



High Grove Solar

**Preliminary Environmental
Information Report**

**Appendix 14.1 Preliminary
Flood Risk Assessment**

April 2025

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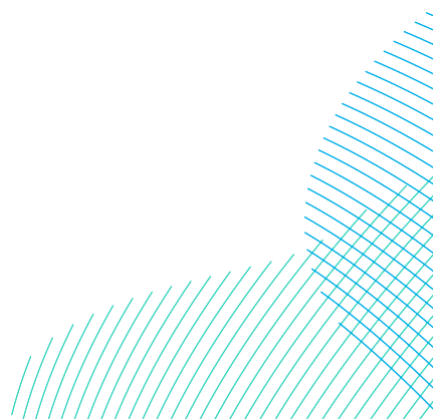
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1 Introduction and scope

- 1.1.1.1 RWE Renewables UK Solar and Storage Ltd (the Applicant), has carried out a Level 1 Flood Risk Assessment (Preliminary FRA) for a proposed solar farm with co-located energy storage (the Proposed Development) located in Norfolk, between Swaffham and Dereham.
- 1.1.1.2 The Proposed Development is a Nationally Significant Infrastructure Project (NSIP) and will be consented under a Development Consent Order (DCO). The Proposed Development requires a site-specific FRA as the site boundary covers more than one hectare in size, in accordance with National Policy Statement (NPS) EN-1 [1], paragraph 5.8.13.
- 1.1.1.3 This report presents the results of the Level 1 FRA. It introduces the Proposed Development, provides information to support the demonstration of the Sequential Test (and the Exception Test, if required), outlines an assessment of the risk of flooding from all sources using available information, and begins to identify recommendations for mitigation and, if required, further detailed flood risk assessment. Where detailed calculations or modelling are recommended, the FRA sets out a suitable approach to this to be agreed with the Environment Agency (EA) and then subsequently undertaken and documented in a future revision to the FRA to be submitted with the DCO application. An approach has been agreed in principle through engagement with the EA, and is presented in Section 6.

2 Planning Policy Context

- 2.1.1.1 NPS's relevant to the Proposed Development are published by the Department for Energy Security and Net Zero, which set out the requirements for assessing and approving Solar NSIP's including:
- **Overarching NPS for Energy (EN-1)**, January 2024 [1], in particular section 5.8.
 - **NPS for Renewable Energy Infrastructure (EN-3)**, January 2024 [2], particularly paragraph 2.4.11 and section 2.10.
- 2.1.1.2 With regard to the assessment of flood risk, the NPS also refer to the primary national planning documents for guidance, as follows:
- **The National Planning Policy Framework (NPPF)** [3], published in December 2024. This Framework sets out the government's planning policies for England and outlines how these are expected to be applied. The NPPF states that the main considerations for any development should be to minimise vulnerability to flooding and apply a sequential, risk-based approach to the location of development, accounting for current and future climate change impacts.
 - **National Planning Practice Guidance (PPG)**: PPG on flood risk and coastal change [4], published August 2022, advises on how to take account of and address the risks associated with flooding and coastal change, stating that the aim is to steer new developments towards areas of lower flood risk. The associated PPG on flood risk assessments: applying for planning permission [5] (August 2024), and on climate change allowances [6] are also provided by the EA.

3 Available information

3.1.1.1 Key sources of information that have been used in the production of this FRA include:

- Environment Agency Flood map for planning map [7]
- Environment Agency Risk of flooding from surface water map
- Environment Agency Susceptibility to groundwater flooding map
- Environment Agency Risk from Reservoirs
- Environment Agency Open Government License Light Detection and Ranging (LiDAR) Composite DTM 1m
- Environment Agency Product 5, 6 and 7 (flood modelling and hydrology reports, model outputs, model inputs):
 - Lower and Upper Nar, JBA 2015
 - Middle and Upper Wissey, JBA 2015
 - Sapiston Stream, River Thet and River Little Ouse, JBA 2015
 - Upper Wensum and Tud, CH2M 2016
- Environment Agency Anglian River Basin Management Plan (RBMP), 2022 [8]
- Environment Agency Broadland Rivers Catchment Flood Management Plan (CFMP), 2009 [9]
- Environment Agency Great Ouse Catchment Flood Management Plan (CFMP), 2009 [10]
- Norfolk County Council Preliminary Flood Risk Assessment (PFRA), 2011 [11]
- Norfolk County Council Local Flood Risk Management Strategy (LFRMS), 2015 [12]
- Norfolk County Council Local Flood Risk Management Strategy Policy Review, 2021 [13]
- Breckland District Council Level 1 Strategic Flood Risk Assessment (SFRA), 2017 [14]

4 Development site

4.1 Site description

- 4.1.1.1 The draft Order Limits of the Proposed Development are in the county of Norfolk (as shown on Figure 2.1 of the PEIR). It is situated between the towns of Narborough and Dereham. The furthest western extent of the draft Order Limits is located at NGR TF750085, and the furthest eastern extent is located at NGR TF973102. The study area is defined as the area 1km outside the draft Order Limits.
- 4.1.1.2 The current land use, outside of the small towns and villages, is predominantly arable farmland, with some highways passing through the draft Order Limits, including the A1122 and the A470.
- 4.1.1.3 The topography is gently undulating Breckland landscape. Much of the draft Order Limits lie on a ridge of slightly higher ground between the Nar valley to the north, Wissey valley to the south, and Wensum valley to the east. Topographic highs of 80-90 metres above Ordnance datum (mAOD) are found towards the east of the draft Order Limits and lows of 10-20mAOD at the west. Steeper sloping topography is located approximately 5km north of the 1 km study area, predominantly in the valley of the River Nar. Localised smaller valley shapes are present associated with smaller tributary watercourses of the surrounding rivers.
- 4.1.1.4 The Proposed Development is predominantly underlain by chalk bedrock from the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation and Culver Chalk Formation. Superficial deposits across the Proposed Development include Lowestoft Formation, with alluvium (clay, silt, sand and gravel) following river corridors, as well as Lowestoft Formation sands and gravels, Lowestoft Formation clay and silt, River Terrace Deposits (sand and gravel).
- 4.1.1.5 Freely draining Breckland sandy soils are generally found towards the western and central areas of the draft Order Limits. Further east, the soils tend towards loamy and clayey soils with more impeded drainage, and wet peaty soils over the alluvium in the bottoms of the valleys of the Wissey and Wendling Beck.
- 4.1.1.6 The Lead Local Flood Authority (LLFA) is Norfolk County Council. Two Internal Drainage Boards are also present within the 1 km study area. The East of Ouse, Polver and Nar IDB covers parts of the western area of the draft Order Limits, and the Norfolk Rivers IDB is in the eastern area of the draft Order Limits.
- 4.1.1.7 Given the extent and position of the draft Order Limits, there are numerous watercourses within the 1 km study area. Some of these have their catchment areas within the draft Order Limits, while the others flow directly through parts of the draft Order Limits. The watercourses are summarised in Table 1, and shown on Figure 14.4 of the PEIR. Those that are designated as 'main river' by the Environment Agency are also indicated.

- 4.1.1.8 The 'main rivers' in the study area are Wendling Beck and the Wissey. There are four Water Framework Directive (WFD) watercourses flowing into the 1 km study area. These are the 'Wissey-Upper', 'Watton Brook', 'Wendling Beck' and the 'Tud'. There are a further six watercourses with catchments that also intersect with the draft Order Limits, as described in Table 1 .

Table 1 ***Watercourses in the study area***

River System	Main Rivers	Tributaries/WFD water bodies
River Great Ouse	Wissey	Wissey-Upper Watton Brook Gadder Old Carr Stream Stringsides Stream
	Nar	Nar Upstream of Abbey Farm
Yare	Wendling Beck	Wendling Beck Tud Blackwater Yare (upstream of confluence with Tiffey-Upper)

5 Proposed Development

5.1 Details of Proposed Development

- 5.1.1.1 A full description of the Proposed Development and a detailed description of the design and environmental mitigation is provided in PEIR Chapter 2 The Proposed Development.
- 5.1.1.2 The Proposed Development is a renewable energy scheme, comprising five distinct Panel Areas covering an area of approximately 1,700 hectares (ha), including solar photovoltaic (PV) panels, on-site Battery Energy Storage Systems (BESS), underground cabling and associated infrastructure including substations and environmental mitigation and enhancement areas. The Proposed Development will also include underground Cable Corridors, which are still being refined, connecting the Panel Areas to one another and to the point of connection. The Proposed Development will have the capacity to generate over 50 Megawatts (MW) of alternating current (AC) electricity. The Proposed Development is located between Narborough and Dereham in the county of Norfolk in the East of England.
- 5.1.1.3 Each of the five main Panel Areas (Central, Northern, Eastern, Western and Southern) contain a collection of photovoltaic (PV) panels mounted on frames. They will be either fixed or tracking design and at a minimum the lowest part of a PV panel will be 0.4m above the ground surface. Panels and their frames are considered to be able to tolerate flood levels that remain below that minimum panel surface level, subject to tolerable debris and impact loading of any panels within areas subject to overland flood flows.
- 5.1.1.4 The Proposed Development will have seven onsite 132kV substations within the draft Order Limits. Each 132kV substation will have a 4000m² area of hardstanding with drainage provided so it is not fully impermeable. The Central, Eastern and Southern Panel Areas will each have two 132kV substations, the Western Panel Area will have one 132kV substation, and the Northern Panel Area will not have any substations. Substations cannot tolerate any flooding and therefore will be located in areas at lowest risk of flooding.
- 5.1.1.5 Panel Areas will be connected to each other and the substations via underground cables with voltages ranging between 33kV – 132kV. These cables will be either placed in existing roads or through an off-road option, and will be appropriately cased to prevent water ingress. These could involve cable ploughing or digging an open cut trench. However Horizontal Direct Drilling (HDD) techniques would be used for any cable routes beneath Main Rivers (high value watercourses). Cable Corridors are included in the draft Order Limits.
- 5.1.1.6 A range of supporting infrastructure comprising of BESS, transformers and invertors and storage containers will also be required. There could be some stand-alone invertors and BESS units spread across the site. However, the majority would be arranged together as a hybrid pack with a footprint of 13 x 22m. The foundations of all units consist of a 0.3m concrete slab with gravel on-top. Multiple

hybrid packs will be located in each Panel Area. It is assumed that all such supporting infrastructure will be located in areas of lowest risk of flooding.

- 5.1.1.7 Security measures such as fencing, CCTV and lighting will also be located across the Proposed Development. Access tracks will also be required for post-construction maintenance. These would utilise points of access of the existing highway network and be permeable to allow water to infiltrate and maintain greenfield runoff rates. Access tracks are assumed to be able to tolerate temporary flooding, however this is subject to the requirement that a suitable safe exit route remains for any staff on site. New crossings of watercourses should be avoided insofar as reasonably practicable, Where new crossings are needed, these will be clear span bridges for main rivers. For minor ordinary watercourses crossings are likely to be culverts and would be designed to reduce any significant impacts on flow, sediment and biological continuity. with a preference to reuse existing crossing points and structures wherever possible. Appropriate crossing methods will be confirmed for the ES following reconnaissance surveys to confirm the receptor value of the watercourse and likely impact which may include clear span bridges or HDD.
- 5.1.1.8 During the operational phase, there will be a limited number of employees on site undertaking solar PV maintenance. Additional cleaning and landscaping will occur occasionally.
- 5.1.1.9 The Proposed Development has an approximate construction completion year of 2031 based on 30 months required for construction. The design life of the Proposed Development is 40 years, and decommissioning is expected to take 12 to 24 months and may be undertaken in stages. Therefore, the development will be assumed, on a precautionary basis, to be reaching its end of life not before 2070. The 132kV substations will either be decommissioned or handed over to the Distribution Network Operator in perpetuity. This FRA will assume the worst case that these substations are not decommissioned.
- 5.1.1.10 Current indicative Proposed Development layout is shown in Figures 2.2 to 2.6 of the PEIR.

5.2 Development type and vulnerability classification

- 5.2.1.1 The NPPF classifies all types of development in accordance with their vulnerability to flood risk, to steer vulnerable developments into areas of lowest flood risk. The Proposed Development involves the construction of a solar farm for the purpose of energy generation and distribution, which is listed under NPPF as 'Essential infrastructure'.
- 5.2.1.2 Note that the flood receptor vulnerability classification under NPPF does not imply the degree of susceptibility to damage or disruption during flood events.
- 5.2.1.3 As previously outlined this FRA assumes a design life of 40 years which including construction and decommissioning results in a lifetime beyond 2070. Given the

status of the Proposed Development as an NSIP, the consideration of later climate epochs up to the 2080's epoch (2070-2125) is required. This means the longer lifetimes of the substations beyond scheme decommissioning will also be accounted for.

5.3 Flood Zone

- 5.3.1.1 The majority of the Proposed Development is within Flood Zone 1 (low risk of flooding), based on the Flood map for planning, as shown in Figure 14.12 of the PEIR. However, some parts of the draft Order Limits, including proposed Panel Areas, are within areas of Flood Zone 3a (high risk), including:
- parts of the Central and Southern Panel Areas are within Flood Zone 2 and 3a of the Wissey watercourse and its tributaries.
 - parts of the Northern and Eastern Panel Areas are within Flood Zone 2 and 3a of the Wendling Beck and its tributaries.
- 5.3.1.2 Breckland Council [14] have differentiated between Flood Zone 3a and 3b for the draft Order Limits. No areas of Flood Zone 3b (functional floodplain) fall within the draft Order Limits.
- 5.3.1.3 In most cases, the Flood Zones are relatively limited in extent around the watercourses in question. However, not all of the smaller watercourses are included in the Flood map for planning, and there may also be areas of high flood risk from such watercourses reflected in the surface water flood mapping as a proxy.

5.4 The Sequential test and the Exception Tests

- 5.4.1.1 Paragraph 5.8.9 of NPS-EN1 and paragraph 172 of the NPPF require that the Sequential Test is conducted to steer new development to areas with the lowest risk of flooding.
- 5.4.1.2 Where new energy infrastructure is, exceptionally, necessary in the flood risk areas, the Sequential Test will need to demonstrate there were no reasonably available sites in areas of lower risk. The majority of the Proposed Development is situated in Flood Zone 1. However, there are minimal areas of the draft Order Limits that lie within Flood Zone 2 or 3, which therefore requires the need to undergo the Sequential Test and, where relevant, the Exception Test.
- 5.4.1.3 It will also need to be demonstrated, as part of the FRA, that the development will be safe for its lifetime without increasing flood risk elsewhere, and, where possible, reducing flood risk overall.
- 5.4.1.4 In accordance with the PPG for flood risk and coastal change, table 2, 'Essential infrastructure' is considered compatible in Flood Zone 1 and 2. The parts of the

Proposed Development occurring only in these Flood Zones are likely to be able to satisfy the requirements of the Sequential Test.

- 5.4.1.5 Based on the current design, some parts of the Proposed Development are proposed in relatively localised areas of Flood Zone 3a. Here, 'Essential infrastructure' may be considered compatible on demonstration of the Exception test (Inset 1). This test requires alternative sites to be investigated with lower flood risk areas. It would only be appropriate to move onto the Exception Test when the Sequential Test has identified no other reasonably available, lower risk sites.

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

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Inset 1 Flood risk vulnerability and flood zone 'incompatibility' (from PPG)

- 5.4.1.6 The Applicant has carefully considered a series of alternative locations for the Proposed Development. A detailed account of this process has been provided in PEIR Chapter 3 Alternatives and Design Iteration. Flood risk was one of the key considerations in site selection, and the consideration of alternative sites, and the Applicant has worked to identify land through voluntary agreement with landowners in areas of lower risk of flooding wherever possible.
- 5.4.1.7 An alternative sites assessment, which includes the consideration of land parcels in terms of their susceptibility to flooding (from surface water and sources of flooding other than rivers or sea), will be submitted with the DCO application. It will provide evidence to demonstrate that the Sequential Test and Exception Tests requirements, as outlined above, have been met.

6 Consultation

6.1 Scoping opinion

6.1.1.1 The baseline understanding of flood risk, from flood mapping, was summarised in the EIA Scoping Report submitted to the Planning Inspectorate on 6 September 2024. The Planning Inspectorate published a Scoping Opinion on 17 October 2024 which included responses from stakeholders on flood risk and assessment requirements. The stakeholders who returned comments were the Environment Agency, Anglian Water and the Planning Inspectorate. A summary of the key points is collated below.

Environment Agency

- Some areas of the draft Order Limits are within Flood Zones 2 and 3 as allowed via the exception test. These areas should not result in a net loss of floodplain storage, impeded water flows or increase flood risk elsewhere. The sequential test should also be applied.
- The Proposed Development should ensure there is no net loss of floodplain storage and flood plain compensation should be considered. The Proposed Development must ensure there is no increase in flood risk to third parties and should not result in impeded water flows.
- The higher central (design case) and upper end estimates (sensitivity test) should be used to assess climate change impacts. Given the design life of the Proposed Development is 40 years, the 2080's epoch should be used to assess climate change impacts.
- The appropriate fluvial freeboard allowance on top of the design event and climate allowance will need to be chosen to reflect the uncertainty in the modelling data. Typically for other solar projects, the Environment Agency have asked for a 300mm allowance, but it could be higher (e.g. more than 600mm).
- When using the flooding from surface water mapping for fluvial flood risk it is important to ensure it is a suitable proxy for flood risk including effects of climate change.
- Many watercourses within the draft Order Limits have small catchment areas and were not used to inform Flood Zones. Therefore, Flood Zones cannot be used implicitly to rule out flood risk.

Planning Inspectorate

- The differences between Flood Zones 3a and 3b should be distinguished within the FRA.

Anglian Water

- The FRA should consider the impact of any increase in surface water or groundwater flooding as a result of the Proposed Development in exacerbating sewer flooding.

6.2 Stakeholder engagement

- 6.2.1.1 Engagement was undertaken with Norfolk County Council (the LLFA) on 28 February 2025 to discuss the Scoping Opinion Response, and approach to the FRA and Drainage Strategy. The responses to comments from the LLFA will be considered for the ES.
- 6.2.1.2 A number of meetings were held with the Environment Agency to discuss the Applicant's proposed response to the Scoping Opinion, and approach to the FRA and Drainage Strategy. On 6 March 2025 it was agreed that a proportionate assessment could be undertaken at ES using the available modelling or new NaFRA2 data to inform the FRA without undertaking detailed modelling. This Preliminary FRA has been drafted on the basis of the discussion with the Environment Agency, and the proposed approach is set out in in Sections 8 and 9 of this report.
- 6.2.1.3 A full list of engagement is included in Chapter 14 Water Resources and Flood Risk.

7 Site specific flood hazards

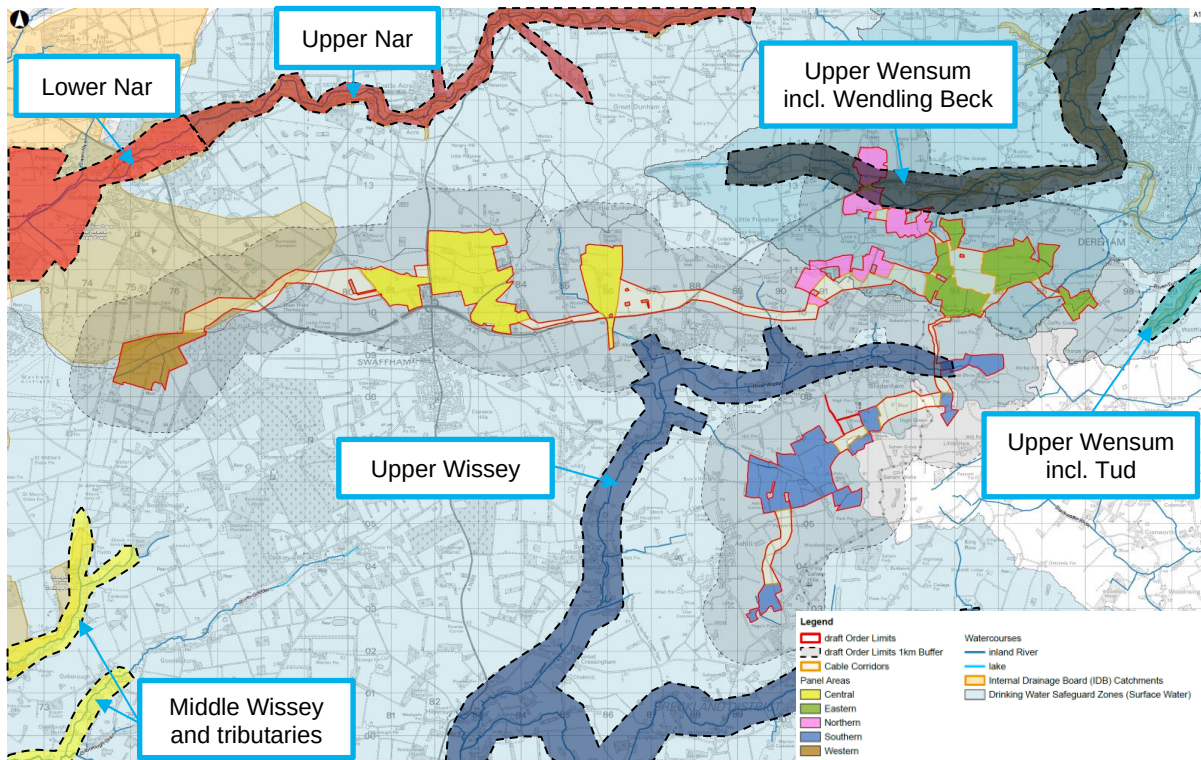
7.1 Fluvial flood risk

- 7.1.1.1 Based on the Flood Map for planning, the draft Order Limits of the Proposed Development include areas within Flood Zone 2 and Flood Zone 3, as shown in Figure 14.12 of the PEIR, which indicates a medium and a high risk of flooding from rivers, respectively. The sources of fluvial flood risk and the parts of the Proposed Development they relate to are:
- Wendling Beck and a tributary of Wendling Beck – flows through part of the Northern Panel Area and surrounding draft Order Limits from west to east, and through part of the Eastern Panel Area toward Dereham
 - Upper Wissey and tributaries – while the majority of the draft Order Limits avoid the valley bottom and floodplain of the River Wissey itself, numerous smaller tributaries are mapped as flowing from within or flowing through the Proposed Development towards the Wissey, in the Central and Southern Panel Areas and surrounding draft Order Limits.
 - None of the locations of hybrid BESS units or substations are identified by the Flood Map for Planning to be at a high flood risk.
- 7.1.1.2 The Flood map for planning does not consider the effect of any flood defences, nor does it account for future climate change.
- 7.1.1.3 The Historic flood map [15] shows no records of flooding within the draft Order Limits from the fluvial sources listed above, as of August 2024. The absence of records in the Historic flood map does not imply there is no risk of flooding, and may be expected given the area is sparsely populated.
- 7.1.1.4 According to the Environment Agency [16] within the draft Order Limits only Wendling Beck, located in the Northern Panel Area, has existing flood defence assets. As a designated main river downstream of Great Fransham, the Environment Agency has responsibility for maintenance of the river channel and natural high ground on the riverbanks. On this watercourse there is also a privately maintained weir at Abbey Farm which is within 1km of the draft Order Limits. River Wissey downstream of Bradenham is also designated as main river, while its numerous tributaries are ordinary watercourses, and there are no flood defence assets listed in this area.
- 7.1.1.5 In consultation with the Environment Agency details of existing hydraulic models in the area were obtained (Product 5 model reports). The models available for the surrounding catchments and downstream sections of watercourses located within the draft Order Limits include the Upper Wensum, Lower and Upper Nar, Middle and Upper Wissey, as well as Eastern Rivers (Thet, Little Ouse) further south. Model output data (Product 6) and model input files (Product 7) for the six models have also been received.

- 7.1.1.6 Only the Upper Wissey and Upper Wensum models interact with the draft Order Limits with only the uppermost reaches of these models reaching the study area (see Table 2). Furthermore, the full upstream extents of the tributary watercourses mapped on the draft Order Limits are not fully represented in the modelling, which focuses primarily on the main channels (see Table 2). Therefore, existing EA models contain a current lack of detail about the realistic current and future flood levels and flood extents associated with the watercourses (particularly the smaller ones) within the draft Order Limits.

Table 2 ***Existing Hydraulic Model Spatial Extents***

Model	Model details	Watercourses within the draft Order Limits included
Lower River Nar	1D-2D ISIS-Tuflow; JBA 2015	Nar Upstream of Abbey Farm
Upper River Nar	2D Tuflow + ESTRY structures; JBA 2015	Nar Upstream of Abbey Farm
Upper Wensum	Two separate models Wendling Beck: 1D ISIS, CH2M 2016 Tud: 1D ISIS, CH2M 2016	Wendling Beck Tud
Middle Wissey	1D-2D ISIS-Tuflow; JBA 2015	Wissey: Old Carr Stream and Gadder Tributaries
Upper Wissey	2D Tuflow + ESTRY structures; JBA 2015	Wissey: Wissey – Upper; Watton Brook
Eastern Rivers (Thet, Little Ouse)	Not within study area	



Inset 2 Existing Hydraulic Model Extents (illustrative outlines)

7.2 Surface water flood risk

- 7.2.1.1 The risk of flooding from surface water, as shown in Figure 14.11 of the PEIR, represents overland flow routes and ponding in depressions in the landscape. It consequently also picks up some of the same flood risk areas as depicted in the fluvial flood mapping. Several smaller upstream tributaries of Wendling Beck and the River Wissey (including upstream reaches of named tributaries the Gadder and Watton Brook) are not explicitly shown in the fluvial flood maps. For these watercourses the surface water flood maps can be used as a proxy (noting that they do not represent the effects of future climate change). Areas adjacent to these smaller tributaries have a flood risk of a 3.33% Annual Exceedance Probability (AEP) surface water event and are found in all Panel Areas except the Western Panel Area (which exhibits no surface flood risk).
- 7.2.1.2 Outside the main channels surface water flood risk is generally low. However, within 1km of the draft Order Limits there are some surface flooding risk zones which appear to be dispersed plots of low-lying ground relative to their surroundings, but no instances of these are observed within the draft Order Limits.
- 7.2.1.3 Some BESS/transformers are located in areas of low to medium surface water flood risk. In the Central and Southern Panel Areas there are 132kV substations located in areas of low to medium surface water flood risk (1 in 100 to 1 in 1,000 year events). In the Eastern Panel Area, there is one 132kV substation located in an area of high surface water flood risk (1 in 30 year event).

- 7.2.1.4 Opportunities to move this infrastructure out of area of flood risk will continue to be explored as the design develops and further data is released by the Environment Agency in 2025. If the 132kV substation in the Eastern Panel Area cannot be moved from a high flood risk area, as the design of the Proposed Development progresses further hydraulic analysis or modelling may be required to define the local flood risk in more detail in these areas in order to develop appropriate mitigation.

7.3 Groundwater flood risk

- 7.3.1.1 The majority of the study area has a limited susceptibility to groundwater flooding as shown in Figure 14.14 of the PEIR. Generally, areas with high susceptibility occur in the valley bottoms of the River Wissey and the Wendling Beck. The Northern Panel Area and surrounding draft Order Limits are located within the Wendling Beck valley, and there is potential for groundwater flooding to occur at the surface in this area.
- 7.3.1.2 The Proposed Development may include sub-surface features such as buried cables. Localised groundwater flood risk will be considered for impacts, both to the operation of the Proposed Development, and also to surrounding receptors arising from impacts on groundwater flow pathways. The Proposed Development would look to mitigate potential groundwater impacts on flowpaths, and subsequently flooding, through embedded design measures.

7.4 Artificial water bodies

- 7.4.1.1 Reservoir flood maps by the Environment Agency indicate areas at risk of flooding in the extremely unlikely event that a reservoir should fail, as shown in Figure 14.13 of the PEIR. They describe both a ‘dry day’ scenario, showing the extent of flooding in the event of a reservoir failure alone, and a ‘wet day’ scenario, showing the extent of reservoir flooding at the same time as rivers experiencing an extreme flood.
- 7.4.1.2 Although there are several small reservoirs near the draft Order Limits, all but one are downstream of areas within the draft Order Limits and therefore pose negligible risk. Hangour Hill (grid reference TF 75589 08230) is a raised reservoir on the boundary on the Western Panel Area. In the event of the reservoir failing, water would flow south away from the Proposed Development, including through a small southern portion of the Western Panel Area, even when other river levels are normal. No further details are known about this reservoir at this stage, but information including its condition, owner, maintenance regime, and whether it is classed as a large raised reservoir will be sought and assessed in the ES. As such, its risk rating cannot be ascertained at this stage.

7.5 Additional sources

- 7.5.1.1 Flood risk may come from additional sources such as Anglian Water infrastructure (for example sewer flooding). Anglian Water infrastructure is considered within the Preliminary Drainage Strategy (Appendix 14.2) The generation of additional foul water discharges will be collected in sealed storage tanks and regularly emptied and disposed of in accordance with regulatory requirements.

7.6 Summary

Table 3 *Summary of flood risk in draft Order Limits*

Source	Flood risk in draft Order Limits
Fluvial	Western – negligible Central – generally negligible (see surface water risk), apart from close proximity of Flood Zone 3 from small tributary of the Wissey flowing through part of this Panel Area from Sporle towards the A47 Northern – high risk to parts of the Panel Areas located in Flood Zone 2 and 3 of Wendling Beck (main river) Eastern – negligible (see surface water risk) Southern – high risk to parts of the Panel Areas and Cable Corridor located in Flood Zone 2 and 3 of River Wissey (main river)
Surface water	Western – negligible surface water risk within the Panel Area, some localised risk from overland pathways in Cable Corridor Central – some localised high risk from overland flow pathways associated with smaller watercourses flowing through Panel Area or Cable Corridors, including a tributary of the River Nar flowing towards South Acre, overland flowpaths

Source	Flood risk in draft Order Limits
	towards Swaffham and the River Gadder, multiple tributaries or overland flowpaths towards the River Wissey, and isolated locations of surface water ponding near the A47 Northern – localised high risk from overland pathway to parts of the Panel Area and Cable Corridors associated primarily with Wendling Beck as its various smaller tributaries, but also with a tributary of the River Wissey at West End Eastern – localised high risk from overland pathway to parts of the Panel Area and Cable Corridors, including tributaries of the Wendling Beck (including one which is main river flowing into Dereham Stream), but also with a tributary of the River Wissey Southern – localised high risk from overland pathway to parts of the Panel Area and Cable Corridors associated primarily with River Wissey and its various smaller tributaries (including one which is main river towards North Pickenham), one flowpath associated with a tributary of Blackwater River at Little Hale, and flowpaths associated with tributaries of Watton Brook (some of which are classified as main river)
Groundwater	Northern – potential for groundwater flooding at the surface in the valley bottom around Wendling Beck affecting this Panel Area Other areas – generally low potential, except very localised areas around small tributary valleys
Artificial water bodies	Western – localised flood risk to part of the Panel Area associated with a reservoir near Hangour Hill Other areas – negligible
Additional sources	An information request on drainage incident records will be requested from Anglian Water. A utilities search is being undertaken and risks will be confirmed in the ES

8 Climate change

- 8.1.1.1 There are two generic approaches to designing for climate change; the precautionary approach, which involves incorporating mitigation measures for potential climate change impacts now; and the managed adaptive approach which involves making provision for mitigation measures to be undertaken at a future date when there will also be greater certainty regarding the likely impacts of climate change on parameters such as river flow and rainfall.
- 8.1.1.2 The NPS EN-1 requires NSIPs to assess the impacts on and to the Proposed Development across a range of climate scenarios. The PPG for flood risk assessment and climate change sets out the use of climate change allowances during planning processes to minimise vulnerability and provide resilience to the development and its users over the whole design life of the development. These allowances are derived from the Environment Agency and are considered on a management catchment scale across England [17]. Relevant climate change allowance data should be considered by designers in assessing the most sustainable means of addressing potential climate change impacts with regards to peak river flows and peak rainfall intensity respectively [18]. The NPS EN-1 also requires sensitivity tests of the Proposed Development to credible maximum climate change scenarios.
- 8.1.1.3 As previously highlighted the Proposed Development is assumed to reach the end of its lifetime and decommissioning not before 2070. Therefore, the Proposed Development will be assessed against the 2080s climate epoch (2070-2125), as identified in consultation with the Environment Agency (Section 6). This also allows for a longer timeframe of assessment to cover the proposal for the substations to continue operation after the decommissioning of the rest of the solar farm once ownership has transferred to National Grid or Distribution Network Operator.
- 8.1.1.4 The Proposed Development is located across several different management catchments. Most of the area drains towards the Wissey in the Cam and Ely Ouse management catchment (Table 4). An area of the Proposed Development in the north east drains into the Wendling Beck, which is part of the Broadland Rivers and North West Norfolk management catchment (Table 5). Some of the land near Swaffham drains northwards into the River Nar, which is in the North West Norfolk management catchment (Table 6).
- 8.1.1.5 Each of these catchments has a very slightly different peak river flow allowance. The appropriate allowance will need to be used to predict future flood risk in different parts of the draft Order Limits, but where such data may be limited then on a precautionary basis the highest of the values should be chosen for consistency of assessment across the entire Proposed Development.
- 8.1.1.6 Climate allowances are predictions of anticipated change for peak river flow, peak rainfall intensity, sea level rise and offshore wind speed and extreme wave height.

The range of allowances is based on percentiles. A percentile describes the proportion of possible scenarios that fall below an allowance level. The 50th percentile is the point at which half of the possible scenarios for peak flow fall below it, and half fall above it. An allowance based on the 50th percentile is exceeded by 50% of the projections in the range. At the 70th percentile it is exceeded by 30%. At the 95th percentile it is exceeded by 5%. The **central** allowance is based on the 50th percentile, **higher central** allowance is based on the 70th percentile, and the **upper end** allowance is based on the 95th percentile.

- 8.1.1.7 For 'Essential Infrastructure' development located within Flood Zone 3 the PPG requires the **higher central** allowance values for peak river flow be used for climate change assessment, with the **upper end** used to represent a credible maximum scenario sensitivity test. The values for the three relevant management catchments are summarised and highlighted in Table 4, Table 5, and Table 6.

Table 4 *Peak river flow allowances for the Cam and Ely Ouse Management Catchment (Accessed: 08/10/2024)*

Total Potential Change	Central Estimate	Higher Central Estimate	Upper End Estimate
Total potential change anticipated for the '2020s'	2%	7%	21%
Total potential change anticipated for the '2050s'	-2%	5%	22%
Total potential change anticipated for the '2080s'	9%	19%	45%

Table 5 *Peak river flow allowances for the Broadland Rivers Management Catchment (Accessed 08/10/2024)*

Total Potential Change	Central Estimate	Higher Central Estimate	Upper End Estimate
Total potential change anticipated for the '2020s' (2015-2039)	8%	14%	27%
Total potential change anticipated for the '2050s' (2040-2069)	3%	10%	27%
Total potential change anticipated for the '2080s' (2070-2125)	11%	20%	44%

Table 6 *Peak river flow allowances for the North West Norfolk Management Catchment (Accessed 08/10/2024)*

Total Potential Change	Central Estimate	Higher Central Estimate	Upper End Estimate
Total potential change anticipated for the '2020s' (2015-2039)	2%	7%	21%
Total potential change anticipated for the '2050s' (2040-2069)	-2%	5%	22%
Total potential change anticipated for the '2080s' (2070-2125)	9%	19%	45%

8.1.1.8 For some of the areas of Proposed Development, the contributing drainage areas within draft Order Limits are smaller than 5km² due to being located near the headwaters of the Nar, Wissey and Wendling Beck catchments. Many of the associated watercourses, including some that are main rivers, as well as other minor tributary watercourses and overland flow paths, are not represented in any of the existing hydraulic models with accuracy. Where new modelling may be required, particularly for any direct rainfall modelling, it may be appropriate to apply peak rainfall intensity allowances instead. The approach will need to be discussed and agreed with the Environment Agency for later stages of assessment. Given the assumed lifetime of 2070, the relevant rainfall intensity allowance is for the 2070s (2061 – 2125) epoch, using the **central** allowance for both the 1% and 3.3% AEP events. These values for the three relevant management catchments are summarised in Table 7, Table 8 and Table 9.

Table 7 *Peak rainfall allowances for the Cam and Ely Ouse Management Catchment (Accessed: 11/10/2024)*

	Total Potential Change	Central Allowance	Upper End Allowance
3.3% AEP	Total potential change anticipated for the '2050s' (2022-2060)	10%	35%
	Total potential change anticipated for the '2070s' (2061-2125)	20%	35%
1% AEP	Total potential change anticipated for the '2050s' (2022-2060)	20%	40%
	Total potential change anticipated for the '2070s' (2061-2125)	25%	40%

Table 8 *Peak rainfall allowances for the Broadland Rivers Management Catchment (Accessed: 11/10/2024)*

	Total Potential Change	Central Allowance	Upper End Allowance
3.3% AEP	Total potential change anticipated for the '2050s' (2022-2060)	20%	40%
	Total potential change anticipated for the '2070s' (2061-2125)	20%	40%
1% AEP	Total potential change anticipated for the '2050s' (2022-2060)	20%	45%
	Total potential change anticipated for the '2070s' (2061-2125)	25%	40%

Table 9 **Peak rainfall allowances for the Broadland Rivers Management Catchment**
(Accessed: 11/10/2024)

	Total Potential Change	Central Allowance	Upper End Allowance
3.3% AEP	Total potential change anticipated for the '2050s' (2022-2060)	20%	35%
	Total potential change anticipated for the '2070s' (2061-2125)	20%	35%
1% AEP	Total potential change anticipated for the '2050s' (2022-2060)	20%	40%
	Total potential change anticipated for the '2070s' (2061-2125)	25%	40%

8.1.1.9 Whether river flow or rainfall is the most appropriate approach to use should be considered further in relation to any existing or new modelling that may be needed, and in consultation with the Environment Agency, and incorporated into the ES as required.

8.1.1.10 However, due to limited variation and for design ease, the maximum values across all catchments and Panel Areas are suggested to be used on a precautionary basis. These values are highlighted below:

- A potential 20% in river flow, with a sensitivity test of 45%.
- A potential 20% increase in peak rainfall intensity for a 3.3% AEP, and 25% increase for a 1% AEP.

8.1.1.11 Flood model data has been received from the Environment Agency. While some of these include relevant climate allowances in the available model data, many of the models do not include the various smaller watercourses, and therefore the hydrology and climate allowances will need to be carefully reviewed in the ES.

9 Flood risk management measures

- 9.1.1.1 Avoidance and mitigation measures will be taken to ensure, insofar as reasonably practicable, the Proposed Development is safe from flooding for its lifetime, and that flood risk to surrounding receptors is not increased. The design flood level will be the 1% (1 in 100) annual flood, plus an appropriate allowance for climate change, and an appropriate freeboard allowance for uncertainty.
- 9.1.1.2 During construction, operation and decommissioning of the Proposed Development, appropriate measures must be taken to ensure flood risk hazards are mitigated against. The following methods are ways in which this risk can be planned for and mitigated:
- Apply a sequential approach to site layout by avoiding placing infrastructure in areas of Flood Zone 2 or 3, insofar as reasonably practicable. Thereafter, design components placed in areas at risk of flooding now or in the future should be those which are not susceptible or are less susceptible to water damage that would disrupt operations if flooded. As the design continues to be refined, the sequential approach to site layout will remain under close consideration to avoid placing components in flood risk areas.
 - For the remaining design elements that need to be placed in flood risk areas following application of a sequential approach, they should be designed to be compatible with floodwater in a way that avoids the need for flood defences or ground raising insofar as is reasonably practicable. Adapting designs to raise up vulnerable components such as electricity systems above the design flood level is preferable to wholesale ground raising in Flood Zone 2 or 3, which could cause displacement of flood water and exacerbate impacts to nearby receptors.
 - It is recognised that solar PV modules in particular would be mounted on stands. The stands themselves are compatible with being flooded, provided velocities and debris impact loading are minimal. Where located in the Flood Zones, it would need to be demonstrated in the ES that the presence of the stands does not impact overland flow pathways, e.g. by being prone to blockage, and that floating debris impact loading is not an issue.
 - For solar PV modules located within flood risk areas, the panels will be mounted to ensure they are raised above the design flood (1% AEP plus an allowance for climate change) plus a freeboard allowance for uncertainty (at this stage assumed to be 300mm, subject to agreement with the Environment Agency). The next stage of assessment will require the design flood levels for the relevant design event to be identified, either from existing flood models, or a proportionate hydrological or hydraulic assessment, to ensure this mitigation would be sufficient, or if panels would need to be relocated or raised further.

- Other components such as the BESS are considered highly susceptible to flood damage. The Proposed Development currently includes some BESS, inverters and substation units in areas of medium and high flood risk associated with surface water and fluvial risk from small watercourses, and in some areas in which groundwater is susceptible to emerge at the surface. If these cannot be removed from flood risk areas through refinements to the site layout and design, it may necessitate raising the floor levels of these units above the design flood level, with an allowance for freeboard (at this stage assumed to be 300mm, subject to agreement with the Environment Agency). The Applicant is committed to reconsidering the current design and relocating electrical infrastructure away from the reservoir flood zone subject to any proposed changes not resulting in any materially different effects across environmental topic areas. Any revised layout will be assessed at ES stage.
- It is recommended that any relevant climate change uplifts assessed are accounted for in the design by positioning sensitive site components in relatively elevated areas or raising their elevation at a distance away from the various areas of flood risk. Other aspects that may need to account for this increased risk of flooding include the design of on-site landscaping, drainage systems, and any flood resilience measures, as well as the design of any required river crossings to ensure they do not constrict flood flows. Many of the increased risks due to the potential impacts of climate change can be managed by appropriate design.
- Any displacement of flood water in Flood Zone 3, where shown to be unavoidable following other design and embedded mitigation, will need to be compensated on a level for level, volume for volume basis to the satisfaction of the Environment Agency. This would normally require an allowance for climate change using the central allowance (or higher central allowance if essential infrastructure is located within the area). In addition to mitigating the displacement, impacts on overland flow pathways over the floodplain will also need to be considered and demonstrated to not result in any localised flood impacts. This also applies to bridges or other structures across the river, during the temporary construction phase or the permanent scheme design – these should follow a similar mitigation hierarchy.
- If any parts of the Proposed Development remain within areas at risk of flooding or if there are any resultant changes to local drainage mechanisms, then the incorporation of sustainable drainage systems should be considered in order to control flow rates and reduce volumes of runoff. Further details of the drainage are provided in the Preliminary Drainage Strategy (Appendix 14.2).
- New crossings of watercourses should be avoided insofar as reasonably practicable, with a preference to reuse existing crossing points and structures wherever possible. Appropriate crossing methods will be confirmed for the ES following reconnaissance surveys to confirm the receptor value of the watercourse and likely impact which may include clear span bridges or HDD. Any new structures will be sized to convey the design flood, with an allowance

for climate change. However, consideration should also be given to ensure that reducing any existing constrictions through the site would not inadvertently increase the flows downstream and cause flooding.

- Underground cabling should consider the risk of groundwater flooding and be appropriately waterproofed. Furthermore, the role of underground cabling in creating a barrier to groundwater flow pathways or preferential pathway, and therefore implications to local groundwater flood risk, should be further considered.
- For access tracks situated in Flood Zones, it must be demonstrated that a safe and suitable means of access and egress to the Proposed Development will remain available during a flood event.
- Liaison with environmental design and assessment specialists should be undertaken to consider opportunities to enhance watercourse crossings and river corridors for biodiversity, fish passage and flood risk.

9.1.1.3 To steer the sequential approach to site layout at PEIR, the FRA has used the 0.1% (1 in 1000) annual flood outlines from published flood mapping as an initial guide for the 1% (1 in 100) flood plus appropriate climate change allowance, for both river and surface water flood sources.

9.1.1.4 For the ES, it will be required to demonstrate that the final design of the Proposed Development will not impact on flood risk to nearby receptors, and that it would be safe from flooding for its design life, taking account of the effects of future climate change. Given that existing hydraulic models do not cover many of the smaller watercourses that are likely to interact with the Proposed Development, a proportionate assessment will be undertaken at ES instead of detailed hydraulic modelling of the whole area, in line with NPS EN-1 paragraph 5.8.15, and as discussed with the Environment Agency. A proportionate assessment may include reference to the NaFRA2 data expected to be published in Spring 2025 or localised hydraulic or hydrological assessments for any potentially at-risk areas remaining after the application of the mitigation measures above.

9.1.1.5 At this stage, it is not anticipated that there will be any significant residual flood risk after the risk reduction measures have been taken into account. However, the FRA at ES will identify any residual risks remaining, and set out how these will be safely managed to avoid exposing people to potentially hazardous flooding.

10 Conclusion

- 10.1.1.1 This preliminary FRA has reviewed the current sources of flood risk to the Proposed Development using data available at the time of the assessment. The preliminary assessment indicates that flood sources include from rivers, surface water, a reservoir, and groundwater.
- 10.1.1.2 Flood risk design requirements based on the latest National Planning Policy Guidance and relevant National Policy Statements for energy infrastructure have been used to set out an approach to site selection, site layout and site design. The design team will continue to consider these requirements as the design progresses.
- 10.1.1.3 Certain elements of the Proposed Development are considered sensitive to flooding, such as BESS and substations. No such elements have therefore been located within fluvial Flood Zone 2 or 3, based on the information available at the time of the assessment. As the design progresses, this will be further reviewed in light of any more detailed information, particularly taking account of future flood risk with the effect of climate change. Should sensitive elements be identified to occupy areas of high or medium flood risk (from any source), then the siting of sensitive elements, as part of the overall sequential approach to site layout, will be revised taking into account the latest available information where practicable. This also applies to flood design levels and temporary bridge or culvert sizes at watercourse crossings, to demonstrate that the Proposed Development is safe from flooding for its lifetime, and that it does not cause any increase in flood risk to nearby receptors. The Applicant is engaging with key stakeholders on the flood risk assessment.

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