Gate Burton
ENERGY PARK

Gate Burton Energy Park Environmental Statement

Volume 3, Appendix 9-D: Flood Risk Assessment
Document Reference: EN010131/APP/3.3
January 2023

APFP Regulation 5(2)(a)
Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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Table of Contents

Tables

1. Introduction

1.1.1 This Flood Risk Assessment (FRA) forms an appendix to the Environmental Statement (ES) for the Scheme. Further information on the Scheme is included within **ES Volume 1, Chapter 2: The Scheme [EN010131/APP/3.1]**.

1.1 Purpose of the report

1.1.1 This report considers the flood risk posed to, and from the Scheme from all sources of flooding in accordance with the National Planning Policy Framework (NPPF) (Ref 1), supporting Planning Practice Guidance, and other relevant legislation and policy related to Development Consent Orders (DCOs) including the National Policy Statement for Energy (NPS EN-1) (Ref 2) and NPS EN-3 (Ref 3). Further information on planning policy and guidance is detailed in **ES Volume 3: Appendix 9-B [EN010131/APP/3.3]**.

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 Scheme on flooding elsewhere either through displacement of floodwaters or increased runoff; and
- Identify appropriate flood mitigation measures, including a strategy for disposal of surface water runoff following the principles of Sustainable Drainage Systems (SuDS).

1.2.3 The requirements within draft NPS EN1 are broadly similar to the above and have been considered as part of this FRA.

1.3 Consultation

1.3.1 Statutory consultation has been undertaken at the Preliminary Environmental Information (PEI) Report stage. The following statutory consultees listed below have provided comments on flood risk and drainage:

- Nottinghamshire County Council;
- Lincolnshire County Council;
- Bassetlaw District Council;
- West Lindsey District Council;
- Trent Valley Internal Drainage Board;
- Upper Witham Internal Drainage Board;
- Environment Agency;
- Canal and Rivers Trust;
- Severn Trent Water; and
- Anglian Water.

1.3.2 These comments have been considered in revisions to the Scheme layout in conjunction with other topics. Additional information regarding the consultation process, and the content of each statutory consultee's comments can be found in **ES Volume 1, Chapter 4: Consultation [EN010131/APP/3.1]** and the **Consultation Report [EN010131/APP/4.1]** submitted as part of the Application**.**

1.4 The Scheme

1.4.1 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 'Order limits' (the maximum extent of land potentially required temporarily and/or permanently for construction, operation and maintenance of the Scheme) and is the subject of the DCO Application. Further information on the Scheme is included within **ES Volume 1, Chapter 2: The Scheme [EN010131/APP/3.1]**.

2. Site Description

2.1 Location

2.1.1 The Site comprises an area which straddles the boundary between the counties of Nottinghamshire and Lincolnshire, within the districts of Bassetlaw and West Lindsey. The Site comprises the Solar Energy and Storage Park, the Grid Connection Corridor (which includes small areas of land required for road alternations) to facilitate the Scheme. The rationale for selecting the Site is described in **ES Volume 1, Chapter 3: Alternatives and Design Evolution [EN010131/APP/3.1]**. The maximum extent of land that is expected to be included within the Order limits for the Site, including the maximum areas of the Grid Connection Corridor, is shown on **ES Volume 2: Figure 1-2 [EN010131/APP/3.2]**.

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 must be adhered to. For this FRA, national guidance includes the National Policy Statement (NPS) for Energy (EN-1), NPPF and the accompanying Planning Practice Guidance (PPG) for Flood Risk and Coastal Change while local policy relates to the Local Plan (or Core Strategy). Further information on Legislation, Planning Policy and Guidance is detailed in **ES Volume 3: Appendix 9-B [EN010131/APP/3.3]**.

3.1 NPS EN-1

3.1.1 The overarching National Policy Statement for Energy (NPS EN-1) (Ref 2) sets out the Government's 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.

3.1.2 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 and these generally mirror with the requirements of NPPF (see Section 3.2 below).

3.2 NPPF

3.2.1 Section 14 of the NPPF (Ref 1) 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 The NPPF considers the vulnerability of different types of development to flooding. According to Annex 3 of the NPPF, the Scheme is classified as 'Essential Infrastructure'. Table 2 of the PPG, which illustrates a matrix that identifies which vulnerability classifications are incompatible with each flood zone, confirms that 'Essential infrastructure' development is required to undertake an exception test when located in Flood Zone 3. In order to pass the exception test (Paragraph 164, NPPF), 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.

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

3.2.4 In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the exception Test, should be designed and constructed to:

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

3.2.5 The details of how the Scheme will meet the above criteria is detailed in Section 8.

3.3 Local Plan

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

Central Lincolnshire Local Plan (2017)

3.3.2 Central Lincolnshire Local Plan 2012 - 2036 (2017) (Ref 4) replaced the Local Plans of 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 & Development Management Policies DPD (2011)

3.3.4 Bassetlaw District Council Core Strategy & Development Management Policies DPD (Ref 5) 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 6) 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 7). 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 8). 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 PPS 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 9) provides a comprehensive and robust evidence base to support the Bassetlaw District Council Local Plan. The document takes into account the policy and legislation in the National Planning Policy Framework (at time of publication). 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 (PFRA)

3.3.10 Lincolnshire County Council (Ref 10) and Nottinghamshire County Council (Ref 11) are Lead Local Flood Authorities. Their 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.

4. Flood Risk – to Solar and Energy Storage Park

4.1 Overview

4.1.1 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 Scheme from: fluvial (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.

4.1.2 Whilst developments are typically assessed as a whole site, this assessment is split into two separate elements, for ease of reading:

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

4.1.3 This section assesses the flood risk posed to the Site for the Solar and Energy Storage Park.

4.2 Fluvial

4.2.1 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 Padmoor drain (Ordinary watercourse) along Kexby Lane. Flood zones are illustrated on **ES Volume 2: Figure 9-2 [EN010131/APP/3.2]**.

4.2.2 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.

4.2.3 The land in Flood Zone 1 is assessed as having less than 1 in 1000 annual probability of fluvial or tidal flooding (<0.1%). The land in Flood Zone 2 is assessed as 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 tidal flooding. The land in Flood Zone 3 is assessed as having a 1 in 100 (1%) or greater annual probability of fluvial flooding or as having a 1 in 200 (0.5%) or greater annual probability of tidal flooding.

4.2.4 Historic flood mapping and recorded flood outlines[1] for the Scheme 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. It should be noted that these flood events occurred when raised defences were not present in this area.

4.2.5 Bassetlaw SFRA indicates that the primary source of fluvial flood risk is associated with the River Trent, where there is a history of surface water

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

flooding in the urban areas of Bassetlaw with overland flow routes following topography, and there is an increased risk of groundwater flooding along the River Trent.

4.2.6 Based on the information presented, the overall risk of fluvial flooding is judged to be 'low'. Mitigation measures for those areas in Flood Zone 2 and 3 within the Solar and Energy Storage Park have been incorporated (see Section 7).

4.3 Tidal

4.3.1 Based on a review of the Environment Agency Flood Map, the Solar and Energy Storage Park is not considered to be at risk from tidal flooding based on the distance and elevation from the River Trent.

4.4 Surface Water

4.4.1 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 **ES Volume 2: Figure 9-3 [EN010131/APP/3.2]**) 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.

4.4.2 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 **ES Volume 2: Figure 9-3 [EN010131/APP/3.2]**). This means that each year this area has a chance of flooding of less than 0.1%.

4.4.3 The mapping shows the main overland pluvial flow paths (flowing saturation) that propagate through and across the Solar and Energy Storage Park. These flow paths follow the topography with some ponding in low lying areas (illustrated on **ES Volume 2: Figure 9-3 [EN010131/APP/3.2]**). Padmoor drain, the western side of the railway line embankment and the southern fields draining from the site boundary show the greatest extent of surface water flooding.

4.4.4 The water depth associated with both the high (3.3% AEP) and medium (1% AEP) risk scenarios is shallow (300-900mm max) and very localised, with the low risk (0.1% AEP) scenario depths only exceeding 900mm in only a very limited area, as shown in **ES Volume 2: Figures 9-3a-c [EN010131/APP/3.2]**.

4.4.5 It is noted that there are existing flood risk issues affecting properties on Kexby Lane and a single property on Willingham Road. These are outside of the Order limits but are adjacent, therefore have been considered within the FRA. Near neighbour visits were undertaken on 27/05/2022 to understand the source of flooding to these properties. The visit to Kexby Lane indicated that flood risk to properties was caused by a combination of sources, including the saturation of underlying strata, highway runoff, the surcharging of surface water and foul

sewers, and the backing up of water in highway and surface water drains when water levels are high in the receiving dyke. The visit to Nursery House (Willingham Road) confirmed that flooding was caused by surface water where the infiltration capacity of the underlying clay soils had been exceeded and then conveyed either by overland flow, or via field drains to receiving watercourses.

4.4.6 The summative risk of surface water flooding to the Solar and Energy Storage Park is considered 'very low'. However, given the presence of 'high' risk pockets associated with Padmoor Drain, the western side of the railway embankments, and the fields abutting the Solar and Energy Storage Park's southern boundary, mitigation measures will be required. Mitigation will be achieved through a range of measures including the implementation of a Outline Drainage Strategy (see Section 7).

4.5 Groundwater

4.5.1 Groundwater flooding occurs when water stored beneath the ground rises to the surface and typically occurs after prolonged periods of heavy rainfall. A review of the Lincolnshire County Council Preliminary Flood Risk Assessment (PFRA) (Ref 10) indicates that susceptibility to groundwater flooding is predominantly <25% with minimal areas of 25-50% and 50-75% susceptibility across the Solar and Energy Storage Park.

4.5.2 Further information was sought through purchase of the British Geological Survey (BGS) 'Susceptibility to Groundwater flooding' mapping (see **ES Volume 2: Figure 9-5 [EN010131/APP/3.2]**). This dataset consists of strategic mapping that displays areas susceptible to groundwater flooding on a 50m grid. A suite of rules grounded upon geological, hydrogeological, and topographic information, are utilised to classify the grid cells into one of four classes:

- A: Limited potential for groundwater flooding to occur;
- B: Potential for groundwater flooding of property situated below ground level;
- C: Potential for groundwater flooding to occur at surface; and
- Elsewhere (onshore): Not considered to be prone to groundwater flooding.

4.5.3 Comparison with the site boundary of the Solar and Energy Storage Park shows that the majority of the site is classified as Class A, with isolated areas of Class C around Kexby Lane and Clay Farm (NGR: SK 85090 83079). Based on the above information, the groundwater flood risk to the Solar and Energy Storage Park is considered 'low'.

4.6 Sewers

4.6.1 Sewer flooding generally occurs when the available discharge capacity of the network is exceeded by the inflow, pipes become blocked by debris or sediment, pump failure occurs (if pumped), or it cannot be released at the outfall due to a high water level within the receiving waterbody. In all cases, water may back up through the sewerage system and surcharge through manholes, flooding highways and properties.

4.6.2 Mapping of Anglian Water Ltd and Severn Trent Water Ltd assets across the site and its surrounds was ordered via InfoTrack. Interrogation of the Drainage and Water Plans confirms that there are no public sewers, lateral drains, or disposal mains owned by either provider within the boundary of the Solar and Energy Storage Park. Additionally, there are no properties recorded as being at risk of internal flooding due to public sewers within the bounds of the Solar and Energy Storage Park.

4.6.3 Taking the above information into account, the risk of sewer flooding to the Solar and Energy Storage Park is considered to be 'very low'.

4.7 Artificial Sources

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

4.7.2 The Environment Agency Flood Risk from Reservoirs (Ref 12) 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 250m from the western edge of the Solar and Energy Storage Park at its closest point but is generally greater than 500m. The flood extent associated with the reservoir failure is constrained within the River Trent floodplain with predominant flooding occurring to the west of the River Trent, therefore not affecting the Solar and Energy Storage Park (see **ES Volume 2: Figure 9-6 [EN010131/APP/3.2]**).

4.7.3 There are no canals within or near the Solar and Energy Storage Park that are considered a risk. Based on the information available, the Solar and Energy Storage Park is considered to be at very low risk of flooding from artificial sources.

4.8 Flood Risk Assessment Summary – Solar and Energy Storage Park

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

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

Flood Mechanism	Source	Flood risk to the development	Further Mitigation required?
Fluvial	Main River / Ordinary Watercourse	Low (majority), high (North east side and east boundary, associated with Padmoor drain) Low (with embedded mitigation)	No
Tidal	Main River (River Trent)	Negligible	No
Surface Water Flooding	Runoff from surrounding land and hard surfaces.	Very low (majority), low-high (localised patches)	No

Flood Mechanism	Source	Flood risk to the development	Further Mitigation required?
		Low (with embedded mitigation)	
Groundwater	Rising groundwater levels in the underlying geology.	Low	No
Sewers	Surrounding public / private drainage systems.	Very low	No
Artificial Sources	Reservoirs	Very low	No

5. Flood Risk – to Grid Connection Corridor

5.1 Overview

5.1.0 This section assesses the flood risk posed to the site area for the Grid Connection Corridor.

5.2 Fluvial

5.2.1 The majority of the Grid Connection Corridor is located in Flood Zone 3 (1 in 100 or greater annual probability of river flooding) with a small area located within Flood Zone 1 in the vicinity of Marton (illustrated on **ES Volume 2: Figure 9-2 [EN010131/APP/3.2]**).

5.2.2 The corridor intersects flood defence embankments on both sides of the River Trent that provide a degree of protection to both landward sides. However, there are a number of smaller channels and ordinary watercourses within the corridor that also pose a fluvial flood risk (see **ES Volume 2: Figure 9-4 [EN010131/APP/3.2]** for location of these watercourses).

5.2.3 The West Lindsey SFRA (2009) (Ref 8) 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 Corridor to the east of the River Trent.

5.2.4 The climate change mapping in the Bassetlaw SFRA (2019) (Ref 9) uses the results from the existing Environment Agency hydraulic models (1% AEP +20% for climate change) and where no hydraulic models exist, Flood Zone 2 has been used as a conservative indication. Environment Agency mapping along the Grid Connection Corridor (1% AEP + 20% for climate change) results in the same extent as the current Flood Zone 3 and does not exceed Flood Zone 2. Therefore, there is no change in flood risk to the Grid Connection Corridor to the west of the River Trent.

5.2.5 Based on the information presented above, the risk of fluvial flooding to the Grid Connection Corridor is considered ‘high’, therefore requiring suitable mitigation measures. However, the cables will buried and encased in a water-resistant outer jacket, whilst flood defences are present along both banks of the River Trent. These factors, combined with the adoption of the proposed mitigation measures for the construction phase at the Solar and Energy Storage Park in Section 7, will reduce the fluvial flood risk to the Grid Connection Corridor to ‘low’.

5.3 Tidal

5.3.1 There is a tidal influence in this area, however it is reasonable to assume that the fluvial influence is likely to outweigh the tidal influence, and therefore the risk from tidal flooding is considered ‘low’ based on the distance upstream from the river mouth and flood defences in the area.

5.4 Surface Water

5.4.1 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 12). Flood risk from surface water is illustrated on **ES Volume 2: Figure 9-3 [EN010131/APP/3.2]**.

5.4.2 The Bassetlaw SFRA (2019) (Ref 9) confirms that the Grid Connection Corridor does not fall within a Critical Drainage Area.

5.4.3 The risk of surface water flooding to the Grid Connection Corridor is judged to be 'very low'.

5.5 Groundwater

5.5.1 A review of the Lincolnshire County Council Preliminary Flood Risk Assessment (PFRA) (Ref 10) indicates that susceptibility to groundwater flooding is predominantly >75% within the Grid Connection Corridor.

5.5.2 As described for the Solar and Energy Storage Park, the BGS 'Susceptibility to Groundwater flooding' mapping has been purchased and indicates that the majority of the Grid Connection Corridor is categorised as class C ('Potential for groundwater flooding to occur at surface'), which corroborates the information in the Lincolnshire County Council PFRA.

5.5.3 Based on the information presented above, the risk of groundwater flooding to the Grid Connection Corridor is judged to be 'high', and therefore mitigation measures will be required. However, the cables will be buried and encased in a water-resistant outer jacket and unlikely to exert a significant effect on groundwater movement. These factors, combined with the adoption of the proposed mitigation measures for the construction phase will reduce the groundwater flood risk to the Grid Connection Corridor to 'low'.

5.6 Sewers

5.6.1 Mapping of Severn Trent Water Ltd assets covering the Grid Connection Corridor was ordered via InfoTrack. Interrogation of the Drainage and Water Plans confirms that there are no public sewers, lateral drains, or disposal mains owned by Severn Trent Water Ltd that intersect the Grid Connection Corridor. The only exception to this is where the Grid Connection Corridor spans 190m of a public surface water gravity sewer and 390m of a public foul water sewer south of the village of Marton (near NGR: SK 84127 81434). The search area was also recorded as not being at risk of flooding from overwhelmed public sewers.

5.6.2 Based on the information described above, the risk of sewer flooding to the Grid Connection Corridor is considered 'very low'.

5.7 Artificial Sources

5.7.1 The River Trent and floodplain intersect the Grid Connection Corridor 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 (i.e. the 'wet day' scenario), with a small area north and east of Cottam that would be flooded when river levels are normal (i.e. the 'dry day' scenario) (see **ES Volume 2: Figure 9-6 [EN010131/APP/3.2]**).Therefore, the risk of flooding from artificial sources to the Grid Connection Corridor is considered 'high'.

5.7.2 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. Whilst the baseline risk of flooding from artificial sources to the Grid Connection Corridor is 'high', as noted for fluvial and groundwater flooding, the cables will be buried and encased in a moisture-resistant outer jacket. Therefore, with mitigation in place, the risk of flooding from this source is considered 'very low'.

5.8 Flood Risk Assessment Summary – Grid Connection Corridor

5.8.1 The flood risk to the Grid Connection Corridor is summarised in Table 2.

Table 2 Summary of flood risk to the Grid Connection Corridor

Flood Mechanism	Source	Flood risk to the development	Further Mitigation required?
Fluvial	Main River / Ordinary Watercourse	High Low (with embedded mitigation)	No
Tidal	North Sea/tidal fluctuations	Low	No
Surface Water Flooding	Runoff from surrounding land and hard surfaces.	Very Low	No
Groundwater	Rising groundwater levels in the underlying geology.	High Low (with embedded mitigation)	No
Sewers	Surrounding public / private drainage systems.	Very low	No
Artificial Sources	Reservoirs	High Very Low (with embedded mitigation)	No

6. Flood Risk – From Development

6.1 Overview

6.1.1 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.

6.1.2 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.'*

6.1.3 Section 9.9 of **ES Volume 1, Chapter 9: Water Environment [EN010131/APP/3.1]** provides information on the embedded mitigation measures to manage surface water flood risk from the development. In addition, Section 7 provides a summary of the Outline Drainage Strategy that is provided in **ES Volume 3: Appendix 9-C [EN010131/APP/3.3]**.

6.2 Solar and Energy Storage Park

6.2.1 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 measures to manage surface water flood risk is provided in Section 7 and further detail is provided in **ES Volume 3, Appendix 9-C: Outline Drainage Strategy [EN010131/APP/3.3]**.

6.2.2 Flooding from the proposed development for other sources (fluvial, tidal, sewer, artificial and groundwater) is considered low and unlikely to increase from these sources. The mitigation for surface water flooding from the development will also mitigate for flood risk from fluvial and groundwater sources. There is limited sewerage infrastructure and no artificial sources within the site and therefore flood risk from these sources will remain low.

6.3 Grid Connection Corridor

6.3.1 The proposed Grid Connection Corridor 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 no increase in risk from these sources during operation.

6.3.2 Examination of Severn Trent Water's Drainage and Water Plans for the Grid Connection Corridor indicate that only a small section of the Grid Connection Corridor intersects an area where there are public sewers (to the south of Marton). No discharges to the public sewer are proposed from construction or operation within the Grid Connection Corridor. It is therefore considered that there will be no increase in sewer flood risk from the Grid Connection Corridor.

6.3.3 Non-intrusive techniques such as horizontal directional drilling will be utilised to install the cables beneath the River Trent at a depth of up to 25m, such that there will be no impact on the banks and bed of the watercourse, or the flood defences flanking the river. This will ensure that there will be no effect on the flow regime or flooding potential of the River Trent

6.3.4 It is anticipated that the Grid Connection Corridor will require temporary crossing of watercourses. HDD is proposed for a number of crossings with the remainder to be by open cut, damming and over-pumping will be employed to maintain the continuity of flow within these watercourses. Disruption of flow pathways on the floodplain will be minimised by ensuring that topsoil and construction materials are kept outside of the 1 in 100 year (1% AEP) floodplain extent during construction, and pre-existing ground levels on the floodplain are maintained, as far as practicable.

6.3.5 During construction, two temporary compounds are proposed within the Grid Connection Corridor (see **ES Volume 2: Figure 3-4 [EN010131/APP/3.2]**). Whilst these are located within Flood Zone 3, the temporary nature (48 months), limited spatial extent compared to flood zone extent, presence of flood defence infrastructure on the River Trent and distance from potential receptors that could be impacted, the likelihood of increased flood risk from these is considered to be low. These will be returned to current conditions post construction, therefore there will be no change in flood risk from all sources during operation.

6.3.6 The proposed buried cables may impede groundwater flow locally. The proposed grid connection corridor is predominantly within green open space (arable fields) with the exception of minor roads. The profile of the cable ducting is comparatively small relative to the spatial and vertical extent of the secondary aquifers. Therefore, the impacts of the Grid Connection Corridor on groundwater flow and vulnerable receptors are considered to be low.

6.3.7 Disruption of the groundwater flow is more likely during the construction phase (temporary) when the cables are being installed. Groundwater ingress to the launch/exit pits for HDD will be managed through standard construction techniques such as pumping, damming or shoring up the pits with sheet piling. Relevant permissions/permits will be sought and agreed at the DCO requirements stage in consultation with the relevant authority. The volume is unlikely to be significant when compared to other flood risk sources and therefore any temporary discharge of water is unlikely to increase flood risk from groundwater sources beyond existing levels during construction.

7. Mitigation Measures

7.1.1 It has been demonstrated above that the primary flood risk to the Solar and Energy Storage Park will be from fluvial and surface water sources during the three project phases. An Outline Drainage Strategy has been prepared (see **ES Volume 3: Appendix 9-C [EN010131/APP/3.3]**) and is secured by a requirement of the draft DCO, includes measures to manage the risk of surface water flooding to the site, additional details of which can be found in Section 6.2. The mitigation measures required to alleviate the risk of fluvial flooding to the site are detailed below.

7.1 Fluvial

7.1.1 The eastern boundary of the Solar and Energy Storage Park west of Marton Road and the north-east corner around Kexby Lane, are both located in Flood Zones 2 and 3 associated with the Padmoor Drain. At the construction, operation and decommissioning stages, the following mitigation measures will be put in place, this will reduce the assessed flood risk in Section 4.7 to low:

Construction/Decommissioning

7.1.2 Monitoring of weather forecasts on a monthly, weekly and daily basis by the applicant during the construction, so that works in the channel of any watercourse can be halted or avoided where there is a significant risk of high flows or flooding.

7.1.3 Notification of construction laydown area site office and supervisor about potential impending flooding through the use of the Floodline Warnings Direct or an equivalent service.

7.1.4 Production of an Emergency Response Plan by the Applicant following the receipt of the DCO consent and prior to construction (secured via the CEMP), which will provide details of the response to an impending flood event.

7.1.5 During the construction phase, topsoil and other construction materials will be stored outside of the 1 in 100 year (1% AEP) floodplain extent where feasible. Likewise, there will be no changes in ground levels within the floodplain as far as practicable.

Operation

7.1.6 Sequential location of solar PV panels and vulnerable electrical components (e.g. inverters, switchgears etc) outside of Flood Risk Zones 2 and 3.

7.1.7 A minimum 10m maintenance buffer between the centreline of watercourse channels and the solar PV panels.

7.1.8 The lowest part of the solar PV panels will be raised to 0.8m above ground level. This allows for a maximum flood depth of 0.5 m + 0.3 m freeboard. This predominantly relates to surface water flood risk as panels have been sequentially located outside of Flood Zone 2 and 3.

7.2 Surface Water

7.2.1 **ES Volume 3, Appendix 9-C: Outline Drainage Strategy [EN010131/APP/3.1]** sets out the outline drainage strategy for the Scheme based on the Order limits. This provides details on the management of surface water generated within the Solar and Energy Storage Park. No surface water drainage is proposed for Grid Connection Corridor as the cables will be buried, and the corridor will be restored to greenfield conditions post construction.

7.2.2 The proposed strategy aims to mimic the natural drainage conditions of the site as much as possible. The proposed solar PV panels will be held above ground individually on narrow diameter piled legs. This prevents sealing the ground with an impermeable surface beneath solar panels allowing rainfall/runoff to infiltrate to ground throughout the Scheme. As a result, it is considered that the Scheme's impermeable area will remain consistent to its pre-development state.

7.2.3 It is considered that rainfall will mostly permeate into the ground where it falls, and that any runoff generated within arable fields collects in local low spots where it infiltrates to ground or enters a watercourse as appropriate where the site drainage interacts with one.

7.2.4 The Scheme will provide minimal alterations to the existing topography and ground conditions on-site. Any excess peak surface water runoff generated within the site boundary will be attenuated onsite before it is infiltrated to ground. Attenuation will be provided in the form of swales and infiltration basins. These features will be strategically located based on existing overland flow routes to capture runoff. Check dams will be placed strategically within swales to optimise their storage potential on steeper slopes. Where the attenuation lies within the solar field, the legs of the solar panel will be extended so that the solar panel lies above any potential flooding.

7.2.5 Where proposed access tracks cross watercourses, the intention is to use open span crossings and minimise the introduction of 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, will be used to control runoff where required.

7.2.6 The proposed surface water drainage network has been designed to accommodate runoff from all storms up to and including the 1% AEP +40% for climate change. For an extreme storm event, any exceedance flows that cannot be retained by the proposed attenuation flow overland, following the existing topography, where ultimately, they will be contained within the SuDS features.

8. Sequential and Exception Test

8.1.1 The location of the Solar and Energy Storage Park and the Grid Connection Corridor themselves were largely dictated by the availability of a grid connection point at Cottam Power Station and a single contiguous land parcel (or sites in close proximity to one another) within a 5km radius of the existing National Grid Infrastructure. **ES Volume 1, Chapter 3: Alternatives and Design Evolution [EN010131/APP/3.1]** provides an explanation of how the Scheme has considered alternatives, taking into consideration of wider environmental and sustainability factors.

8.1.2 The Sequential and Exception Tests have been undertaken to satisfy both the NPS EN-1 and the NPPF requirements. 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' with the majority of the Solar and Energy Storage Park situated within an area of low risk of flooding from any source.

8.1.3 A sequential approach has been applied to the layout and design of the Solar and Energy Storage Park with the BESS substation, the Power Conversion Unit, and the solar PV panel arrays located in areas with the lowest risk of flooding from any source, as shown in **ES Volume 2: Figure 2-4 [EN010131/APP/3.2]**. Where required, embedded mitigation within the design has been included. The Sequential Test is therefore considered passed for the Solar and Energy Storage Park due to flood risk from any source to be low following the embedded mitigation.

8.1.4 The Grid Connection Corridor is predominantly located within an area of high risk of fluvial flooding (Flood Zone 3). Whilst other Grid Connection Corridor 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.

8.1.5 In this instance, it is therefore necessary to apply the exception test for the Grid Connection Corridor 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.

8.1.6 The Scheme's objective of generating low-carbon electricity for an operational period of 60 years aligns with the urgent need to decarbonise electricity generation in the UK, as established by the UK'S "Net Zero" law passed in June 2019, and in NPS EN-1. Likewise, the British Energy Security Strategy (Ref 14) outlines that new low-carbon generation must be developed to meet the UK's future energy requirements, with the development of large-scale solar in the UK being an integral part of this. Therefore, the Scheme will have both a national, and global significance, through its decarbonisation of the nation's electricity generation, and is clearly commensurate with national energy policy – as

detailed further within the **Statement of Need [EN010131/APP/2.1]** and the **Planning Statement [EN010131/APP/2.2]**.

8.1.7 **ES Volume 1, Chapter 9: Ecology and Nature Conservation [EN010131/APP/3.1]** (Section 8.10) provides details on habitat creation and enhancement. These are all intended to contribute to the Scheme achieving over 10% Biodiversity Net Gain (BNG) in line with the Environment Act 2021 (Ref 15). This has included areas of proposed BNG and ecological enhancement within areas excluded for solar panels due to surface water flood risk. Further information on BNG and ecological enhancement is included within the BNG report (**ES Volume 2, Appendix 8-M [EN010131/APP/3.2]**) and the **Outline Landscape and Ecological Enhancement Plan (OLEMP) [EN010131/APP/7.10]**.

8.1.8 Therefore, taking the above into account, it is judged here that the Scheme will provide wider sustainability benefits that outweigh its impacts on flood risk.

8.1.9 As detailed within this FRA, embedded mitigation measures and an Outline Drainage Strategy, secured by a requirement of the draft DCO will be implemented, in order to ensure that the Scheme will not increase the risk of flooding from all sources either to, or arising from the Scheme during the construction, operational and decommissioning phases. Thus, the Scheme satisfies the second requirement of the Exception Test and will remain safe throughout its lifetime without increasing flood risk to third party land.

8.1.10 In summary, the above demonstrates that the Scheme is considered to pass the Sequential and Exception Test.

9. Conclusions

9.1 Overview

9.1.1 This FRA has assessed flood risks to and from the 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 Corridor is in Flood Zone 3, associated with the River Trent and its floodplain.

9.1.2 The Scheme is classed as 'Essential Infrastructure' under the NPPF and therefore should avoid Flood Zone 3 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 'negligible' risk from tidal sources;
- The risk of surface water flooding to the majority of the Solar and Energy Storage Park is considered to be 'very low'. There are a few areas where the risk is higher but these generally cover a small spatial extent. An outline 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
- The risk of flooding from sewers 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 Corridor have been considered and assessed as follows:

- The majority of the Grid Connection Corridor is in Flood Zone 3, associated with the River Trent and its floodplain and therefore considered 'high' risk without mitigation. The cable will be buried below ground, inherently flood protected, and protected by existing flood defences; it will therefore remain operational during times of flood. Incorporating mitigation, the risk within these areas is considered low;

- There is a 'low risk' from tidal sources;
- The risk of surface water flooding to the majority of the Grid Connection Corridor is considered to be 'very low'. There are a few isolated areas where the risk is higher but these cover a small spatial extent. As per the mitigation measures for fluvial flood risk, the development will remain operational during times of flooding and therefore the risk from this source remains 'very low' due to the use of buried cables;
- The risk of groundwater flooding is considered to be 'high' based on available data. However, during operation, the effects are unlikely to be discernible from fluvial and/or surface water flooding and with the mitigation measures in place, the risk is considered to be reduced to 'low';
- The risk of sewer flooding is considered to be 'very low'; and
- The risk of flooding from artificial sources is considered to be 'high'. The existing flood defences, low likelihood of reservoir failure, and mitigation measures that the cable will be buried during operation, the risk from this source is considered to be reduced to low.

9.3 Flood Risk – From Development

Fluvial

9.3.1 The following potential sources of flooding 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.

9.3.2 The following potential sources of flooding which could come from the Grid Connection Corridor 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

9.3.3 An Outline Drainage Strategy has been developed alongside the FRA outlining how surface water will be managed in order to prevent increase in flood risk from this source. This provides 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 (**ES Volume 3, Appendix 9-C: Outline Drainage Strategy [EN010131/APP/3.3]**).

9.4 Sequential and Exception Test

9.4.1 Section 8 provides the rational and justification around the Sequential and Exception Test. The Scheme has been considered in two separate elements,

the Solar and Energy Storage Park and the Grid Connection Corridor. These are both classed as 'Essential Infrastructure' under the NPPF.

9.4.2 The Solar and Energy Storage Park infrastructure is predominantly located within Flood Zone 1 (for fluvial and tidal sources) and is considered to be predominantly at low risk from other sources of flooding (surface water, groundwater, sewer and artificial). This element of the Scheme is therefore considered to pass the Sequential Test and application of the Exception Test is not required. In addition, the FRA demonstrates that reasonable steps have been taken to sequentially located infrastructure within the Solar and Energy Storage Park to areas of lower risk from all sources of flooding.

9.4.3 The Grid Connection Corridor is predominantly location within Flood Zone 3 (for fluvial and tidal sources). A series of Grid Connection Corridors have been considered, however, these were also located in Flood Zone 3 and the 'least worst' corridor has been adopted taking account of other wider environmental and sustainability constraints. As there is not alternative at lower risk for connection to the national grid, the Exception Test has been applied. Section 8 has provided evidence to demonstrate that the overall benefits of the Scheme associated with the Grid Connection Corridor outweigh flood risk and that appropriate mitigation has been considered to ensure that the development remains operational during times of flooding. It is therefore considered that this element of the scheme passes the Exception Test.

10. References

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