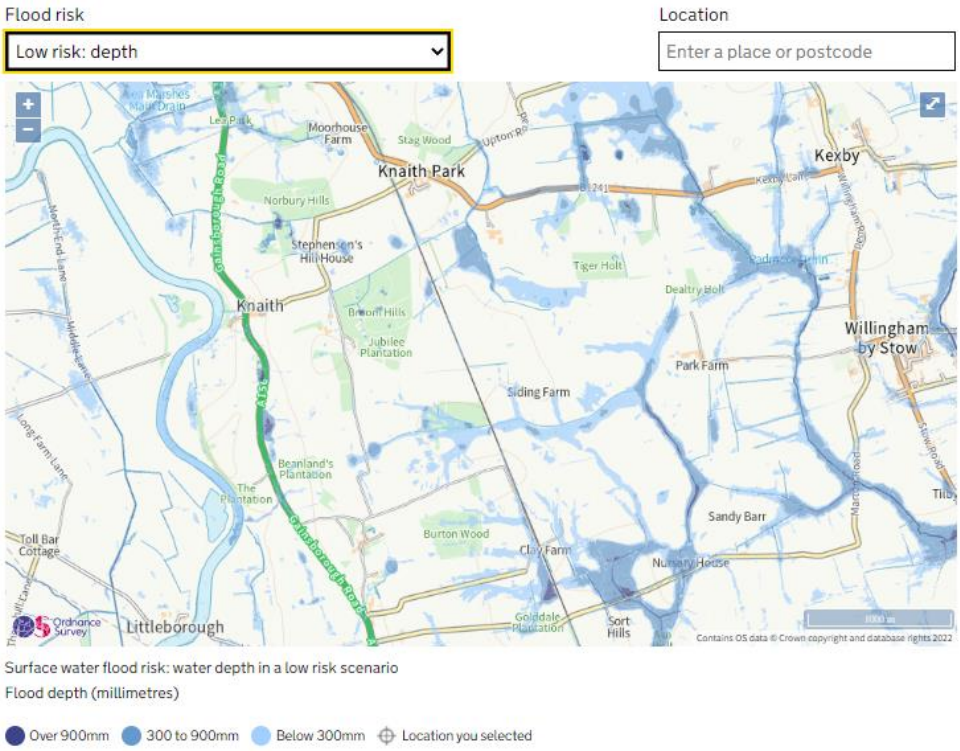

Plate 1: EA surface water flood risk mapping for Solar Energy and Storage Park, risk of flooding low (light blue), medium risk (blue), high risk (dark blue)

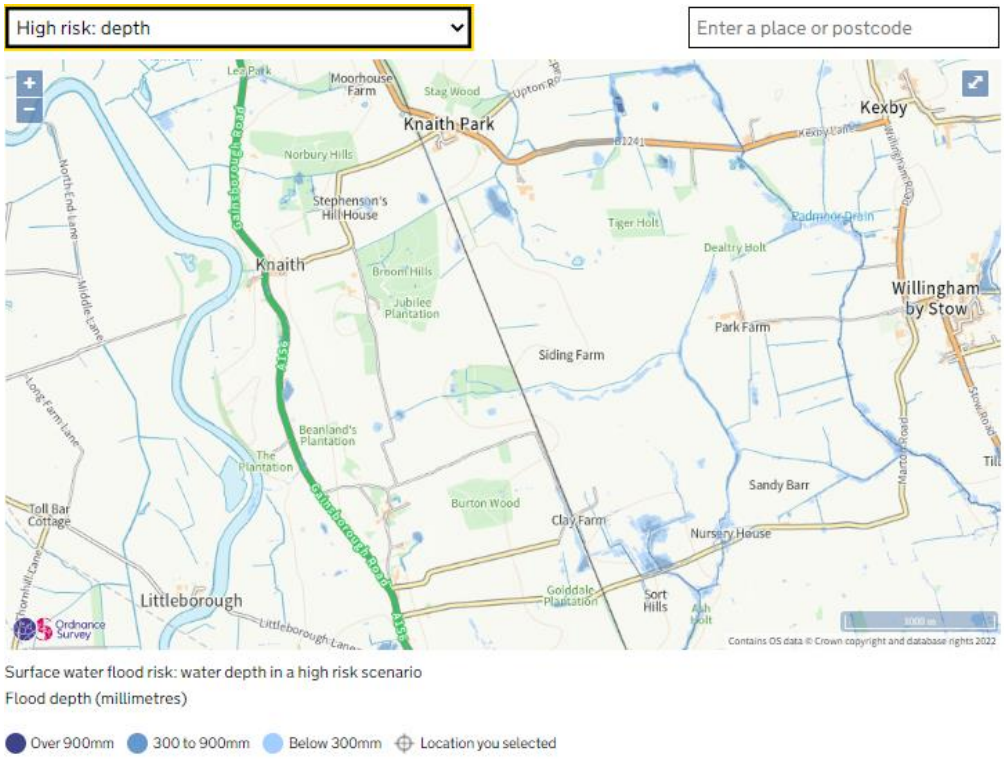

Plate 2: EA surface water flood risk, water depth in a high-risk scenario (chance of flooding of greater than 3.3% AEP).

5.6 Groundwater

5.6.1 A review of the Lincolnshire County Council Preliminary Flood Risk Assessment (PFRA) (Ref 11) indicates that susceptibility to groundwater flooding is predominantly <25% with minimal areas of 25-50% and 50-75% susceptibility and therefore the risk from this source is considered to be very low to low. It is considered that groundwater flood risk is unlikely to increase from the Solar and Energy Storage Park as the majority of the infrastructure will be above the ground surface. Infiltration into the soil and underlying geology will remain as existing conditions. Further confirmation will be sought via BGS Groundwater Flood Map at the ES stage.

5.7 Sewers

5.7.1 A review of vulnerable infrastructure (BESS/Sub Station) and compound found no sewer records in these areas; therefore the risk is considered very low. Where required, an additional search will be undertaken at ES stage, should there be any revisions to the design following statutory consultation.

5.8 Artificial Sources

5.8.1 Artificial flood sources include raised channels such as canals or storage features such as ponds and reservoirs.

5.8.2 The Environment Agency Flood Risk from Reservoirs (Ref 1) indicates that the Solar and Energy Storage Park is not at risk of flooding in the unlikely event of a failure of a major reservoir. The closest extent associated with reservoir failure is located approximately 600m along the western edge of the Solar and Energy Storage Park. The flood extent associated with this reservoir is constrained to the opposite side of the River Trent to the Solar and Energy Storage Park.

5.8.3 There are no canals near the Solar and Energy Storage Park.

5.8.4 Based on the information above, the Solar and Energy Storage Park is considered to be at low risk of flooding from artificial sources.

5.9 Flood Risk Assessment Summary – Solar and Energy Storage Park

5.9.1 The flood risk to the Solar and Energy Storage Park is summarised in Table 5-1.

Table 5-1: Summary of flood risk to the Solar and Energy Storage Park

Flood Mechanism	Source	Flood risk to the development	Mitigation required?
Fluvial (majority of site)	Main River / Ordinary Watercourse	Low (majority), high (North west side and west boundary, associated with Padmoor drain)	Yes (sequential location of infrastructure)

Flood Mechanism	Source	Flood risk to the development	Mitigation required?
Tidal	River Trent	Very low	No
Surface Water Flooding	Runoff from surrounding land and hard surfaces.	Very low (majority), low – high (localised shallow patches)	Yes
Groundwater	Rising groundwater levels in the underlying geology.	Very low - low	No
Sewers	Surrounding public / private drainage systems.	Very low	No
Artificial Sources	Reservoirs	Very low	No

6. Flood Risk to Grid Connection Route

6.1 Overview

6.1.1 This section assesses the flood risk posed to the site area for the Grid Connection Route.

6.2 Fluvial

6.2.1 The majority of the Grid Connection Route is located in Flood Zone 3a (1 in 100 or greater annual probability of river flooding) based on the Bassetlaw Level 1 SFRA flood maps[3] with a small area located within Flood Zone 1 in the vicinity of Marton (illustrated on **PEI Report Volume 2: Figure 9-2**).

6.2.2 The corridor intersects flood defence embankments both sides of the River Trent that provide a degree of protection to the landward side. However, there are a number of smaller channels and watercourses within the corridor that also pose a fluvial flood risk.

6.2.3 The West Lindsey SFRA (2009) (Ref 9) uses Flood Zone 2 as a proxy for the extent of Flood Zone 3 including climate change (up to 2109). Using this approach, there is no change in flood risk designation for the Grid Connection Route to the east of the River Trent.

6.2.4 The climate change mapping in the Bassetlaw SFRA (2019) (Ref 10) uses the results from the existing Environment Agency hydraulic models (100-year +20%) and where no hydraulic models exist, Flood Zone 2 has been used as a conservative indication. Environment Agency mapping along the grid connection route (100-year + 20%) appears to result in the same extent as the current Flood Zone 3 and does not exceed Flood Zone 2. Therefore, this is no change in flood risk to the Grid Connection Route to the west of the River Trent.

6.3 Surface Water

6.3.1 The risk of surface water flooding is generally very low (annual chance of flooding of less than 0.1% AEP) with isolated patches of low (chance of flooding of between 0.1% and 1% AEP), medium (chance of flooding of between 1% and 3.3% AEP), and high risk (chance of flooding of greater than 3.3% AEP) generally associated with drains and agricultural ditches (Ref 13). Flood risk from surface water is illustrated on **PEI Report Volume 2: Figure 9-3**.

6.3.2 The Bassetlaw SFRA (2019) (Ref 10) confirms that the Grid Connection Route does not fall within a Critical Drainage Area.

[3] bssfra012defendedoutlines5.pdf (bassetlaw.gov.uk)

6.4 Groundwater

6.4.1 A review of the Lincolnshire County Council Preliminary Flood Risk Assessment (PFRA) (Ref 11) indicates that susceptibility to groundwater flooding is predominantly >75% within the Grid Connection Route, it is therefore considered that without appropriate mitigation where required, flood risk from this source is high. Localised impacts on groundwater flows within the vicinity of the buried cable may occur but are unlikely to increase flood risk to vulnerable receptors as the Grid Connection Route is predominantly within green open space consisting of arable fields. Further confirmation will be sought via BGS Groundwater Flood Map at the ES stage.

6.5 Tidal

6.5.1 There is a tidal influence associated with the River Trent however based on the Bassetlaw Level 1 SFRA[4], this primarily focuses on fluvial flooding, it is therefore reasonable to consider that the fluvial influence outweighs the tidal influence. Furthermore, the area benefits from flood defence and the cable route will be buried therefore the risk from this source is considered to be low.

6.6 Sewers

6.6.1 A search has been undertaken to identify Anglian Water / Thames Water sewerage assets within the Grid Connection Route. At this stage, it is considered unlikely that flooding from sewers will impact the Grid Connection Route as the majority of the route is through arable fields with only one location where the route crosses a Thames Water sewer. The Bassetlaw Level 1 SFRA addendum[5] indicates that within the postcode area within the cable route, only 1-2 incidences of sewer flooding have occurred and therefore the risk of flooding from this source is considered to be very low.

6.7 Artificial Sources

6.7.1 The River Trent and floodplain intersect the Grid Connection Route and is located within the extent associated with the risk of flooding from a reservoir breach. The majority of the route is covered by the combined risk of when there is also flooding from rivers, with a small area north and east of Cottam that would be flooded when river levels are normal (see Plate 3 below).

6.7.2 Statutory reservoirs (large, raised reservoirs with volumes above ground of 25,000 m^3 or over) are regularly inspected and maintained as set out in the Reservoirs Act 1975. Whilst the consequence of failure can be significant, the likelihood of failure is typically low. The risk of flooding from this source is considered negligible as the Grid Connection Route is proposed to be a buried cable.

[4] JBA Consulting Report (bassetlaw.gov.uk)
[5] JBA Consulting Report Template 2015 (bassetlaw.gov.uk)

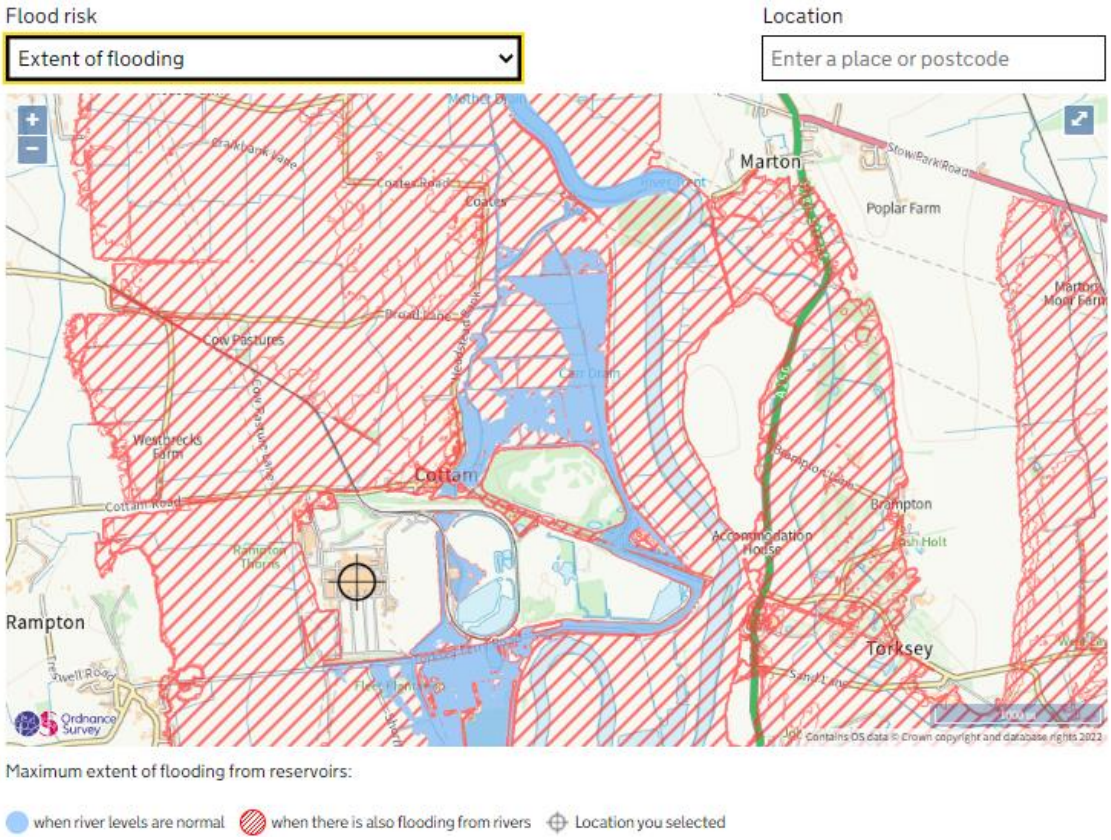

Plate 3: EA extent of reservoir flooding mapping (Ref 13).

6.8 Flood Risk Assessment Summary – Grid Connection Route

6.8.1 The flood risk to the Grid Connection Route is summarised in Table 6-1.

Table 6-1: Summary of flood risk to the Grid Connection route

Flood Mechanism	Source	Flood risk to the development	Mitigation required?
Fluvial	Main River / Ordinary Watercourse	High (defences are present)	No
Tidal	River Trent	Very low risk	No
Surface Water Flooding	Runoff from surrounding land and hard surfaces.	Very low (majority)	No
Groundwater	Rising groundwater levels in the underlying geology.	High	TBC at ES Stage
Sewers	Surrounding public / private drainage systems.	Very low	No
Artificial Sources	Reservoirs	Very low	No

7. Flood risk – From development

7.1 Overview

7.1.1 The NPPF highlights how built development can lead to an increased risk of flooding by increasing surface water runoff. Development often increases the area of impermeable surfaces thereby promoting rapid run-off to surface water sewers or watercourses rather than percolation into the ground. The effect can be to increase both total and peak water flows, contributing to flooding.

7.1.2 However, the draft NPS EN-3 (Renewable Energy Infrastructure) highlights in paragraph 2.50.7 that:

"As solar PV panels will drain to the existing ground, the impact will not in general be significant. 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. 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. Culverting existing watercourses/drainage ditches should be avoided. Where culverting for access is unavoidable, it should be demonstrated that no reasonable alternatives exist and where necessary it will only be in place temporarily for the construction period."

7.1.3 Section 9.9 of **PEI Report Volume 1, Chapter 9: Water Environment** provides information on the embedded mitigation measures to manage surface water flood risk from the development.

7.2 Solar and Energy Storage Park

7.2.1 As noted in paragraph 6.1.2, solar PV panels will drain to the existing ground and the impact will generally not be significant. A summary of the main embedded mitigation measure to manage surface water flood risk are provided below. These will be developed further within the Surface Water Drainage Strategy that will accompany the ES and will be secured through a required of the draft DCO.

- Individual PV Panels will be held above the ground surface on mounting structures (see **PEI Report Volume 1, Chapter 2: The Scheme**). This will avoid sealing the ground with impermeable surfaces. As a result, it is assumed that the impermeable area will remain largely consistent with its pre-development state. However, runoff from the PV Panels may alter the existing routing of runoff. To prevent ponding occurring around the PV Panels, a series of boundary and routing swales will be constructed to convey surface water runoff away from the PV Panels and towards receiving watercourses or soakaways/infiltration basins to ground. These will be grassed and will have the minimum gradient to provide conveyance but not to encourage scour and soil erosion.

- Additional SuDs attenuation such as ponds will be incorporated to control any increase in the rate of flow towards the receiving watercourses, and to provide treatment for any contaminants collected on areas of hardstanding. At this stage, pond and outfall locations have not been determined but will be confirmed at the ES stage
- Where proposed access tracks cross water courses, the intention is to use open span crossings and not introduce any new culverts for temporary or permanent access routes. Tracks will use permeable materials such as crushed rock/gravel and localised SuDS, such as swales and infiltration trenches, to control runoff where required.

7.3 Grid Connection Route

7.3.1 The proposed grid connection is via buried cables, therefore the likelihood of increased flood risk from this is considered to be low. In particular, for flood risk sources above ground (fluvial, tidal, surface water and artificial), there will be quantifiable increase in risk from these sources.

7.3.2 The depth and construction of the flood defence embankment will be identified through liaison with the Environment Agency and directional drilling will be used at a sufficient depth to avoid compromising the structural integrity of the flood defence embankment. Therefore, the likelihood of increased flood risk from this crossing is considered to be low.

7.3.3 The proposed buried cable will not increase flood risk from sewers. During the ES stage, information on wastewater assets, pumping stations and sewers within the grid connection route will be confirmed with Thames Water and Anglian Water and appropriate mitigation measures will be considered to avoid and minimise potential impacts to these assets.

7.3.4 The proposed buried cables may impede groundwater flow locally. The proposed Grid Connection Route is wholly within green open space (arable fields) and therefore any increases are unlikely to affect vulnerable receptors.

8. Addressing the Sequential and Exception Test

8.1.1 The aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. The Scheme is classified as ‘Essential Infrastructure’ and the majority of the development is situated within areas with the lowest risk of flooding from any source.

8.1.2 A sequential approach has been applied to the layout and design of the Solar and Energy Storage Park with the Scheme being located, as far as possible, in areas with the lowest risk of flooding from any source with embedded mitigation where required.

8.1.3 However, the Grid Connection Route is predominantly located within an area of high risk of fluvial flooding (Flood Zone 3). Whilst other grid connection route

options were considered, these were also located within Flood Zone 3 and there are no alternative routes at lower risk of flooding from any source.

8.1.4 In this instance, it is therefore necessary to apply the exception test and demonstrate that:

- *The development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
- *The development 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.*

8.1.5 **PEI Report Volume 1, Chapter 3: Alternatives and Design Evolution** sets out details of how the Scheme has considered alternatives including sites and layouts. An alternative sites assessment which includes consideration of sites in terms of their susceptibility to flooding, having regard to the Flood Zone within which they are predominantly located will be submitted with the DCO application and will provide evidence to demonstrate the Sequential Test requirements (as required by the NPPF and NPS EN-1) have been met. Details of how the Sequential Test and Exception Test have been met for the Scheme will be provided in an update to this FRA to accompany the DCO application.

9. Conclusions

9.1 Overview

9.1.1 This FRA has assessed flood risks to and from the DCO Site. The majority of the Solar and Energy Storage Park lies in Flood Zone 1, with minimal areas of Flood Zone 2 and 3 in the north-east corner of the Solar and Energy Storage Park and along the eastern border, both associated with Padmoor Drain. The majority of the Grid Connection Route is in Flood Zone 3, associated with the River Trent and its floodplain. Other sources of flood risk (tidal, surface water, sewer, groundwater and artificial) also impact both elements of the Scheme to differing degrees.

9.1.2 The Scheme is classed as 'Essential Infrastructure' under the NPPF and therefore should avoid Flood Zone 3a and 3b where feasible. Where this is unavoidable, the development is required to pass the Exception Test and should be designed and constructed to remain operational and safe in times of flooding.

9.2 Flood risk – To development

9.2.1 The following potential sources of flooding which could affect the Solar and Energy Storage Park site have been considered and assessed as follows:

- With the majority of the Scheme located in Flood Zone 1, the current risk from fluvial sources is considered to be 'low'. However, the Scheme does have areas of higher risk (Flood Zone 2 and 3) which increases the risk in these locations to 'high', the development will be designed accordingly in order to remain operational during times of flood. Based on the design, the risk within these areas should be considered low;
- There is 'low risk' from tidal sources;
- The risk of surface water flooding to the majority of the Solar and Energy Storage Park is considered to be 'low'. There are a few areas where the risk is higher but these generally cover a small spatial extent. A surface water drainage strategy incorporating SuDS will be implemented to manage these flow paths to ensure that the development remains safe throughout its life time;
- The risk of groundwater is likely to be 'low' based on available information. Further information will be sought at the ES stage and updated for the DCO submission;
- The risk of sewer flooding is considered to be 'very low'; and
- The risk of flooding from artificial sources is considered to be 'very low'.

9.2.2 The following potential sources of flooding which could affect the Grid Connection Route have been considered and assessed as follows:

- The majority of the Grid Connection Route is in Flood Zone 3, associated with the River Trent and its floodplain. The cable will be buried, inherently flood protected, and protected by existing flood defences; it will therefore remain operational during times of flood. Based on these factors, the risk within these areas should be considered low;
- There is 'very low risk' from tidal sources;
- The risk of surface water flooding to the majority of the Grid Connection Route is considered to be 'very low'. There are a few isolated areas where the risk is higher but these generally cover a small spatial extent. A surface water management strategy will be implemented to manage these flow paths to ensure that the development remains safe throughout its life time;
- The risk of groundwater is considered to be 'high' based on available information although will be localised and unlikely to be discernible from fluvial and/or surface water flooding. Further information will be sought at the ES stage and updated for the DCO submission;
- The risk of sewer flooding is considered to be 'very low'; and
- The risk of flooding from artificial sources is considered to be 'very low', due to the combined factors of existing flood defences, low likelihood of reservoir failure, and that the cable will be buried during operation the risk from this source is mitigated.

9.3 Flood risk – From Development

9.3.1 With the exception of fluvial and surface water sources, an increase in flood risk from other sources from development is considered unlikely or very localised (groundwater for the buried cable). Where required further detail will be added at ES stage.

Fluvial

9.3.2 The following potential sources of flooding which could come from the Solar and Energy Storage Park have been considered and assessed as follows:

- Structures and panels will be sequentially located to avoid areas of high fluvial flood risk and raised to a sufficient height to avoid flood water, being preferentially located in Flood Zone 1 (which is the majority of the Solar and Energy Storage Park). Therefore, there is no loss of floodplain storage, and structures will not impede water flows or increase flood risk elsewhere. This meets the criteria set in Section 3.1.

9.3.3 The following potential sources of flooding which could come from the Grid Connection Route have been considered and assessed as follows:

- The cable will be underground so there will be no loss of floodplain storage, impedance of water flows or increase to flood risk elsewhere.

Surface Water

9.3.4 An outline Surface Water Drainage Strategy will be developed alongside the impact assessment outlining how surface water will be managed in order to

prevent any increase in flood risk. This would be developed into a detailed drainage strategy prior to construction. It will provide measures to manage drainage from new infrastructure required by the Scheme (e.g. PV panel arrays, access tracks and areas of hardstanding across the Site) and manage any required changes to existing land drainage arrangements (**PEI Report Volume 1, Chapter 2: The Scheme**).

10. References

Ref 1 National Planning Statement (NPS) for Overarching Energy EN-1 (2011).

Ref 2 National Planning Statement (NPS) for Renewable Energy EN-3 (2011).

Ref 3 Revised (draft) National Policy Statement for Energy (2022).

Ref 4 Department of Communities and Local Government (DCLG) (2021) National Planning Policy Framework (NPPF).

Ref 5 Central Lincolnshire Local Plan (2017). Available at: https://www.n-kesteven.gov.uk/central-lincolnshire/local-plan/

Ref 6 Bassetlaw District Council Core Strategy (2011). Available at: https://www.bassetlaw.gov.uk/planning-and-building/planning-services/planning-policy/core-strategy-and-development-policies/core-strategy-adopted-development-plan/

Ref 7 The Draft Bassetlaw Local Plan 2020 – 2037 (2021) Available at: https://www.bassetlaw.gov.uk/planning-and-building/the-draft-bassetlaw-local-plan/

Ref 8 Lincolnshire County Council (2018) Sustainable Drainage Design and Evaluation Guide. Available at: https://www.lincolnshire.gov.uk/downloads/file/1951/sustainable-drainage-design-and-evaluation-guide-pdfa

Ref 9 West Lindsey SFRA (2009) https://www.west-lindsey.gov.uk/planning-building-control/planning/planning-policy/evidence-base-monitoring/strategic-flood-risk-assessment

Ref 10 Bassetlaw District Council SFRA (2019) https://www.bassetlaw.gov.uk/media/3802/bassetlaw-strategic-flood-risk-assessment.pdf

Ref 11 Lincolnshire County Council PFRA (2011) https://www.lincolnshire.gov.uk/flood-risk-management/preliminary-flood-risk-assessment/1

Ref 12 Nottinghamshire County Council PFRA (2011) https://www.nottinghamshire.gov.uk/media/1598/pfra-1.pdf

Ref 13 Environment Agency Flood Risk Map for Planning. Available at: https://flood-map-for-planning.service.gov.uk/

Ref 14 National Planning Statement (NPS) for Electricity Networks Infrastructure (EN-5).