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Interested party reference number FA3 AE8AE5

The Examining Authority,

The Planning Inspectorate

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15th September 2025

Subject: Requirement for Catastrophic Flood Risk Modelling regarding the One Earth Solar Farm Project Development Consent Order Application

Dear Sirs,

This letter serves as a formal introduction to the enclosed report, "The Catastrophic Flood Risk Modelling Imperative: A Justification Based on UK NSIP Framework." This document has been prepared to provide a comprehensive analysis of the hydrological and environmental implications of the proposed 3,500-acre solar farm on a sensitive floodplain, and to justify the requirement for a catastrophic flood risk model as a core component of the One Earth Solar Farm Project's Development Consent Order (DCO) application.

The Nationally Significant Infrastructure Projects (NSIP) regime is a front-loaded process that demands a high degree of certainty and evidence-based analysis prior to the Examination Phase. Given that the One Earth Solar Farm project, due to its scale, falls under this regime, there is a clear responsibility to demonstrate that it is resilient and will not increase flood risk elsewhere.

The enclosed report details how standard hydrological models are scientifically and legally insufficient for a project of this scale and complexity. It demonstrates how a catastrophic flood risk model is required to meet the stringent requirements of the National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG). This includes the need to assess all sources of flooding, account for climate change allowances over the project's entire lifetime, and provide definitive, verifiable data that the development will be safe and will not increase flood risk to the surrounding area.

Yours faithfully

Stephen fox

Requirement for Catastrophic Flood Risk Modelling regarding the One Earth Solar Farm Project Development Consent Order Application

Summary: From Recommendation to Requirement

This report confirms that the proposed 3,500-acre solar farm on a sensitive floodplain necessitates a catastrophic flood risk modelling framework. This is not just a recommendation, but a **non-negotiable requirement** for project feasibility and regulatory compliance within the UK's Nationally Significant Infrastructure Projects (NSIP) regime [1]. Standard hydrological models are both scientifically and legally inadequate because they fail to account for the complex and compounded risks of a project this size, such as the collective runoff from 1.5 million panels and the potential for new, channelized flows to develop over time [2, 3]. These models also lack the high-resolution, probabilistic data required by the National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG), which demand that a development does not increase flood risk elsewhere [4].

A catastrophic model, which simulates extreme events over thousands of years [5], provides a quantifiable view of risk. This advanced analysis is essential for proactive risk management, securing financing and insurance [6], and demonstrating the institutional legitimacy required to gain a Development Consent Order (DCO) [1]. The upfront cost of this modelling is a direct mitigation of the far greater financial, legal, and reputational costs associated with a miscalculated remediation, which can span years or even decades [7].

The Fundamental Flaw of Standard Hydrology Models

This section explains why conventional hydrological modelling is fundamentally inadequate for a project of this scale and complexity [8].

The Problem of Scale and Aggregation

While a small solar array may have minimal hydrologic impact, the effects do not scale linearly to a 3,500-acre site [9]. For example, applying a minimal 0.35% runoff increase from a 30-panel array to a site with 1.5 million panels would be a critical error [10]. The cumulative impact of this vast number of panels poses a significant risk. The aggregation of many small runoff issues can overwhelm drainage systems, leading to a major, systemic problem [11]. The core flaw of standard models is their inability to predict this **emergent, non-linear behaviour** [8]. This can lead to underestimating required mitigation and causing off-site flooding [12].

The "Disconnected Impervious Surface" Paradox

A solar farm's hydrology can paradoxically behave more like a natural landscape due to the "disconnected impervious surface" nature of solar arrays [13]. A more critical issue is that standard models fail to capture the **kinetic energy and channelization risk** at the drip lines [16]. The real risk is not the total runoff volume, but the concentration and speed of runoff in specific, unpredicted locations [17]. A standard model, which aggregates risk, will miss these localized points of failure, potentially leading to new drainage channels and accelerated erosion [18]. A catastrophic model is designed to address this spatial and kinetic variability, not just total volume [5].

Regulatory and Legal Rationale for Advanced Modelling

This section demonstrates that a catastrophic model is a **non-negotiable component of compliance** for large-scale UK floodplain development [23].

The NSIP Framework: A Different Burden of Proof

In the UK, a 3,500-acre solar project is a Nationally Significant Infrastructure Project (NSIP) [24] and requires a DCO from the Secretary of State, not local planning permission [1]. The DCO process is "front-loaded," with a heavy emphasis on comprehensive pre-application evidence [25]. A core mandate for NSIPs is to prove the development will not increase flood risk elsewhere [26], and a site-specific Flood Risk Assessment (FRA) must assess risk from "all sources" [27]. The NPPF is explicit: development in flood risk areas must be "made safe for its lifetime without increasing flood risk elsewhere" [4]. For a project of this magnitude, a standard FRA is insufficient [28]. The NSIP process shifts the burden of proof to the developer, who must provide an authoritative, data-rich analysis to prove no off-site damage will occur [29].

The Requirement for "Detailed Methods" and Climate Change Allowances

The PPG advises that a development must be "made safe from flooding" and not "increase flood risk elsewhere" [4]. This includes accounting for climate change with specific "allowances" for peak rainfall and river flow [31]. The guidance specifies that for developments with a lifetime beyond 2100, the "upper end allowance" for extreme climate change scenarios must be assessed [32]. A catastrophic model is the most robust tool for meeting these requirements [5]. It moves beyond single-event analysis to simulate millions of events over thousands of years, providing a probabilistic understanding of risk [5, 33]. This framework is necessary to fill the regulatory void for a project of this scale [34].

The Science of Catastrophe Modelling: Beyond the 100-Year Flood

This section defines what a catastrophic flood model is, distinguishing it from standard hydrological models [5].

Defining Catastrophe Models

A flood catastrophe model simulates "millions of stochastic, or random, events over a long period—in the case of Fathom's Global Flood Cat model, 10 million events over 10,000 years" [7]. The core value is its ability to move beyond a static "100-year flood" scenario to a **probabilistic risk assessment** [5]. It quantifies the probability of a specific flood magnitude and the associated financial loss [35]. This is the difference between a static hazard map and a dynamic, data-driven financial tool [36]. Catastrophe models provide metrics like **Exceedance Probability (EP) curves** and **Average Annual Loss (AAL)** [37], which are essential for communicating risk [6].

Core Components of the Model

A comprehensive analysis of risk is rooted in three core components:

- **Event Set:** Simulates the long-term, stochastic nature of flood events [38].
- **Hazard:** A "flood footprint" representing the flood depth for each grid cell [39]. It can capture all potential sources of flooding, including fluvial (river), pluvial (rainfall), and rising groundwater [40].
- **Exposure:** Quantifies damage based on the "spatial distribution of asset values and building heights" [41]. This links the physical hazard to a financial outcome [42].

These components provide a holistic view of risks and enable data-driven decisions on the design and placement of assets, such as electrical equipment, which are vulnerable to flood damage [43].

Catastrophic Modelling as a Strategic Due Diligence Tool

This section presents the compelling business case for investing in catastrophic modelling [44].

Compliance with TCFD and UK Financial Regulations

In the UK, financial regulations require large companies to make climate-related financial disclosures based on the Task Force on Climate-related Financial Disclosures (TCFD) framework [46]. Physical climate risks, such as flooding, are a key component [47]. Catastrophe models provide the specific, verifiable data required to meet these disclosure obligations [48], inform financial forecasting [49], and demonstrate proactive risk management [50].

Quantifying Financial Risk and Optimizing Capital Reserves

Catastrophe models transform an ambiguous environmental risk into a quantifiable financial one [51]. The models provide metrics like AAL and EP curves to help companies "select and differentiate risks" [52]. This is crucial for financial stakeholders, as it provides the data needed for "data-driven underwriting decisions" and to "optimize capital reserves" [53].

Avoiding a Catastrophic Correction

The "slow timeline for (mitigation) correction" is more dependent on "institutional, regulatory, and legal processes than on the speed of physical work" and can span years or decades [55]. The upfront cost of a catastrophic model is a small fraction of the potential multi-year, multi-million-pound cost of a catastrophic failure [56]. A flawed initial analysis can lead to a cascading series of failures: regulatory non-compliance, legal challenges, and significant financial losses [57]. A "fix" for a miscalculation is not a simple engineering repair; it is a full-scale, politically charged re-evaluation of the entire project [58]. The catastrophic model is an **insurance policy against institutional failure** [59], providing the data and transparency needed to secure stakeholder trust and navigate the NSIP consenting process without costly delays [60].

Conclusion and Actionable Recommendations

The analysis confirms that a catastrophic flood risk model is a **mandatory prerequisite** for any NSIP of this scale and location [1]. The scientific realities of a large-scale "disconnected impervious surface" on a floodplain, combined with the stringent legal mandates, make standard hydrological approaches scientifically inadequate and legally indefensible [8]. The model is a strategic investment that quantifies financial risk, secures institutional legitimacy, and provides the data necessary to avoid a multi-year, multi-million-pound remediation effort [45].

Based on this analysis, the following recommendations are provided:

- **Recommendation 1: Engage NSIP Stakeholders with a Catastrophe Model.** Immediately engage a specialized firm to initiate a comprehensive catastrophic flood risk assessment [61]. The model's outputs should be used to inform the Flood Risk Assessment and submitted as part of the formal NSIP application [1].
- **Recommendation 2: Use Model Outputs to Drive Design.** Mandate that the model's high-resolution data on flood depths, velocities, and exceedance probabilities be used to inform and justify all key project design decisions [62]. This includes the precise elevation of electrical equipment and the design of on-site drainage features [63]. The model's outputs can be used to "test the potential effects of flood defences" before they are built [64].
- **Recommendation 3: Embed Findings into Regulatory Documents.** Utilize the model's outputs as the primary evidence in all applications for permits, particularly the Development Consent Order application [65]. This will provide the definitive proof required to demonstrate compliance with the non-negotiable mandate to avoid off-site physical damage [66].

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Bookmarks

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