



Proposed Solar Farm, Land off Heath Road, Bagworth, Leicestershire Flood Risk Assessment

Renewable Connections
December 2025

DOCUMENT CONTROL

Job No	R444	
File Reference	G:\workfiles\R444 HEATH ROAD SOLAR FARM\REPORTS\R444-DOC02-FRA-Issue 2.docx	
	Name	Date
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EXECUTIVE SUMMARY

- I. The Proposed Development is for a solar photovoltaic farm and associated infrastructure, including two cable route corridors to the point of connection with an anticipated lifespan of 40 years on land off Heath Road, Bagworth, Leicestershire. The site is approximately 31.9 hectares in area, and the current use comprises arable agricultural land and is bound by hedgerows.
- II. The application site lies wholly within Flood Zone 1, defined as land with a low probability of flooding, having a less than 0.1% (1 in 1000) annual probability of river flooding. The pre-development potential flood risk to the site from the majority of sources of flooding is considered to be predominately 'very low'. There are areas of elevated surface water flood risk associated with low-lying areas of the site where surface water could accumulate and where topography could concentrate runoff. However, these areas of risk are isolated and shallow (<0.3m) in the development parcels even during the extreme 'low' risk event (less than 0.1% / 1 in 1000).
- III. The flood mitigation measures, including restricting control equipment to areas of 'very low' risk and raising sensitive equipment above ground level would ensure the proposed development would remain operational and safe in times of the 'design flood'.
- IV. It is considered that the aims of the sequential test are satisfied and development is located in a predominately 'low' to 'very low' risk area and the development is compatible in the small areas of elevated surface water flood risk.
- V. With respect to surface water runoff, the solar panels are raised above the existing ground allowing a permanent grass sward to be maintained underneath the panels. Rainfall falling onto the photovoltaic panels would runoff directly to the ground beneath the panels and infiltrate into the ground at the same rate as it does in the site's existing greenfield state, and access tracks will be semi-permeable in nature (unbound crushed stone).
- VI. The extent of impermeable cover as a result of the Solar Farm amounts to only 0.09% of the operational site area. The effect on runoff rates is minimal with a 0.13% increase in the Mean Annual Flood (Q_{BAR}) compared with the greenfield runoff.
- VII. A sustainable drainage strategy, involving the implementation of SuDS in the form of interception swales, is proposed for managing surface water runoff on the development site. Interception swales are proposed at the low points of the site to intercept extreme flows which may already run offsite. The interception swales have no formal discharge arrangements but will gradually empty by a process of infiltration, evaporation, and evapotranspiration and provide runoff pathway management. The volume of depression storage provided within the proposed interception swales (111.3m³) is greater than the additional runoff volume generated as a result of the extreme 1 in 100 year storm event, including an allowance for climate change (17.49m³) and is an appropriate form of mitigation given the 'temporary' nature of a Solar Farm and the need to be able to readily reinstate the land at the end of its lifespan and is a practical implementation of Natural Flood Risk Management.
- VIII. The overall conclusions drawn from this Flood Risk Assessment are that future users of the development would remain appropriately safe throughout the lifetime of the proposed development, and that subject to a planning condition requiring the drainage arrangements as indicated on Drawing No. R444/04 Rev E to be implemented and maintained in accordance with the procedures set out at Table E of this FRA, together with the flood mitigation measures outlined in paragraph 3.70 the development will not increase flood risk elsewhere and will reduce flood risk overall.

1. INTRODUCTION

- 1.1. This Flood Risk Assessment (FRA) has been prepared on behalf of Renewable Connections in connection with proposals for the development of a proposed solar photovoltaic farm and associated infrastructure, including two cable route corridors to the point of connection on land off Heath Road, Bagworth, Leicestershire, known as Heath Road Solar Farm.
- 1.2. The site is situated approximately 2.5km south of the village Bagworth and approximately 2.8km east of the village Barlestone. The nearest post code to the site is LE9 9NR and the approximate grid reference for the site is SK 45465 05723 (X: 445465 , Y: 305723). The extent of the site is shown on **Figure 1.1** below. The site extends to approximately 31.9 hectares in area. The existing use comprises agricultural land and is bound by hedgerows.

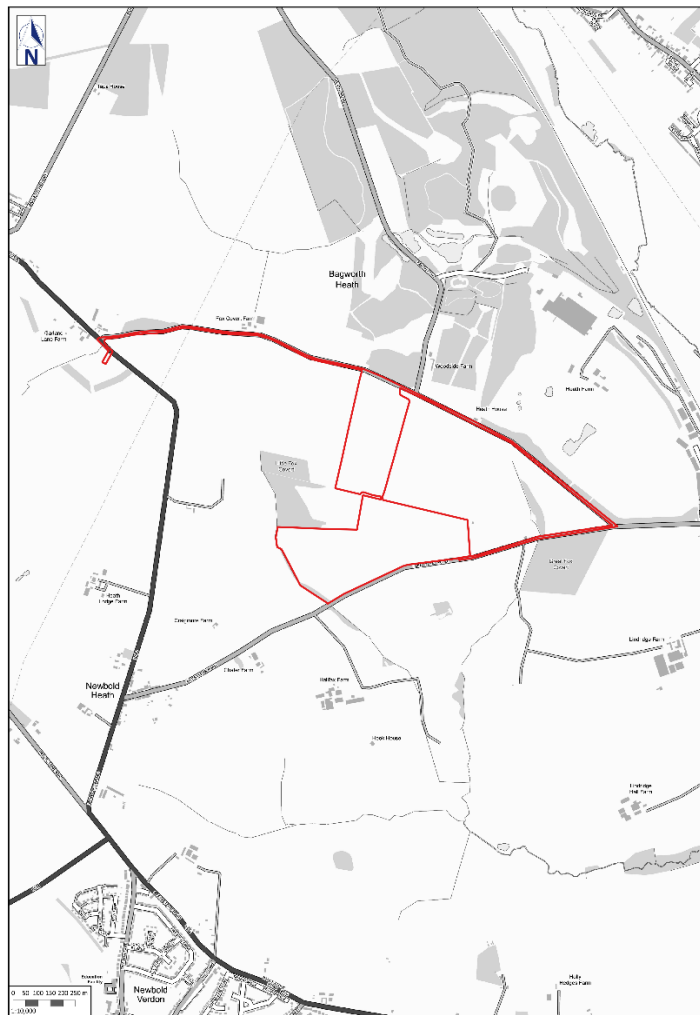


Figure 1.1: Site Location Plan

- 1.3. The development proposals comprise a solar photovoltaic farm and associated infrastructure, including two cable route corridors to the point of connection. A Site Layout is reproduced in **Appendix A**. The lifespan of the solar farm is anticipated to be 40 years.
- 1.4. The main purpose of this site-specific FRA is to provide sufficient flood risk information to support a planning application for the development proposals and to demonstrate that the development would be appropriately safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where practicable, would reduce flood risk overall.

2. SCOPE OF THE ASSESSMENT

National Planning Policy

- 2.1. The Government's National Planning Policy Framework (NPPF) sets out the Government's policy on development and flood risk. The Government's planning practice guidance category dealing with flooding is contained in Flood Risk and Coastal Change section of the Guidance.
- 2.2. The NPPF¹ requires the application of a sequential, risk-based approach to the location of development and local planning authorities should only consider development in flood risk areas appropriate where informed by a site-specific flood risk assessment. Footnote 63 of the NPPF states that a site specific flood risk assessment is required for proposals of 1 hectare or greater in Flood Zone 1.
- 2.3. The Environment Agency's Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences, and show the extent of the natural floodplain and the additional extent of an extreme flood. An extract from the Environment Agency's Flood Map for Planning, obtained from the GOV.UK website, which shows the Flood Zones in the vicinity of the site, is reproduced as **Figure 2.1** below. The application site lies wholly within Flood Zone 1 defined as land with a low probability of flooding, having a less than 0.1% (1 in 1000) annual probability of river flooding².

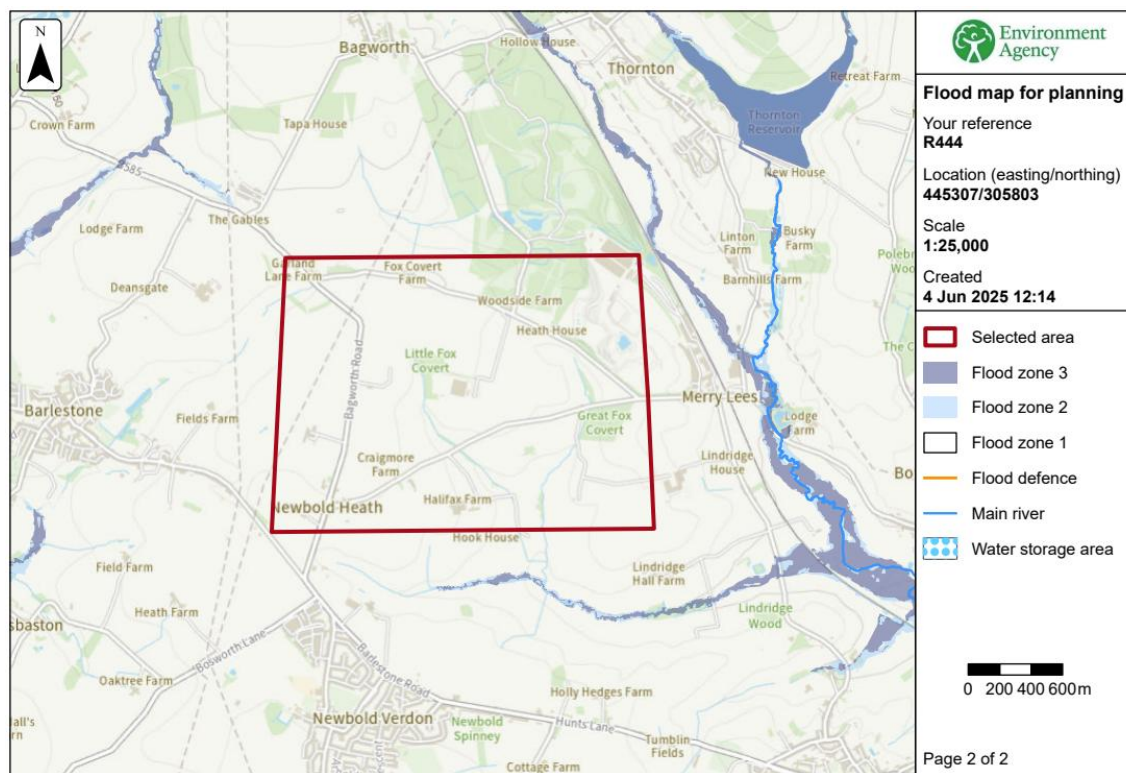


Figure 2.1: Flood Map for Planning

- 2.4. Paragraph 20 in the Flood Risk and Coastal Change Planning Practice Guidance advises that a site-specific flood risk assessment is carried out to assess the flood risk to and from a development site. The objectives of a site-specific flood risk assessment are to establish:

¹ NPPF paragraphs 170 - 182.

² Planning practice guidance reference ID: 7-065-20140306.

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test, and;
- whether the development will be safe and pass the Exception Test, if applicable.

2.5. Paragraph 1 of the guidance states “flood risk” is a combination of the probability and the potential consequences of flooding. Areas at risk of flooding are those at risk of flooding from any source, now or in the future. Sources of flood risk include rivers and the sea, direct rainfall on the ground surface, rising groundwater, overwhelmed sewers and drainage systems, reservoirs, canals and lakes and other artificial sources. Flood risk also accounts for the interactions between these different sources.

2.6. Paragraph 21 in the Guidance advises that the information provided in the flood risk assessment should be credible and fit for purpose. Site-specific flood risk assessments should be proportionate to the degree of flood risk and make optimum use of information already available, including information in a SFRA for the area, and the interactive flood risk maps. A flood risk assessment should also be appropriate to the scale, nature and location of development.

2.7. Guidance from the Environment Agency, published on the Government’s GOV.UK website, includes guidance on how to carry out a flood risk assessment entitled: “Flood risk assessment: flood zones 1, 2, 3 and 3b’.

Local Planning Policy

2.8. The Hinckley & Bosworth Borough Council’s Local Plan 2006 to 2026 is made up of a series of documents including Site Allocation and Development Management Policies (DPD) which was adopted in July 2016 and replaces a number of the Local Plan (2001) policies. This document contains policies relevant to the proposed development.

2.9. DM7 ‘Preventing Pollution and Flooding’ states:

“Adverse impacts from pollution and flooding will be prevented by ensuring that development proposals demonstrate that:

It will not adversely impact the water quality, ecological value or drainage function of water bodies in the borough; ...

h) The development doesn’t create or exacerbate flooding by being located away from areas of flood risk unless adequately mitigated against in line with National Policy”

2.10. DM 10 ‘Development and Design’ states:

“Developments will be permitted providing that the following requirements are met: ...

h) An appropriate Sustainable Drainage Scheme is submitted to and approved by the relevant Authority. Schemes should incorporate wildlife areas, ponds, swales and permeable paving where appropriate; ...”

2.11. Hinckley and Bosworth Council are currently working on a new Local Plan which will set out land allocations and planning policies for the period 2024 to 2045. The Draft Local Plan (June 2021-August 2021) has completed its initial Regulation 18 and Regulation 19 Consultation, and a further round of Regulation 18 Consultation in July 2024-September 2024. The Local Development Scheme (LDS) indicates that the timeframes going forwards that a further round of Regulation 18 and 19 consultations will need to be programmed in late 2025-early 2026 to allow for changes arising from the new NPPF, NPPG and standard housing method introduced in December 2024. The Local Plan submission to the Secretary of State (Regulation 22) is anticipated for late 2026 and in late 2027 for adoption. The consultation draft plan (dated July 2024) contains draft policies relevant to the proposed development.

2.12. Draft policy SP05 'Mitigation and Adapting to Climate Change' states:

"Proposals will be supported where they support Hinckley & Bosworth becoming carbon neutral by 2050; through where relevant: ...

Mitigating and adapting to the impacts of climate change, including by:

o. Demonstrate that flood risk from all sources has been mitigated, including use of Sustainable Drainage Systems (SuDS) following the Drainage Hierarchy and nature-based solutions where appropriate;"

2.13. Draft policy SP06 'Flood Risk' states:

"Planning applications for development proposals that require a Flood Risk Assessment will be required to address the actual and residual risk from all forms of flooding and the impact of climate change. The Flood Risk Assessment should be prepared in accordance with national guidance and having regard to local guidance, including the recommendations set out in the Borough Council's Strategic Flood Risk Assessment.

Development in areas at risk of flooding will only be supported where it is satisfactorily demonstrated that:

a) The Sequential Test has been passed;

b) Where required, the Exception Test has been passed;

c) The proposed development will not increase the risk of flooding on site or elsewhere, and appropriate floodplain compensation is provided where necessary; and

d) The proposed development, including the access and egress, will be safe and resilient to flooding for its lifetime, taking into account the relevant climate change allowances.

Where development is permitted within flood risk areas, it must demonstrate that, where required, it will reduce fluvial and surface water flood risk and manage residual risks, address the impacts of climate change through appropriate flood mitigation and adaptation measures, including enhancements to existing defences or provision of new defences.

All development proposals should, wherever possible, include measures to reduce and manage surface water in accordance with the principles laid out within the drainage hierarchy through appropriate sustainable drainage systems (SuDS) and avoiding where possible discharge to the public sewerage system so as to minimise and manage flood risk

and improve water quality in accordance with relevant Local Plan policies on climate change and pollution control.”

2.14. Draft policy SP28 ‘Blue Infrastructure’ states:

“New development will be required to contribute towards the delivery of a high quality multi-functional Blue Infrastructure network by expecting Blue Infrastructure assets to be provided, protected, maintained and enhanced to deliver multiple water management benefits and services for biodiversity, nutrient neutrality recreation and landscape.

Proposals will be supported that: ...

b) Do not involve the culverting of watercourses, except where essential to allow highways and/or other infrastructure to cross;

c) Protect, enhance and support the creation of ‘wet woodland’ habitats, ponds, scrapes, lakes, reed beds, raingardens and floodplain meadows

d) Make appropriate provision to protect, enhance, improve and maintain accessible networks of Blue Infrastructure, including through deculverting and re-naturalisation of hard banks if appropriate including through de-culverting and re-naturalisation of hard banks if appropriate and removal of barriers to fish movement;

e) Maintain and enhance natural drainage features;

f) Provide ‘buffer strips’ of vegetation along the banks of all water courses; ...

Proposals for built development will be required to be at least eight metres away from the top of the bank of the nearest watercourse or main river. New development proposals on or adjacent to a canal or river corridor should also include provision or provide enhancements to existing routes to allow for safe and convenient walking and cycling access wherever possible.

Developers must consider the long-term management and maintenance (at least 30 years) of blue infrastructure and should demonstrate how these considerations have informed site proposals. Details of maintenance requirements and arrangements must be set out, including who is responsible for these requirements. Funding arrangements for delivery of the long-term maintenance requirements should be demonstrated to the local authority before construction starts, including measures to secure biodiversity through all phases and stages of the development.”

Summary of Scope

2.15. The scope of this FRA is therefore to provide sufficient information to satisfy the relevant requirements of the NPPF and its associated guidance, local planning policy and guidance from the Environment Agency³.

³ Environment Agency (July 2024) [Guidance Flood risk assessment: flood zones 1, 2, 3 and 3b](#)

3. FLOOD RISK ASSESSMENT

Site Description and Hydrological Context

- 3.1. The Ordnance Survey map of the area shows geographical features including watercourses and other bodies of water.
- 3.2. The site is split into two development parcels. The northernmost development parcel is located on land south of Heath Road. The southernmost development parcel is north of Merrylees Road. The site is undeveloped and predominately arable agricultural land. An access track is present running along the eastern boundary of the northernmost development parcel serving the agricultural buildings to the west of the site.
- 3.3. The northernmost development parcel is bound by drainage ditches (ordinary watercourses) on its western, southern and eastern boundaries. The southernmost development parcel is bound by drainage ditches (ordinary watercourses) on its northern, western and southern boundaries. The ditch network drain broadly towards the south eastern or western boundaries following the topography of the land.
- 3.4. The existing surface water drainage arrangements, including locations of watercourses, are indicated on Flood Constraints Drawing No. R444/02 Rev D a copy of which is included in **Appendix B**. Potential existing overland flow routes have been identified based on the site's topography.

Existing Drainage

- 3.5. Currently the site naturally drains by a combination of overland flows towards the watercourses and drainage ditches located along the sites boundaries and infiltration into the underlying ground.
- 3.6. PFA Consulting have not been advised of the existence of any agricultural land drainage system within the site which has the potential to be damaged by the construction of the Solar Farm.

Site Levels

- 3.7. The northernmost development parcel slopes from a high point of 144m Above Ordnance Datum (AOD) in the northern corner to the eastern boundary (approximately 135m AOD). A typical gradient in the northernmost development parcel is between 1 in 20 and 1 in 30.
- 3.8. The southernmost development parcel slopes from a high point of 139m AOD in the centre northern area, to around 126m AOD in both south east and south west directions. A typical gradient in the eastern area of the southernmost development parcel is approximately 1 in 28 AOD in the north and approximately 1 in 10 in the south east. The western area of the southernmost parcel has a typical gradient of approximately 1 in 5.
- 3.9. A Topographical Survey, conducted by AIMS Ltd in January 2024, HR/DWD/HV/001 003 005 is found in **Appendix C**.

Ground Conditions

- 3.10. The British Geological Survey[®] NERC (2024) online geological mapping indicates that the majority of the application site is underlain by Edwalton Member bedrock (Mudstone). The south west corner of the southernmost development parcel is underlain by Gunthorpe Member bedrock (Mudstone), with a small band of Cotgrave Sandstone Member bedrock (Sandstone).
- 3.11. Superficial deposits are also present on the site. Oadby Member (Diamicton) overlay bedrock deposits across the majority of the site. A smaller area of Glaciofluvial Superficial Deposits (sand and gravel) overlay bedrock deposits in the southern area of the northernmost development parcel.

- 3.12. From an inspection of the Environment Agency's Aquifer Designation Map dataset held on Natural England's MAGIC website the site is underlain by both bedrock aquifers and superficial deposit aquifers. The Aquifer Classifications are set out on **Figure 3.1** and **Figure 3.2** below.
- 3.13. The Edwalton member bedrock (Mudstone) is classified as a 'Secondary B' Aquifer. Secondary B Aquifers are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
- 3.14. The small band of Cotgrave Sandstone Member bedrock (Sandstone) in the south west is classified as a Secondary A aquifer which is classified as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

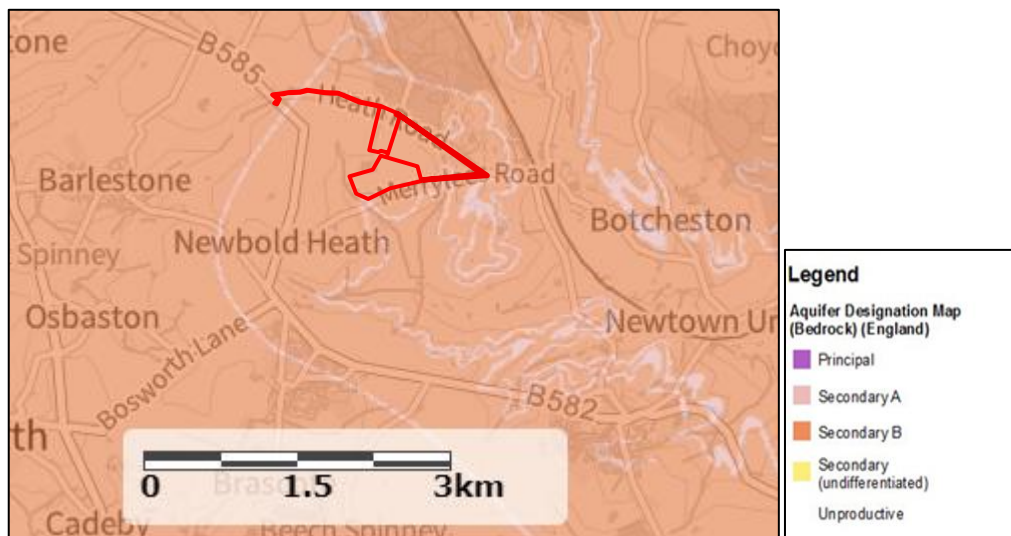


Figure 3.1: Environment Agency's Aquifer Designation Map (Bedrock Deposits)

- 3.15. The Oadby Member and Glaciofluvial superficial deposits are classified as 'Secondary (undifferentiated)' Aquifers. Secondary (undifferentiated) Aquifers are assigned where it has not been possible to attribute Category 'A' or 'B' to a rock type. These areas are generally classified as both 'minor' and 'non-aquifer' in different locations due to the variable characteristics to the rock type. The Oadby Member (Diamicton) superficial deposits are classified as a Secondary A aquifer.

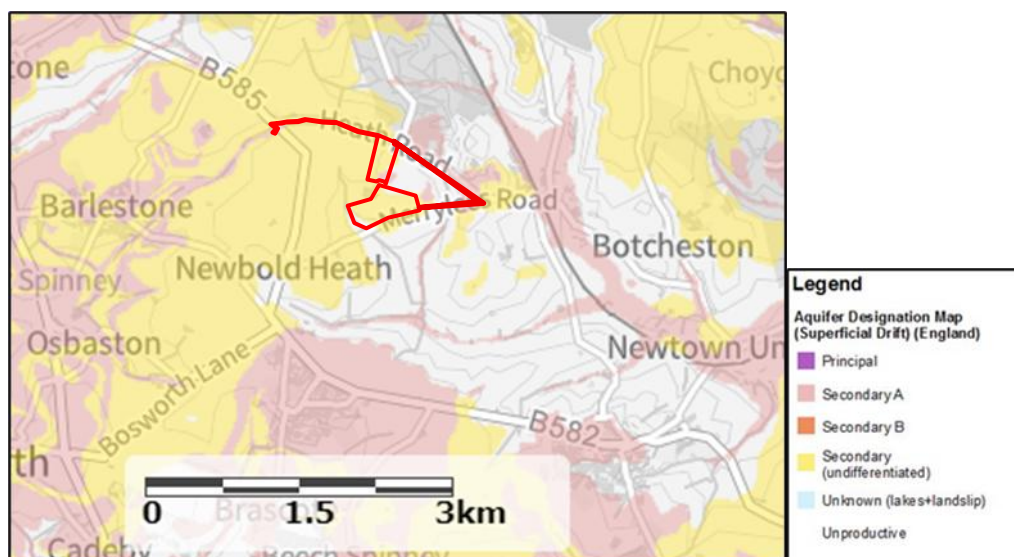


Figure 3.2: Environment Agency's Aquifer Designation Map (Superficial Deposits)

- 3.16. From an inspection of the Environment Agency's Source Protection Zones dataset the site does not lie within a Groundwater Source Protection Zone.
- 3.17. Based on the Flood Studies Report (FSR) Winter Rainfall Acceptance Potential (WRAP) Map, as shown on Drawing No. R444/03 Rev A reproduced in **Appendix D**, the site is located in a 'Soil Index Class 4' area. Soil Index Class 4 has the lowest Winter Rainfall Acceptance Potential and the highest Standard Percentage runoff, and so suggests the underlying soil has relatively poor permeability.
- 3.18. The Cranfield Soil and AgriFood Institute (CSAI), incorporating the National Soil Resources Institute (NSRI), at Cranfield University maintains soil reports and maps for England and Wales. The Soilscales dataset map indicates that soils in the area are classed as 'slowly permeable seasonally wet slightly acid but base rich loamy and clayey soils'. These soils are identified as having 'impeded drainage' suggesting they are impermeable, when they do drain, they drain to stream networks.
- 3.19. Based on the available information the underlying ground conditions appear to be relatively impermeable.

Climate Change

- 3.20. The NPPF and its guidance requires development to take account of the impacts of climate change. The allowances to be made for climate change effects when assessing flood risk are related to the lifetime of the development.
- 3.21. Guidance on the lifetime of development is provided at paragraph 6 in the Flood Risk and Coastal Change Planning Practice Guidance. The lifetime of a non-residential development depends on the characteristics of that development. The lifespan of the Solar Farm is anticipated to be 40 years after which the infrastructure will be removed and the site returned to agricultural use.
- 3.22. Under heading 4 in the Site-Specific Flood Risk Assessment Checklist in the Flood Risk and Coastal Change Planning Practice Guidance, it asks how is flood risk at the site likely to be affected by climate change and states that further advice on how to take account of climate change in flood risk assessments is available from the Environment Agency. Guidance published by the Environment Agency, entitled 'Flood risk assessments: climate change allowances', sets out the climate change allowances to be used for peak river flow, peak rainfall intensity, sea level rise, offshore wind speed and extreme wave height. This guidance was last updated on 27 May 2022.

- 3.23. There are a range of climate change allowances for each river basin district and epoch for sea level rise and are based on percentiles. A percentile describes the proportion of possible scenarios that fall below an allowance level. The higher central allowance is based on the 70th percentile (only 30% of projections would exceed this allowance) whereas the upper end allowance is based on the 95th percentile (only 5% of projections would exceed this allowance).

Peak Rainfall Intensity Allowances

- 3.24. With respect to the peak rainfall intensity allowance, the site lies in the Soar Management Catchment. The Guidance advises for development with a lifetime between 2061 and 2100 assess the central allowance for the 2070s epoch (2061 to 2125) and design your development so that for the central allowance in the 1% annual exceedance probability event there is no increase in flood risk elsewhere and your development will be safe from surface water flooding. The total potential change anticipated for 2070s epoch (2061 to 2125) is +25% for the central allowance in the 1% AEP rainfall event.

Standard of Protection

- 3.25. In terms of providing an acceptable standard of protection against flooding for new development, where development is necessary in flood risk areas the development should be made safe for its lifetime without increasing flood risk elsewhere. The Site-specific flood risk assessment checklist makes reference to the assessment of the 'design flood'.
- 3.26. Paragraph 2 in the Flood Risk and Coastal Change Planning Practice Guidance defines a 'design flood' as follows:

'This is a flood event of a given annual probability, which is generally taken as:

river flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year); or

tidal flooding with a 0.5% annual probability (1 in 200 chance each year); or

surface water flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year),

plus an appropriate allowance for climate change.

- 3.27. Therefore, in terms of providing an acceptable standard of protection against flooding for new development, the development should be appropriately safe without increasing flood risk elsewhere in the 'design flood'.
- 3.28. The Government published its 'Non-statutory technical standards for sustainable drainage systems' in March 2015. They should be used in conjunction with the NPPF and planning practice guidance. Standard S7 states that the drainage system must be designed so that flooding does not occur on any part of the site for a 1 in 30 year rainfall event. Standard S8 goes on to state that the drainage system must be designed so that flooding does not occur during a 1 in 100 year rainfall event in any part of a building (including a basement); or in any utility plant susceptible to water within the development.

Site Specific Flood Risk

- 3.29. In addition to flooding from rivers and the sea it is also necessary to consider the potential consequences of flooding from all other sources, which include directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.

Sources of Information

- 3.30. A Level 1 SFRA was produced by JBA Consulting on behalf of Hickley and Bosworth Borough Council in July 2019. This provides an overview of flood risk from all sources including from rivers, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources.
- 3.31. The Government's GOV.UK website contains 'Long Term Flood Risk Information' which includes interactive maps showing 'Flood risk from rivers or the sea' and 'Flood risk from surface water'. These maps show the chance of flooding in one of four risk categories: High risk means that each year this area has a chance of flooding of greater than 3.3% (1 in 30); Medium risk between 1% and 3.3% (1 in 100 and 1 in 30); Low risk between 0.1% and 1% (1 in 1000 and 1 in 100); and Very low risk less than 0.1% (1 in 1000). The 'Flood risk from surface water' map indicates the extent, depth and velocity of water for High, Medium and Low risk scenarios. The Long Term Flood Risk Information also includes a 'Flood risk from reservoirs' map, which includes flood depth and flood speed.

Flooding from Watercourses

- 3.32. As identified in 2.3 above, the site lies entirely within Flood Zone 1, which is defined as the zone with the lowest probability of flooding from rivers.
- 3.33. There are no main rivers in the vicinity of the site. The Rothley Brook is approximately 1.8km from the site to the south west and does not affect the proposed development site.
- 3.34. In summary, risk of flooding from watercourse is assessed as 'very low'.

Flooding from Surface Water

- 3.35. The Risk of Flooding from Surface Water Map indicates where surface water may be expected to flood or pond when rainwater does not drain away through normal drainage system or soak into the ground, but lies on or flows over the ground instead. The GOV.UK website advises that flooding from surface water is difficult to predict as rainfall location and volumes are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding. The information shown is a general indicator of an area's flood risk. A copy of the GOV.UK's Flood risk from surface water map is reproduced in **Figure 3.3** below.

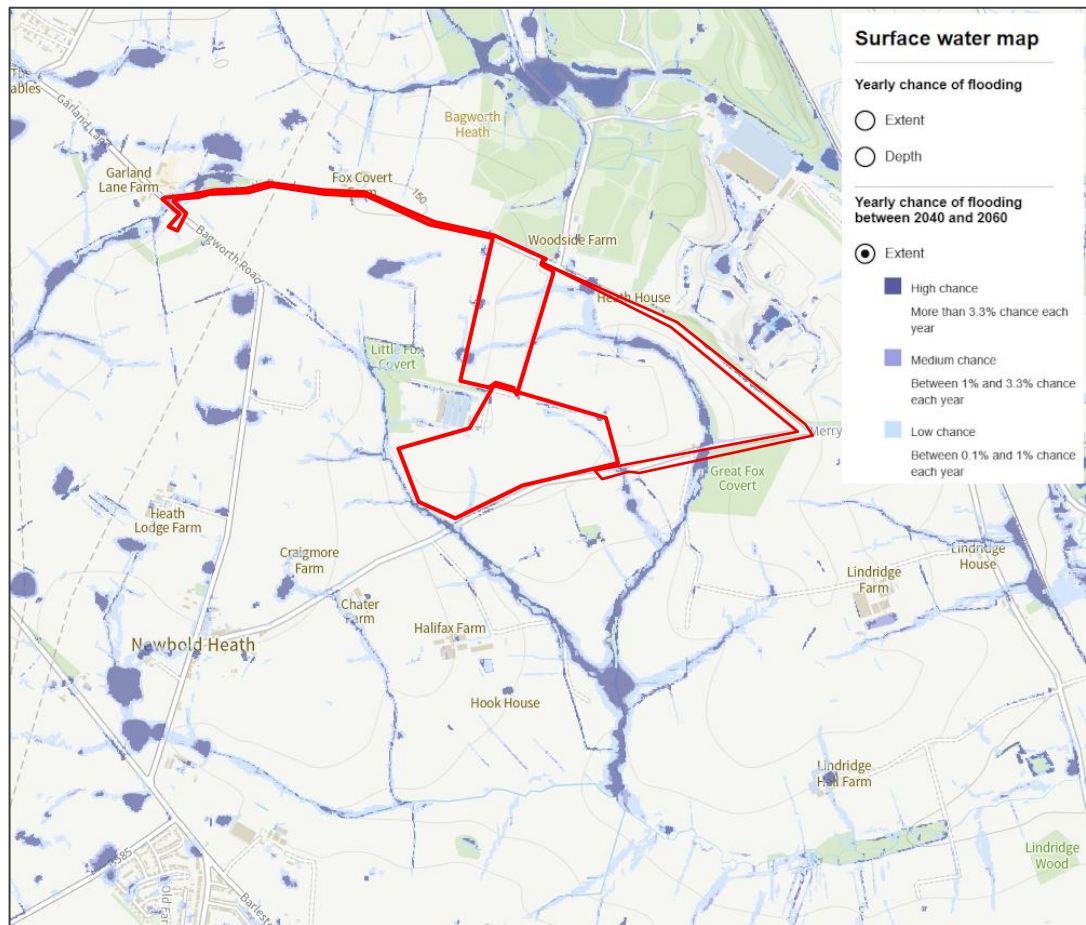


Figure 3.3: Flood Risk from Surface Water Map

- 3.36. The GOV.UK's Flood risk from surface water map shows that the site is located in an area of predominately 'very low' risk (less than 0.1%). Isolated areas of elevated risk are present ('low' risk (between 0.1% and 1%), 'medium' risk (between 1% and 3.3%) and 'high' risk (greater than 3.3%)).
- 3.37. The areas of elevated surface water flooding are associated with low points on the site where surface waters could collect and where topography could concentrate runoff.
- 3.38. The extent of the 'low' risk surface water flood event is shown on Drawing No. R444/02 Rev D contained in **Appendix B**. The northernmost development parcel is affected by two main overland flow routes flowing from west to east. The southernmost development parcel is affected by two main overland flow routes. One on the western boundary associated with the ordinary watercourse and the second affecting the eastern area flowing from north to south. As shown in **Figure 3.4** below the modelled flood depths are predominately shallow with the probability of depths >0.3m assessed as predominately 'very low' (less than 0.1%). Small areas of deeper accumulations are associated with the channels of onsite ditches and ponds.

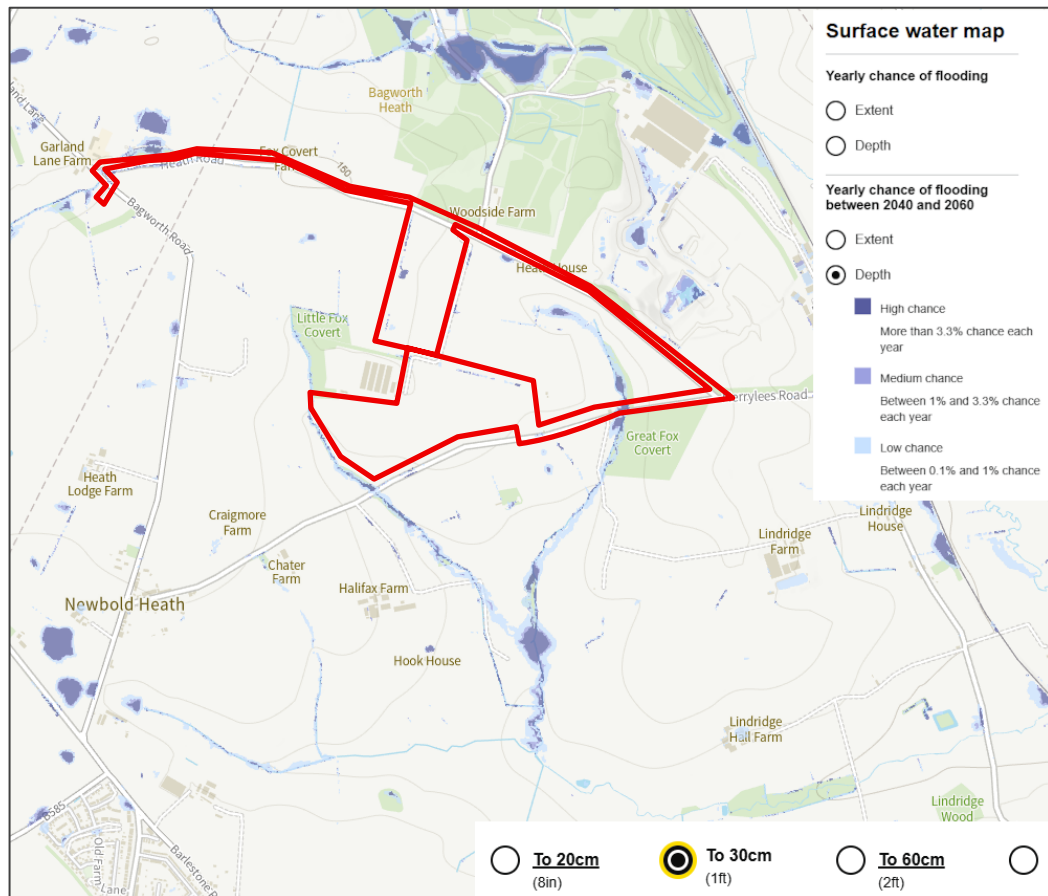


Figure 3.4: Flood risk from surface water depths up to 0.3m

- 3.39. The risk of flooding from surface water is assessed as predominately 'very low' with small isolated areas of elevated risk ('high' to 'low').

Flooding from Groundwater

- 3.40. Groundwater flooding is most likely to occur in low-lying areas underlain by water-bearing permeable rocks termed aquifers. These may be extensive regional aquifers in chalk or sandstone, or localised sands or river gravels in valley bottoms underlain by less permeable rock. Groundwater flooding occurs as a result of water rising from the underlying rocks or from water flowing from abnormal springs. This tends to occur after long periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. In low-lying areas the water table is usually at shallower depths, so during very wet periods, all the additional groundwater flowing towards these areas can cause the water table to rise to the surface causing groundwater flooding.
- 3.41. The Hickley and Bosworth Borough Council Level 1 SFRA uses the Environmental Agency's dataset 'Areas Susceptible to Groundwater Flooding' (AStGWF) which indicates where groundwater may emerge due to geological and hydrogeological conditions. The dataset shows the proportion of each 1 km square that contain geological deposits susceptible to groundwater emergence. The mapping shows that the application site falls predominately within an area <25% chance of groundwater emergence suggesting that the superficial and bedrock deposits are unlikely to be a significant source of groundwater.
- 3.42. In summary, the risk of flooding from groundwater is assessed as 'low' for the site based on the available information and underlying ground conditions.

Flooding from Overwhelmed Sewers and Drainage Systems

- 3.43. Sewer flooding occurs when intense rainfall overloads the sewer system capacity (surface water, foul or combined), and/or when sewers cannot discharge properly to watercourses due to high water levels.
- 3.44. No sewers are identified which cross the site and the SFRA does not identify any incident of flooding from overwhelmed sewers and drainage systems affecting the site. There are also no historic incidences of sewer flooding identified in this area. The risk of flooding from overwhelmed sewers and drainage systems is assessed as 'very low'.

Flooding from Artificial Sources

- 3.45. The GOV.UK's Flood risk from reservoirs map indicates the site is unaffected by flooding from any reservoirs.

Historical Flooding

- 3.46. There have been no historical records of flooding in the vicinity of the site identified.

Summary of Baseline (Pre Development) Flood Risk

- 3.47. A summary of the potential risk from all sources of flooding associated with existing conditions pre-development is shown in Table A below.

Table A: Pre-development Potential Flood Risk from All Sources of Flooding

Flood Source	Potential Risk	Description
Watercourses	Very Low	The site is located in Flood Zone 1, which indicates less than 1 in 1,000 annual probability of river flooding (<0.1%).
Surface Water	Very Low – High	The risk of flooding from surface water on the majority of the site is 'very low' with areas of elevated risk associated with shallow overland flow routes around the low lying areas and where topography could concentrate runoff.
Groundwater	Low	The underlying ground conditions suggest the risk of significant groundwater being present in the underlying geological deposits is low. If groundwater were to emerge it would behave like surface water flooding and collect at low spots of the site associated with ordinary watercourses.
Overwhelmed Sewers	Very Low	The SFRA indicates that there are no historic records of sewer flooding in the postcode area within the vicinity of the site. In addition the application site is located within a rural area and no sewers are known to cross the site. The risk of the site being affected by flooding from overwhelmed sewers and drainage systems is assessed as 'very low'.
Artificial Sources	Very Low	None identified

- 3.48. The pre-development potential flood risk to the site from the majority of sources of flooding is considered to be predominately 'very low'. There are areas of elevated surface water flood risk associated with low-lying areas of the site where surface water could accumulate and where topography could concentrate runoff. However, these areas of risk are isolated and shallow (<0.3m) in the development parcels even during the extreme 'low' risk event (less than 0.1% / 1 in 1000).

- 3.49. It is therefore considered that the most likely cause of potential other flooding affecting the 'greenfield' site would be extreme rainfall falling on the sub-catchment area exceeding the soil's natural infiltration rate or capacity, leading to an increase in the volume and rate of runoff and resulting in overland flood flows and ponding at localised low spots.

The Development Proposals

- 3.50. The development proposals comprise the construction of a solar farm consisting of photovoltaic (PV) modules mounted on metal frames (known as arrays), with associated site infrastructure including ancillary control equipment and two cable route corridors to the point of connection. A Site Layout is reproduced in **Appendix A**.
- 3.51. The array of panels would be situated in rows running from east to west, south facing inclined at an angle of approximately 25-30 degrees from the horizontal, with a varying row spacing that provides approximately 3-4m separation between lines of panels. Each frame typically contains multiple rows of solar panels separated by a horizontal 'rainwater' gaps. These gaps allow rainwater to drain freely to the ground beneath and between the solar panels, replicating the existing greenfield scenario. The lower edge of the panels would be a minimum of 0.8m above ground level, allowing grass to grow underneath the panels. **Figure 3.5** shows a typical cross section of a Solar Array.

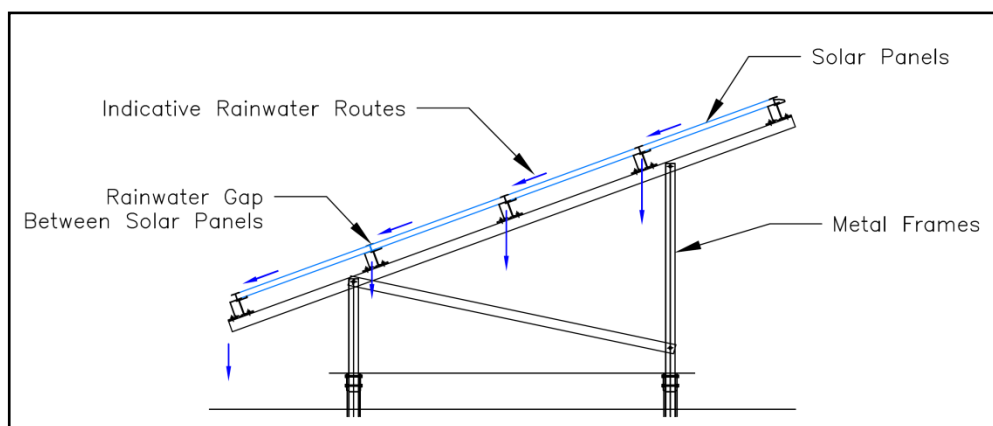


Figure 3.5: Typical Solar Array Cross Section

Note: Based on four PV panels per frame.

- 3.52. The proposed development does not involve any change in ground levels (other than the provision of interception swales discussed in Section 4 of this report). The majority of the site would be converted to permanent pasture underneath the solar panels.
- 3.53. Any access tracks would be formed using semi permeable materials (unbound crushed stone) so as to avoid creating impermeable areas across the site.
- 3.54. Ancillary equipment would be contained in small buildings, typically Glass Reinforced Plastic (GRP) kiosks or container units distributed across the site. Ancillary equipment includes Inverter Cabinets which contain an Inverter, Transformers and associated switch gear; a separate Control Room; and a Sub-substation. Due to their small size and remote rural locations it is proposed that roof water from these buildings would discharge directly onto the surrounding ground. Minimum floor levels for buildings on the site would be set at least 150mm above ground level to prevent the ingress of water and all sensitive control equipment would be raised at least 300mm above ground level.

- 3.55. Cable trenches have the potential to act as land drains and convey any water falling on the site which infiltrates into the ground, to the lower parts of the site (particularly on sloping sites). To prevent this occurring clay 'stanks' should be provided at intervals within the cable trenches. The entry point of any cable or ducting into chambers should also be sealed to prevent water ingress.
- 3.56. The cable route along Heath Road and Merrylees to the Point of Connection (PoC) is assumed to be entirely below ground and therefore would have minimal flood risk and drainage implications.

Development and Flood Risk

- 3.57. This section of the report sets out the flood mitigation measures required to ensure the development is designed and constructed to remain operational and safe in times of flood for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere.

Flooding from Surface Water

- 3.58. The risk of flooding from surface water is assessed as between 'very low' with areas of elevated risk associated with low lying areas and topographical features which could concentrate overland flows. 'Low' Risk extents (0.1%AEP / 1 in 1000RP + 20% climate change) and the proposed control equipment are presented on Drawing No. R444/02 Rev D contained in **Appendix B**.
- 3.59. The site layout has been devised using a sequential approach to locate sensitive equipment in areas of lowest flood risk as much as possible taking into account other material planning considerations and operational requirements. Inspection of the plan contained within **Appendix B** shows all sensitive control equipment is located in an areas unaffected by areas of elevated surface water flooding risk. Only solar arrays, access tracks and security fencing extend into areas of elevated surface water flood risk.
- 3.60. The proposed Solar PV Panels would be raised at least 0.8m above ground level on metal frames securely anchored into the ground (known as solar arrays). Therefore, panels located in elevated surface water flood risk would remain safe and operational during times of flooding due the shallow depth of flooding anticipated (even in the 'low' risk event).
- 3.61. Due to the nature of the proposed equipment in the area of elevated flood risk the proposed development would not increase flood risk elsewhere and would allow the surface water to flow freely around the panel supports, bases of the structures and security fence. The presence of the panel supports in flood risk areas wouldn't therefore impede water flows due to their small size and profile. The panel supports and security fence would be resistant to shallow flood depths and would be securely anchored into the ground.
- 3.62. The site layout has been devised to locate all ancillary equipment in areas of 'very low' surface water risk. Solar arrays and security fencing which extend into areas of elevated surface water flood risk are designed to remain safe and operational during times of flooding and due to the nature of the equipment would not increase flood risk elsewhere and are appropriate in these areas.

Flooding from Groundwater

- 3.63. The risk of flooding from groundwater affecting the proposed development is assessed as 'low'.
- 3.64. If groundwater emergence were to occur it would likely follow the overland flow paths as indicated on the flooding from surface water map and be directed away from the development. The solar panels are elevated above ground level and all sensitive control equipment is to be raised at least 300mm above ground level and would therefore be unaffected by shallow emergent groundwater and overland surface water flows.

Watercourse Buffers

- 3.65. All built development (solar arrays, security fencing and control equipment) is at least 3m from the onsite ordinary watercourses (drainage ditches) and onsite ordinary watercourses (drainage ditches) are predominately retained within the site layout. The 3m buffer is considered to be sufficient to facilitate occasional maintenance access along the drainage ditch.
- 3.66. Access tracks and cable routes are present within the 3m buffer zones and these features would not affect maintenance access to the adjacent ordinary watercourses (drainage ditches). Access tracks and cables routes are therefore permissible in these areas.
- 3.67. Access tracks utilise existing ditch crossings to avoid the need for new culverts/watercourse crossings on the site.
- 3.68. At two localised locations to facilitate a rationale site layout ordinary watercourse (drainage ditch) could be affected by the internal cable route and/or access track. Inspection of the topographical survey indicates that this section of drainage ditch provides limited land drainage function and any overland flows would be intercepted by the drainage ditch 11m to the east. On this basis to facilitate the development it is proposed that this length of drainage ditch would be truncated/removed to facilitate the development and delivery of the internal cable routes/access track. The drainage function of the site would be predominately unaffected with the drainage ditch to the east retained. If necessary minor localised regrading works would ensure ground levels would fall towards the eastern drainage ditch and smooth out any localised low spots (<0.2m change in levels anticipated). Cross sections through the site and drainage ditch which shows the general fall of the site towards the eastern drainage ditch are shown on Drawing No. R444/05 contained in **Appendix E**. Inspection of this drawing clearly shows the general fall of the land towards the eastern drainage ditch.
- 3.69. Works to any drainage ditches affecting the flow of water within a drainage ditch (such as to facilitate cable routes) would require consent from Leicestershire County Council under Section 23(1) of the Land Drainage Act 1991 (as amended by the FWMA 2010). Land drainage / ordinary watercourse consent is a separate process from the planning process and would be undertaken following planning permission being secured. Locations where land drainage / ordinary watercourse consent could be required (subject to the design of cable routes and/or construction methodology) are identified on Drawing No. R444/06 contained in **Appendix F**.

Summary of Flood Mitigation Measures

- 3.70. The development extends into areas of elevated flood risk from surface water. The scheme has been designed to raise sensitive equipment above any flood depths or protect the sensitive equipment to ensure the proposed development is appropriately flood resilient and resistant and residual flood risk is appropriately managed. The following design flood mitigation measures are proposed:
- Control equipment sequentially located in areas of 'very low' surface water flood risk.
 - Panel supports and security fencing in flood risk areas will be securely piled into the ground and designed to allow for the effect of flowing water pressures and to be resistant to inundation during a flood event.
 - All sensitive control equipment would be raised at least 300mm above ground level and the finished floor level of all buildings would be at least 150mm above ground level to safeguard from the ingress of surface waters.
 - All built development (solar arrays, security fencing and control equipment) is at least 3m from the onsite ordinary watercourses (drainage ditches). To facilitate an internal cable route/access track land drainage / ordinary watercourse consent could be required for amendments to drainage ditches at two locations.

- 3.71. These flood mitigation measures would ensure the proposed development would remain operational and safe in times of the 'design flood'.

Off Site Impacts and Residual Risk

- 3.72. Residual risks are those that remain after the flood risk management and mitigation measures are implemented such as applying the sequential approach to the location of development and taking mitigating actions. Examples of residual risk include:
- a breach of a raised flood defence, blockage of a surface water conveyance system or failure of a pumped drainage system;
 - failure of a reservoir; and
 - a flood event that exceeds a flood management design standard, such as a flood that overtops a raised flood defence, or an intense rainfall event which the drainage system cannot accommodate.
- 3.73. The pre-development potential flood risk to the site from the majority of sources of flooding is considered to be predominately 'very low' and areas of elevated surface water flood risk are identified as a residual risk.
- 3.74. Safe access and egress to and from the development is a route that is safe for use without the intervention of the emergency services or others. As the site is located within Flood Zone 1 it is considered construction staff and occasional maintenance staff can access the proposed development safely without having to pass through a watercourse flood risk area.
- 3.75. In line with normal building practice it is proposed that any on site buildings will have floor levels raised at least 150mm above ground level with appropriate damp proof course protection. This will ensure that the interior of any such building is kept suitably dry.
- 3.76. To protect against soil erosion topsoil it is recommended covering vegetation will, as far as practicable, be maintained across the whole site throughout the construction and operation of the Solar Farm.
- 3.77. For extreme events the site's topography will convey exceedance flows overland towards the low points as it presently does. Flow will be intercepted by existing drainage ditches (as in the present greenfield state) and as a result of the development by the proposed interception swales in the lower portion of the application site (as discussed in Section 4.0 below). It is therefore considered that the proposed development would have adequate flood protection for extreme events over the lifetime of the development and by the provision of the interception swales promotes a minor benefit in intercepting overland flows.
- 3.78. A summary of the potential risk from all sources of flooding post-development with the various development mitigation measures incorporated is shown in **Table B** below.

Table B: Post-development Potential Flood Risk from All Sources of Flooding

Flood Source	Potential Risk	Description
Watercourses	Very Low	No change compared with pre-development risk. The site lies within Flood Zone 1, which has a low probability of river flooding.
Surface Water	Very Low – High	No change compared with pre-development risk. All sensitive equipment is raised above ground level and control equipment is sequential located to avoid areas of elevated flood risk so would not be susceptible to overland flows. Overland flows intercepted by proposed interception swales providing a degree of betterment downstream.
Groundwater	Low	No change compared with pre-development risk. All equipment raised above ground and would not be susceptible to shallow emergent groundwater.
Overwhelmed Sewers	Very Low	No change compared with pre-development risk.
Artificial Sources	Very Low	No change compared with pre-development risk.
Off-site Impacts	Low	By intercepting overland flows through the use of interception swales (discussed in Section 4.0 below) the proposed development would reduce flood risk overall.

- 3.79. On this basis it is considered that the proposed site design and drainage measures can safely manage any residual risks and that the proposed drainage measures would lead to an overall reduction in flood risk.

NPPF Planning Policy Requirements

Flood Risk Vulnerability and Flood Zone ‘Compatibility’

- 3.80. Annex 3 of the NPPF sets out the Flood Risk Vulnerability Classification of development and categorises different types of development according to their vulnerability to flood risk. Paragraphs 77-78 of the Flood Risk and Coastal Change Planning Practice Guidance refer to two Flood Zone and Flood Risk Tables. Table 1: Flood Zones provides a definition of each Flood Zone. Table 2: Flood risk vulnerability and flood zone ‘compatibility’ maps the vulnerability classes against the flood zones to indicate where development is appropriate and where development should not be permitted.
- 3.81. The Environment Agency’s Flood Map for Planning indicates that the site lies within Flood Zone 1, which is defined as the zone with the lowest probability of flooding from rivers.
- 3.82. With reference to Annex 3 of the NPPF Solar Farms are classified as Essential Infrastructure.
- 3.83. With reference to Table 2, Essential Infrastructure is appropriate in Flood Zone 1.

Sequential Test

- 3.84. As set out in paragraph 174 of the NPPF, the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source.

- 3.85. As the site lies wholly within Flood Zone 1 and other sources of flood risk are predominately assessed as 'low' to 'very low' flood risk the location of the site is in broad accordance with the aims of the Sequential Test.
- 3.86. Only very small and isolated areas of elevated surface water flood risk ('high' and 'medium' risk areas) are present on the site. These areas equate to 1474m² of 'medium' risk (0.8% of the area within the security fence – the operational area) and only 309m² of 'high' risk (0.2% of the operational area).
- 3.87. As set out above the development is compatible in these areas of elevated surface water flood risk and can remain safe and operational during times of flooding without increasing flood risk elsewhere.
- 3.88. It is noted that the Environment Agency's⁴ guidance states:

'You may not need a sequential test if development can be laid out so that only elements such as public open space, biodiversity and amenity areas are in areas at risk of any source of current or future flooding.'

- 3.89. As such it is considered there is some flexibility in the application of the sequential test for elements of the development that would be compatible in areas of flood risk.
- 3.90. Solar farm developments have specific technical requirements for a location to be suitable. These include good levels of solar irradiation, appropriate topography (large flat/gently sloping open areas of land) and proximity to an available connection to the national electricity transmissions system or grid with sufficient capacity for the electricity generated by the Proposed Development. This restricts 'reasonably available sites' in a suitable location within the search area (area around the Point of Connection) for a solar farm of this size. The proposed development benefits from an accepted grid connection offer with Western Power Distribution (the DNO) to connect to an existing substation a short distance from the site which would facilitate a quick connection to the grid.
- 3.91. An Alternative Sites Assessment ('ASA') has been produced by DWD to identify if there are any potentially more suitable sites situated on previously developed and/or non-agricultural land or lower grade agricultural land. The ASA concludes:

'As a result, no alternative agricultural sites could be identified on lower grade agricultural land and none were added to the long-list or short-list.'

With regards to brownfield sites, two sites of an appropriate size were identified by via the Council's SHELAA. However, neither site comprised a more suitable alternative to the Proposed Site.

On this basis, it is considered proven that there are no suitable alternative sites available on lower grade agricultural land or previously developed land.'

- 3.92. It is considered that the aims of the sequential test are satisfied and development is located in a predominately 'low' to 'very low' risk area and the development is compatible in the small areas of elevated surface water flood risk. In addition the ASA provides evidence that there are no 'reasonably available sites' in a suitable location within the search area for a solar farm of this size.

⁴ Environment Agency (24 May 2024) [Guidance: Flood risk assessment: flood zones 1, 2, 3 and 3b](#)

4. SURFACE WATER DRAINAGE ASSESSMENT

Hydrological Effect of Solar Farms

4.1. It is generally accepted that Solar Farm developments have a minimal effect on runoff rates as long as permanent vegetation is maintained under and around the solar panels. The site remains a predominately permanently grassed field with discrete control equipment distributed across its area. This general view is supported by guidance, as summarised below, and quantified in the sections below.

4.2. BRE published its 'Biodiversity Guidance for Solar Developments'⁵ in 2014. The report recognises that in most Solar Farms:

'normally only 25-40% of the surface is over-sailed by panels' and "because panels are raised above the ground on posts greater than 95% of a field utilised for solar farm development is still accessible for plant growth ...'

4.3. Natural England's 'Technical Information Note TIN101: Solar Parks: Maximising Environmental Benefits'⁶ states:

'The key to avoiding increased run-off and soil into watercourses is to maintain soil permeability and vegetative cover. Permeable land surfaces underneath and between panels should be able to absorb rainfall as long as they are not compacted and there is some vegetation to bind the soil surface.'

4.4. In addition Cook and McCuen (2013) 'Hydrologic Response of Solar Farms'⁷ research paper concludes that provided grass cover is maintained the addition of solar panels over a grassy field does not have much of an effect on runoff volumes, the peak runoff nor the time to peak. A copy of the research paper's abstract is reproduced below:

'Because of the benefits of solar energy, the number of solar farms is increasing; however, their hydrologic impacts have not been studied. The goal of this study was to determine the hydrologic effects of solar farms and examine whether or not storm-water management is needed to control runoff volumes and rates. A model of a solar farm was used to simulate runoff for two conditions: the pre- and post paneled conditions. Using sensitivity analyses, modeling showed that the solar panels themselves did not have a significant effect on the runoff volumes, peaks, or times to peak. However, if the ground cover under the panels is gravel or bare ground, owing to design decisions or lack of maintenance, the peak discharge may increase significantly with storm-water management needed. In addition, the kinetic energy of the flow that drains from the panels was found to be greater than that of the rainfall, which could cause erosion at the base of the panels. Thus, it is recommended that the grass beneath the panels be well maintained or that a buffer strip be placed after the most downgradient row of panels. This study, along with design recommendations, can be used as a guide for the future design of solar farms.'

4.5. It follows that the majority of the site will remain as 'soft' surface, with grassland around and underneath the solar panels, which in itself will minimise runoff from the site.

⁵ BRE (2014) Biodiversity Guidance for Solar Developments. Eds G E Parker and L Greene.

⁶ Natural England (2011) Natural England Technical Information Note TIN101 Solar parks: maximising environmental benefits.

⁷ Cook & McCuen (2013) Hydrologic Response of Solar Farms, Journal of Hydrologic Engineering, 18(5), 536-541.

- 4.6. The solar arrays are spaced to avoid any shadowing effect from one panel to another with topography dictating the exact row spacing which can range between 3 – 4 metres. Between each row of solar panels is a vegetated buffer strip which would contribute to slowing the flow of runoff across the development site.
- 4.7. **Figure 4.1** shows a typical scene from an operational Solar Farm with vegetation cover between and under the solar arrays which will delay surface water runoff and prevent soil erosion.



Figure 4.1: A Typical Operational Solar Farm

- 4.8. Soil compaction will be limited during construction and operation of the Solar Farm. During construction only light machinery will be required to install the solar array and vehicle movements will be minimised. Low ground pressure vehicles are recommended during wet weather working. Any HGVs will be restricted to a temporary construction compound by the site's entrance.
- 4.9. If necessary, to alleviate the effects of any compaction during the construction process, any affected areas will be harrowed and seeded prior to final commissioning of the Solar Farm in accordance with the detailed landscape planting scheme and management plan to be secured by an appropriately worded planning condition.
- 4.10. During operation of the Solar Farm maintenance of the panels will be infrequent, minimal and will only require light machinery. Thus, the infiltration rate of the underlying ground is unlikely to be changed by the proposed development.
- 4.11. During the operation of the Solar Farm the areas under and around the solar array will be suitable for grazing by livestock, typically sheep.
- 4.12. At present the proposed development site is used for arable agriculture which requires the periodic ploughing of the site. Exposed soil is at a greater risk of erosion compared with a field with covering vegetation and can result in greater runoff. Upon completion of the Solar Farm the site will be permanently grassed thereby reducing the risk of soil erosion and reducing potential runoff compared with the existing condition.
- 4.13. Taking into account the above, the proposed surface water management measures need to be proportionate to the minimal hydrological effect of Solar Farm developments. The effect of the proposed development on runoff rates and volumes is assessed below.

Runoff Rate Assessment

- 4.14. The proposed development will have a very limited extent of impermeable ground cover. The area beneath the solar panels will remain grassed and the post development site infiltration rate will not adversely change. The excavation of cable trenches which are backfilled with a granular surround to the cables and then backfilled with excavated material potentially increase the infiltration capacity of the site as the cable trenches act as land drains. Nonetheless rainwater falling onto each panel will drain freely onto the ground beneath the panel and infiltrate into the ground at the same rate as it does in the site's existing greenfield state as indicated in TIN101⁸. Thus, the total surface area of the photovoltaic array will not be considered an impermeable area in this assessment (only the area taken up by the panel supports). Similarly, it can be assumed that any rainwater falling onto the semi-permeable access tracks will soak into the ground beneath or adjacent to the tracks at the same rate that it presently does.
- 4.15. The extent of impermeable area created as a result of the proposed Solar Farm is summarised in **Table C**.

Table C: Created Impermeable Areas

	Quantity	Unit Area (m ²)	Total Area (m ²)
Piles	11,526	0.006	69.16
Customer Substation	1	12.19m x 2.44m = 29.74m ²	29.74
DNO Substation	1	5.62m x 5.11m = 28.72m ²	28.72
20ft Power Station	3	6.06m x 2.44m = 14.79m ²	44.36
Total Impermeable Area			171.98
Operational Site Area (area within security fence)			190,456.75
Total Impermeable Area = 0.09% of Total Site Area			

- 4.16. In its current greenfield state the application area is considered to be 100% undeveloped. As a result of the development of the Solar Farm the extent of impermeable area will be approximately 171.98 m² or 0.09 % of the operational site area (the area of the site enclosed by the security fence).
- 4.17. The Environment Agency's report Rainfall Runoff Management for Developments [Report – SC030219] published in October 2013 provides advice on the management of stormwater drainage for developments including the calculation of greenfield runoff. The report states:

'The Environment Agency will normally require that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (1 in 100 year event) the developed rate of runoff into a watercourse should be no greater than the undeveloped rate of runoff for the same event based on the calculation of Q_{BAR} or Q_{MED} and the use of FSSR growth curves.'

⁸ Natural England (2011) Technical Information Note TIN101: Solar parks: maximising environmental benefits.

- 4.18. Table 1 of that Report states that for developments between 0 - 50 hectares the Institute of Hydrology (IH) Report 124 Flood Estimation for Small Catchments (1994) method can be used to estimate the greenfield site flow rate, Q_{BAR} (the Mean Annual Flood). Where developments are smaller than 50 ha, the analysis for determining the greenfield index flood flow rate should use 50ha in the formula and linearly interpolate the flow rate value based on the ratio of the development area.
- 4.19. The ICP SuDS Method contained with Micro Drainage software system calculates Q_{BAR} based on the IH124 methodology with pro-rata values for sites smaller than 50ha.
- 4.20. The FSR WRAP Map, shown in **Appendix D**, indicates the site is located in 'Soil Index Class 4', and a Soil Index value of 0.45 has been used to calculate Q_{BAR} using the ICP SuDS Method.
- 4.21. Q_{BAR} has been calculated for the site in both an undeveloped 'greenfield' site and post development site. Copies of the MicroDrainage greenfield runoff calculations are included in **Appendix G**. A summary of the pre and post development runoff rates for the various return period events is shown in **Table D**. The mean annual peak rate of runoff, referred to as Q_{BAR} in ICP SuDS Method, for the pre-development greenfield site is 78.5 l/s. Whereas the post development site Q_{BAR} is calculated as 78.6 l/s.

Table D: Greenfield Runoff Rates

Return Period (Years)	1	Q_{BAR}^a	30	100
Greenfield Runoff Rates (l/s)	65.1	78.5	153.7	201.7
Post Development Unmitigated Runoff Rate (l/s)	65.2	78.6	154.0	201.9

^a Q_{BAR} = Mean Annual Flood with an approximate return period of 2.3 years.

- 4.22. The calculations contained in **Appendix G** quantify the effect of the proposed Solar Farm on greenfield runoff rates. These calculations show that this effect of the Solar Farm on Q_{BAR} runoff rates is negligible and only equates to an increase of 0.1 l/s or 0.13% of the greenfield runoff rate.

Runoff Volume Assessment

- 4.23. The Depth-Duration-Frequency (DDF) Model function was used in the Flood Estimation Handbook (FEH) web service to calculate the depth of rainfall from a 24 hour, 100 year storm event at the site. The results of this calculation are shown on **Figure 4.2**. Thus, the 24 hour, 100 year plus climate change design rainfall for the application site is 101.7mm (or 0.1017m) (81.36x1.25)). The total extent of impermeable area created as a result of the proposed development is 171.98m². The volume of runoff generated by this rainfall event falling on 171.98m² impermeable area calculated by this method equates to 17.49m³ (0.1017m x 171.98m²).
- 4.24. On this basis, the additional runoff generated in the extreme 24 hour duration, 1 in 100 year storm event, including an allowance for climate change, would amount to approximately 17.49m³.

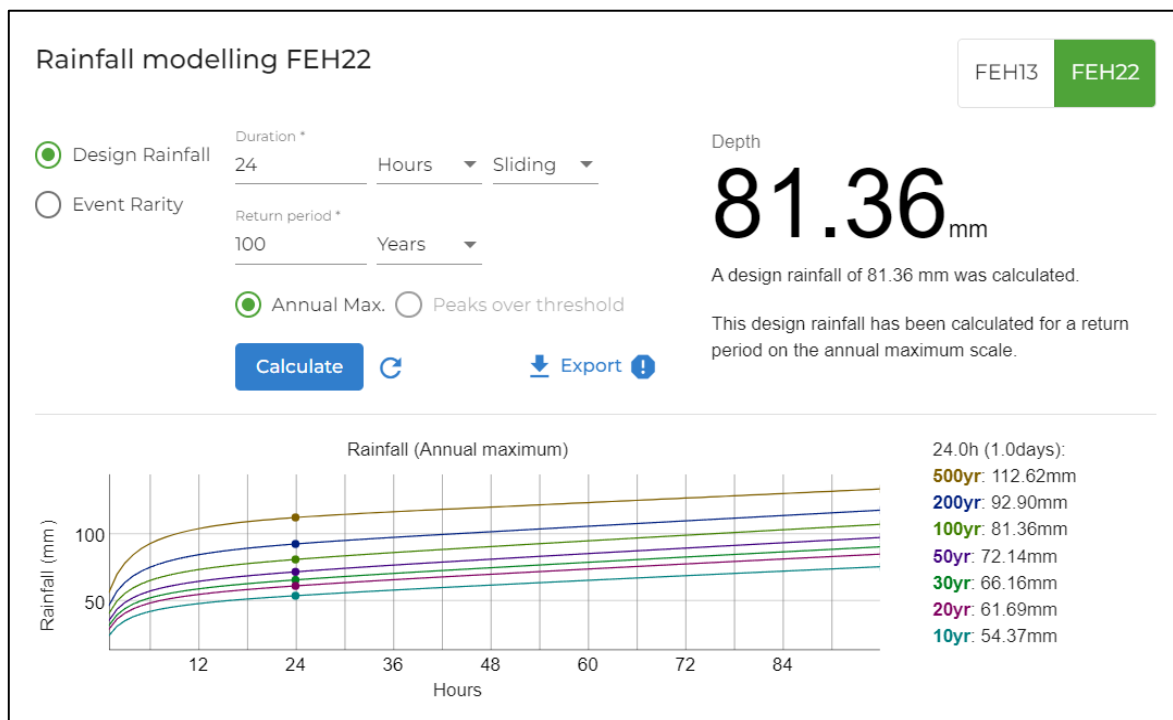


Figure 4.2: Depth-Duration-Frequency (DDF) Modelling Outputs

Sustainable Drainage Systems

- 4.25. Government policy set out in paragraph 182 of the NPPF states ‘*applications which could affect drainage on or around the site should incorporate sustainable drainage systems to control flow rates and reduce volumes of runoff, and which are proportionate to the nature and scale of the proposal.*’
- 4.26. Paragraph 55 in the Flood Risk and Coastal Change planning practice guidance advises that sustainable drainage systems are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. Sustainable drainage systems can contribute to the causes and impacts of flooding and deliver a wider range of additional biodiversity and environmental net gains.
- 4.27. Guidance on the design and construction of SuDS is provided in Ciria C753 ‘*The SuDS Manual*’.

Natural Flood Risk Management

- 4.28. Paragraph 64 of the Flood Risk and Climate Change planning practice guide states:
- ‘Natural flood management techniques work with natural processes to protect, restore and emulate the natural functions of catchments, floodplains, rivers and the coast. They aim to manage the sources and pathways of flood waters whilst providing wider benefits to people, wildlife and the environment.’**
- 4.29. Ciria published the Natural Flood Management Manual (C802) in 2022 which provides further background information and guidance on the different Natural Flood Management (NFM) measures that can be implemented to reduce flood risk. NFM measures can be used across the landscape to protect, restore or mimic the natural hydrological process that occur. These include increasing infiltration of water, slowing the flow of water across the landscape, storing water and holding back sediment. NFM can also deliver co-benefits such as habitat creation and biodiversity enhancement, soil improvement and retention and water quality improvements.

- 4.30. The Manual divides NFM into 13 broad categories of which soil and land management, runoff management, and runoff storage are particularly relevant to Solar Farm developments.
- 4.31. Soil and land management techniques include changes to land management practices to reduce soil compaction, and encourage more natural habitats to restore or enhance the ability of the soil to infiltrate and store water. Additional vegetation will increase interception and evapotranspiration and an improved soil structure can increase evaporation from the near-surface soil and this can be achieved through the use of cover crops and reduced till techniques (reduced ploughing). Permanent vegetation cover therefore increases surface roughness and maintains soil structure slowing the flow of runoff.
- 4.32. Runoff management techniques include buffer strips to interrupt or divert overland flow pathways across the landscape, encourage infiltration into the ground, slowing the flow and diverting water away from problematic locations. As described above vegetation in buffer strips will increase onsite interception and evapotranspiration. Encouraging areas of temporary standing water and waterlogged ground, stores water on the land surface increasing the potential for evaporation losses.
- 4.33. Runoff storage techniques include scrapes, bunds and swales to store water on overland flow pathways to reduce the flow towards a watercourse and encourage infiltration. As well as increasing the potential for evaporation losses these techniques can be used to lengthen the flow pathway slowing the progress of runoff across the landscape. In addition, infiltration losses increase with increased residence time and even on sites with relatively impermeable ground conditions, long residence time will still encourage infiltration losses.
- 4.34. The use of both multifunctional SuDS and NFM techniques to manage flood risk from development sites is recognised in paragraph 49 of the Flood Risk and Coastal Change planning practice guidance.
- 4.35. The nature of Solar Farm developments in rural locations with minimal impact on runoff rates or volumes mean that NFM techniques would be an appropriate means of managing surface water runoff from the site and contribute to delivering flood risk betterment and reducing flood risk overall and have been considered in the section below in addition to SuDS techniques.

Proposed Surface Water Management Measures

- 4.36. A sustainable drainage strategy, involving the implementation of SuDS and NFM techniques, is proposed for managing the surface water runoff from the proposed Solar Farm development.

Management of Runoff from Solar Panels and Control Equipment

Conversion to Permanent Pasture

- 4.37. The conversion to permanent pasture is a key mitigation measure in reducing runoff from the proposed development site and is a significant improvement on the existing situation which requires periodic ploughing, exposing soil and temporarily increasing runoff rates.
- 4.38. Vegetation cover is proposed to be maintained in the areas around the solar panels and field margins throughout the lifetime of the development to minimise the risk of soil erosion and reduce runoff rates. Between each row of solar panels and around the margins of the site a 3 – 4m vegetated buffer strip which would contribute to slowing the flow across the development site in accordance with the good practice suggested by Cook and McCuen.

- 4.39. A copy of the Illustrative Landscape Strategy prepared by EDP is contained in **Appendix H**. Inspection of this plan shows that shade tolerant grassland would be sown and maintained around the solar arrays. While around the boundaries of the site there would be buffer strips sown and maintained as species rich grassland.
- 4.40. The detailed landscape planting scheme and a Landscape and Ecological Management Plan (LEMP) would be covered by a suitably worded planning condition.
- 4.41. The Illustrative Landscape Strategy and associated landscape planting would contribute to reducing compaction risk (by providing vegetation coverage protecting the underlying soil structure), increase surface roughness (reducing runoff rates) and in turn would also provide additional biodiversity benefits.
- 4.42. The biodiversity benefits of the landscape planting and maintenance regime would be secured by a planning condition requiring Habitat Monitoring and Management Plan (HMMP) setting out how the stated biodiversity net gain benefits would be realised for at least 30 years.
- 4.43. Natural England's '*Technical Information Note TIN101: Solar Parks: Maximising Environmental Benefits*' encourages existing land drainage to be maintained. Existing onsite drainage ditches or features will therefore be retained in their existing state (except at one location), and will continue to intercept overland flows from the site.

Interception Swales

- 4.44. As discussed, the mitigation of runoff from solar panel areas and areas of discrete control equipment is primarily achieved by the conversion of the site to permanent pasture. Nonetheless, interception swales are provided to intercept runoff, 'slow the flow' and provide flood risk betterment in accordance with industry best practice.
- 4.45. Whilst it is considered that the photovoltaic panels oversailing permanent pasture will not result in a material increase in surface water runoff, it is proposed to provide a SuDS arrangement by way of interception swales in the lower areas of the site to intercept extreme flows which may already run offsite. It is emphasised that the interception swales do not form part of a formal drainage scheme for the development but are provided as a form of 'betterment' intercepting existing overland flows. The proposed interception swales are designed to have a significantly larger capacity than the increase in runoff volume created by the discrete control equipment distributed around the 19 Ha operational area of the site.
- 4.46. The approach is considered a practical implementation of Rural Sustainable Drainage Systems (RSuDS)⁹ as a means of intercepting runoff and 'slow down flow' with the aim to form 'micro-wetlands' for the benefit of farmland biodiversity and encourage localised recharge of groundwater whilst providing a degree of flood risk betterment. The concept of RSuDS has evolved into the broader field of Natural Flood Risk Management (NFM) and Working With Natural Processes methodology (WWNP). The Environment Agency's WWNP evidence base, published in February 2018, lists swales as a form of 'runoff pathway management'. These techniques aim to delay and even flatten the hydrograph and reduce peak flow locally for small events by intercepting, slowing and filtering of surface water runoff and encouraging infiltration and soil water storage. The use of interception swales is a practical implementation of a NFM runoff storage technique.

⁹ Environment Agency (2012) Rural Sustainable Drainage Systems (RSuDS)

- 4.47. The proposed drainage arrangements, showing the proposed interception swale locations, which are situated having regard to overland flow routes is shown on Drawing No. R444/04 Rev E contained in **Appendix I**.
- 4.48. The purpose of the interception swales is simply to intercept runoff and encourage depression storage within the feature during the extreme storm event, promoting interception losses by infiltration or evapotranspiration and providing runoff pathway management. As such no specific overflow mechanism is proposed. Interception swales would overtop as sheet runoff and overland flow would follow the natural topography as per the pre development situation. This 'simplified' approach to runoff management is considered appropriate and proportionate to the type of development and magnitude of the effect discussed above and is readily reversible at the end of the 40 year life of a Solar Farm.
- 4.49. The interception swales are proposed around the perimeter and at low points of the site as a series of discrete 'stepped' units parallel to the site's contours and perpendicular to the slope to ensure flows are not concentrated or conveyed downhill.
- 4.50. Swales will be formed by creating shallow depressions a minimum of 0.4m deep, with 1 in 3 side slopes, and a base width of 0.5m along the lower boundaries of the site. The material excavated to form the swale will be placed along the lower edge to create a small bund, as shown on the typical details as shown in **Appendix I**.
- 4.51. The swales have no formal discharge arrangements but will gradually empty by a process of infiltration, evaporation, and evapotranspiration and provide runoff pathway management. Exceedance flows will be managed by overland flow routing which mimic the natural greenfield response of the site.
- 4.52. The storage volume of the interception swales has been calculated on the basis that the swales will be 3/4 full (incorporating a 0.1m freeboard). The interception swales provide a total storage volume of approximately 111.3m³. This is greater than the volume of additional runoff generated as a result of the 24 hour, 100 year plus climate change rainfall event (17.49m³). If the full depth of the interception swales is taken into account the depression storage volume would increase to 180.2m³. It is therefore considered that the interception swales would adequately mitigate any increase in runoff volume generated as a result of the minor increase in impermeable area created by the discrete control equipment and would be beneficial in reducing the potential run off for the site in the more extreme storm event.
- 4.53. The depth of the interception swales has been increased compared with the original scheme to increase the volume of depression storage onsite, further increasing betterment provided.
- 4.54. Interception swales will be sown with the appropriate seed mix upon construction and vegetation will be maintained by the site operator thereafter for the life of the proposed development.
- 4.55. The interception swales will be located outside of any Root Protection Zones or within 3m of any ordinary watercourses or drainage ditches.
- 4.56. The volume of depression storage provided in the interception swales is more than sufficient to mitigation change in runoff rates and volumes created by the ancillary control equipment distributed across the site.

Summary of Surface Water Management Measures

- 4.57. The proposed Solar Farm development and mitigation measures proposed in this FRA are compatible with NFM and retains existing ditch / watercourse network that crosses the site (except at one localised location) and through conversion to permanent pasture and introduction of interception swales creating significant amount of onsite depression storage seeks to restore and enhance natural hydrological processes to 'slow the flow' and has a benefit in reducing overland flows during extreme rainfall events. On this basis the proposed development will not increase flood risk onsite or elsewhere and will preserve the application site's natural drainage regime and is considered a proportionate approach to surface water management on a rural solar farm development and is a practical implementation of NFM.

SuDS Construction and Maintenance

- 4.58. The interception swales will be maintained throughout the design life of the development by the site owner generally in accordance with the recommendations in CIRIA C753 '*The SuDS Manual*'. The proposed maintenance procedures are set out in **Table E**.

Table E: Interception Swale Maintenance Procedures

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Litter and debris removal.	As required.
	Grass cutting or animal grazing – to retain grass height to site owner's specification.	As required.
	Manage other vegetation and remove nuisance plants.	Monthly (as stated, then as required)
Occasional Maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where possible.	Annually
	Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, if required.	Annually, or if bare soil is exposed over 10% or more of the swale treatment area.
Remedial Actions	Repair erosion or other damage by re-turfing or reseeded.	As required.
	Re-level uneven surfaces and reinstate design levels.	As required.
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface.	As required.
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip.	As required.
Monitoring	Inspect infiltration surfaces for ponding, compaction, and silt accumulation. Record areas where water is ponding for > 48 hours.	Monthly, or when required.
	Inspect surface for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.

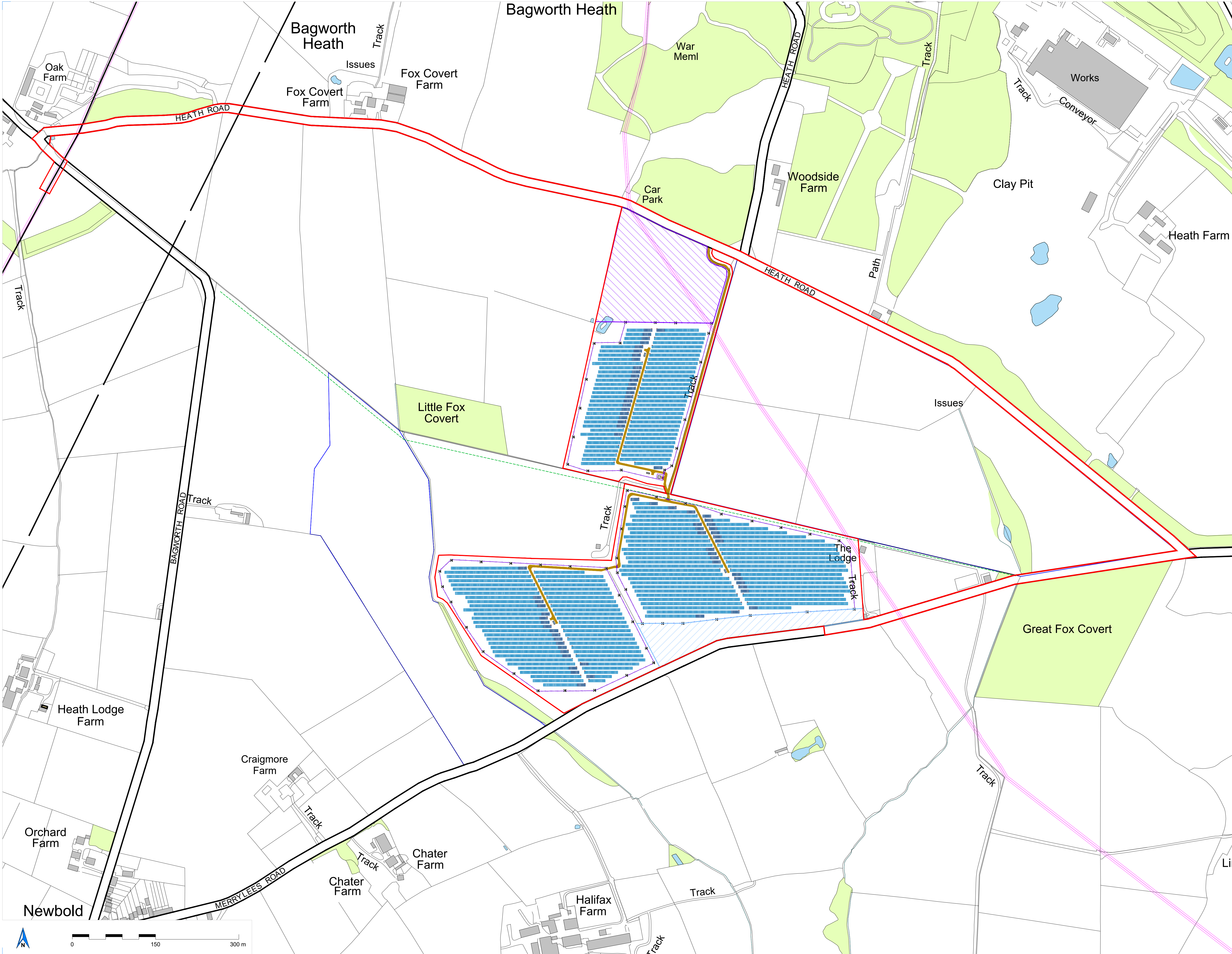
- 4.59. Elsewhere the Environment Agency has recommended the use of a single check sheet to ensure that any drainage issues are picked up at an early stage. Accordingly, a check sheet in the format suggested by the Environment Agency is reproduced in **Appendix J**.

- 4.60. In circumstances where little vegetation cover is present on commencement of construction, it is recommended that the interception swales are provided at the outset. Similarly, if during construction it is evident that the surface of the site is becoming significantly disturbed, then implementing interception swales immediately would act to restrict potential runoff and act as silt traps.
- 4.61. If, however, the site remains “clean” and vegetated during construction, it would be advisable to leave the construction of the interception swales to the end of the construction programme so as to maximise the benefits of the existing vegetation cover.
- 4.62. The timing of the provision of the interception swales is therefore a matter for the construction site manager to determine.

5. CONCLUSIONS

- 5.1. This Flood Risk Assessment has been prepared on behalf of Renewable Connections in connection with a proposed solar photovoltaic farm and associated infrastructure, including two cable route corridors to the point of connection on land off Heath Road, Bagworth, Leicestershire, known as Heath Road Solar Farm.
- 5.2. The site is situated approximately 2.5km south of the village Bagworth and approximately 2.8km east of the village Barlestone. The nearest post code to the site is LE9 9NR and the approximate grid reference for the site is SK 45465, 05723. The site extends to approximately 31.9 hectares in area and its existing use comprises agricultural land and is bound by hedgerows.
- 5.3. The development proposals comprise the construction of a solar farm consisting of photovoltaic modules mounted on metal frames, with associated site infrastructure and ancillary control equipment.
- 5.4. With reference to the GOV.UK's Flood Map for Planning (Rivers and Sea), the entire site falls within Flood Zone 1. This is fully in accordance with the aim of the sequential approach set out in the NPPF which is to steer new development to areas at the lowest probability of flooding in Zone 1. In relation to Flood Risk Vulnerability and Flood Zone 'Compatibility', the planning practice guidance to the NPPF advises that all uses of land are appropriate in Flood Zone 1.
- 5.5. The pre-development potential flood risk to the site from the majority of sources of flooding is considered to be predominately 'very low'. There are areas of elevated surface water flood risk associated with low-lying areas of the site where surface water could accumulate and where topography could concentrate runoff. However, these areas of risk are isolated and shallow (<0.3m) in the development parcels even during the extreme 'low' risk event (less than 0.1% / 1 in 1000).
- 5.6. The development extends into areas of elevated flood risk from surface water. The scheme has been designed to raise sensitive equipment above any flood depths or protect the sensitive equipment to ensure the proposed development is appropriately flood resilient and resistant and residual flood risk is appropriately managed. The following design flood mitigation measures are proposed:
- Control equipment sequentially located in areas of 'very low' surface water flood risk.
 - Panel supports and security fencing in flood risk areas will be securely piled into the ground and designed to allow for the effect of flowing water pressures and to be resistant to inundation during a flood event.
 - All sensitive control equipment would be raised at least 300mm above ground level and the finished floor level of all buildings would be at least 150mm above ground level to safeguard from the ingress of surface waters.
 - All built development (solar arrays, security fencing and control equipment) is at least 3m from the onsite ordinary watercourses (drainage ditches). To facilitate an internal cable route/access track land drainage / ordinary watercourse consent could be required for amendments to drainage ditches at two locations.
- 5.7. These flood mitigation measures would ensure the proposed development would remain operational and safe in times of the 'design flood'.
- 5.8. It is considered that the aims of the sequential test are satisfied and development is located in a predominately 'low' to 'very low' risk area and the development is compatible in the small areas of elevated surface water flood risk.

- 5.9. With respect to surface water runoff, the solar panels are raised above the existing ground allowing a permanent grass sward to be maintained underneath the panels. Rainfall falling onto the photovoltaic panels would runoff directly to the ground beneath the panels and infiltrate into the ground at the same rate as it does in the site's existing greenfield state. Access tracks will be semi permeable in nature (unbound crushed stone). The extent of impermeable cover as a result of the Solar Farm amounts to only 0.09% of the operational site area. The effect on the Mean Annual Flood (Q_{BAR}) is minimal and only equates to a 0.13% increase compared with the greenfield runoff.
- 5.10. A sustainable drainage strategy, involving the implementation of SuDS in the form of interception swales, is proposed for managing surface water runoff on the development site. Interception swales are proposed at the low points of the application site to intercept extreme flows, which may already run offsite and provide runoff pathway management. The volume of storage provided within the proposed interception swales ($111.3m^3$) is greater than the additional runoff generated as a result of the extreme 1 in 100 year storm event, including an allowance for climate change ($17.49m^3$). The interception swales are therefore an appropriate form of mitigation given the 'temporary' nature of the Solar Farm, and a proportionate mitigation measure given the negligible hydrological effect of a Solar Farm and are a practical implementation of NFM.
- 5.11. Existing drainage features will be retained (except at one localised location) and the site will remain vegetated throughout construction and operation of the Solar Farm to prevent soil erosion. The proposed interception swales would lead to an overall reduction in surface water flow rates from the site and mitigate any increase in run-off due to the minor reduction in the overall permeable area of the site. On this basis the proposed development would not increase flood risk onsite or elsewhere and would preserve the application site's natural drainage regime.
- 5.12. The overall conclusions drawn from this FRA are that future users of the development would remain appropriately safe throughout the lifetime of the proposed development, and that subject to a planning condition requiring the drainage arrangements as indicated on plan R444/04 Rev E to be implemented and maintained in accordance with the procedures set out at **Table E** of this FRA and a Check Sheet attached as **Appendix J**, the development will not increase flood risk elsewhere and will reduce flood risk overall.



- Notes:
1. All dimensions to be confirmed on site prior to installation.
 2. All dimensions are indicative only and in m unless otherwise specified.
 3. Drawing based on satellite data:
Imagery date: 16/06/21

Reference drawings

Data-Solar_GroundMount_Project Form_Heath Road.docx	---	17/08/22
RC107 - 21-11-10 - Heath Road Fixed Layout REV3.pdf	---	17/08/22
RC107 - 22-01-17 - Heath Road NMC.amx	---	17/08/22
Heath Road Updated.amx	---	13/11/23
VML_Sk404.dwg	---	13/11/23
RC107 - Heath Road.dwg	---	13/11/23
2302103-TK01A-TK02A-TK03.dwg	---	22/07/24
Drainage Strategy - DRAPI 1 new RLB.pdf	---	22/07/24
Tree Survey.pdf	---	22/07/24

- Legend:
- Site boundary (31.90 ha)
 - Perimeter fence
 - Maintenance track
 - Customer substation
 - DNO
 - 20ft. Power Station
 - Inverter
 - Gate
 - OHL
 - Footpath
 - Skylark mitigation
 - Ecological enhancement area
 - CCTV



Revisions:

Rev	Date	Comments	Drawn	Approve
0	19/08/22	First issue	AP	DB
1	02/09/23	Changes in PV layout	GU	AP
2	02/09/23	Changes in PV layout	GU	AP
3	21/11/23	PV area added, site boundaries changed, configuration changed	IM	NM
4	11/11/23	Layout update	PJ	NM
5	23/07/24	Design constraints implemented	EL	GU
6	12/08/24	Layout update	IV	GU
7	19/08/24	Layout update	IV	GU
8	11/09/24	Layout update	IV	GU
9	11/11/24	Site boundary, skylark and ecological areas	IV	GU
10	14/11/24	Compound area removed	IV	GU
11	10/02/25	Site boundary updated	IV	GU

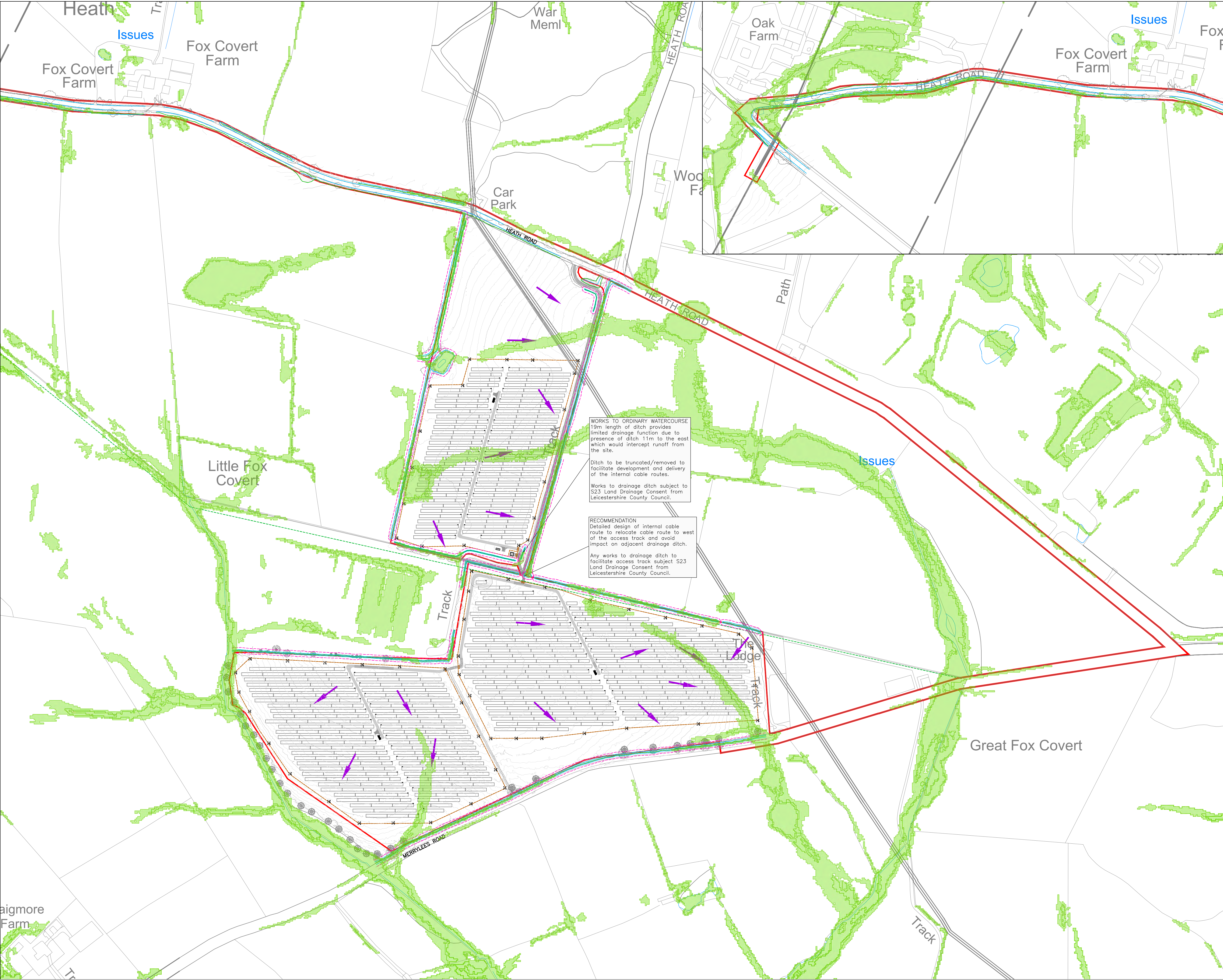
Project: Heath Road
Location: Heath Road and Merry Lees, Bagworth, LE9 9NR, UK
52.648197°, -1.329302°
Title: Indicative Proposed Site Layout

Drawn: Detra Solar / IV Checked: AM
Scale: 1:3000@A1 Date: 12/02/25
Drawing No: RCN1008-PL-01 Rev: 11

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detra SOLAR
Detra Solar
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LT-09320 Vilnius
www.detrasolar.com

Do not scale from this drawing. Site verify all dimensions prior to construction.
Report all discrepancies to the drawing originator immediately. This drawing is to be read in conjunction with all relevant documents and drawings.



Status

FOR PLANNING

This drawing is produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

0m100m

Scale 1:2,500

KEY

Site Boundary

Security Fence

Overland Flow Routes

Top of Bank

Bottom of Bank

3m Watercourse Buffer

Flood Risk Constraints

Risk of Flooding from Surface Water Dataset (Current)

Mid Century Climate Change +20% ('Central' allowance for the 2050s epoch (2040–2060))

Note: +25% Climate Change allowance represents the pluvial 'design flood' for development with a lifetime between 2061 and 2100.

NOTES

1. Drawing based on the Site Layout, produced by Renewable Connections, Drawing No. RCN1008–PLE–01 Rev 11 (Dated: 12/02/25)

2. Surface water flood risk zones based on extract from the Environmental Agency Website (Ref: rofsw_cc01_4bandPolygon.shp, downloaded June 2025)

3. Drawing based on Topographical Survey, produced by AIMS Ltd, Drawing No. HR/DWD/HV/001 003 005 006 (Dated: 17/01/2024)

4. Contains public sector information licensed under the Open Government Licence V3.0.

Rev #	Date	Description	Drawn	Check
	13/06/23	First Issue.	RS	IS
A	05/03/24	Site Boundary Update	JS	
B	09/09/24	New Layout	RS	BF
C	25/10/24	Development advice updated	BF	
D	05/06/25	Layout Revision. Flood extents updated to latest EA data.	SLC	BF

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Client

Renewable Connections

Project

Heath Road Solar Farm

Drawing Title

Flood Constraints Plan

Sheet 1 of 1

Drawing No.

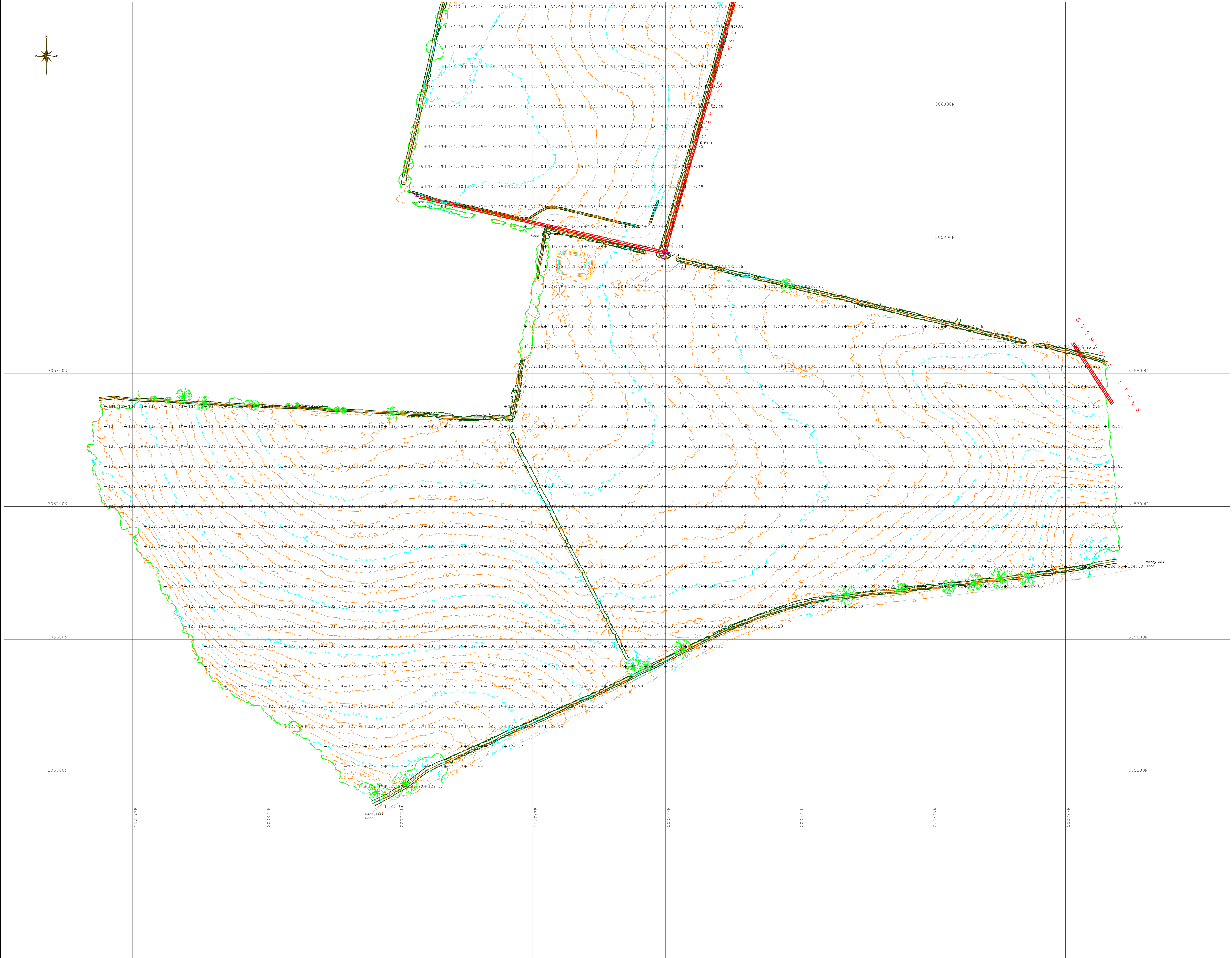
R444/02

E-Mail: scosgrove@pfaconsulting.co.uk

Rev

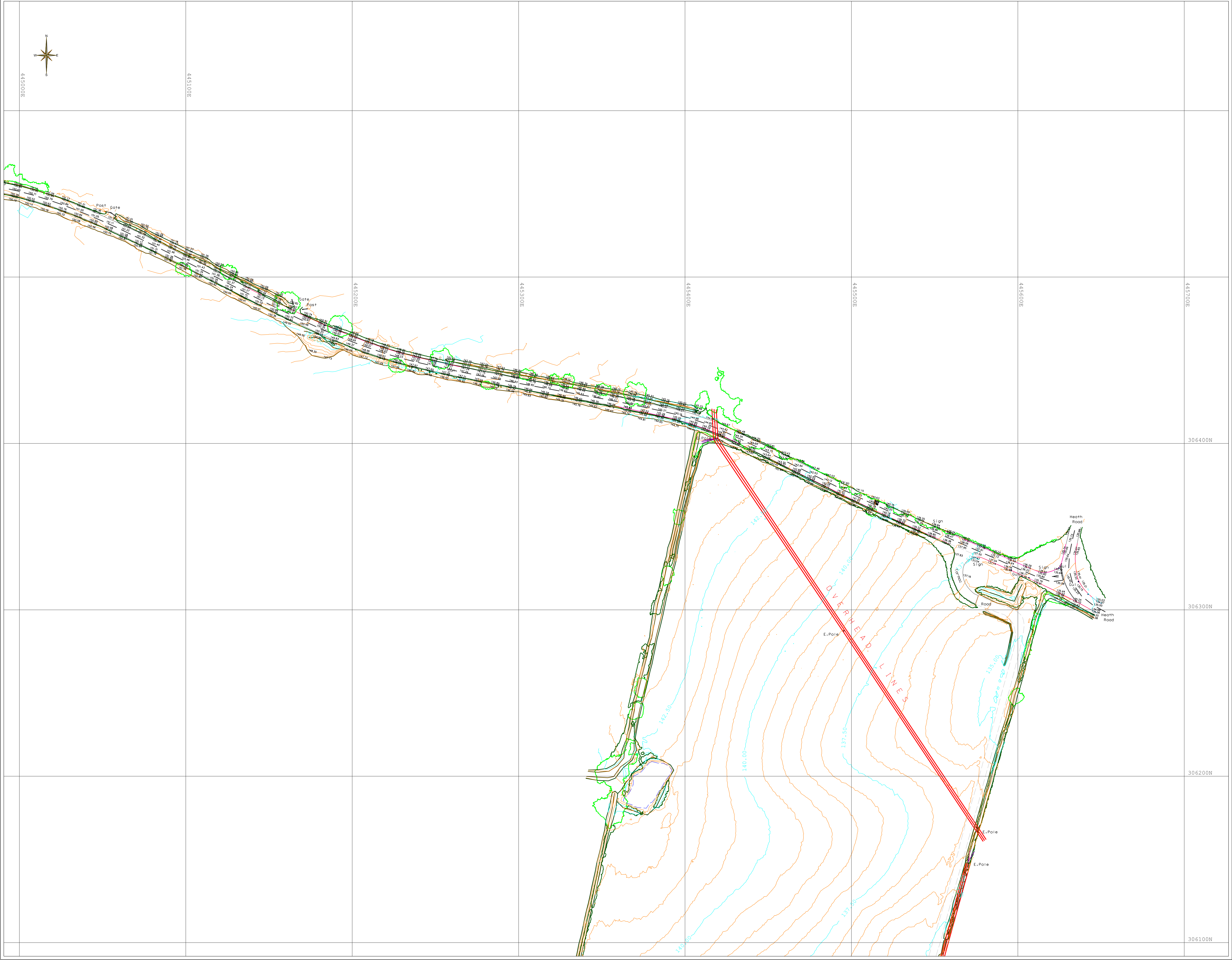
D

A1



Architectural Water Level		Inspection Cover	
Banister		Ironing Wall	
Bollards		Lamp Post	
Bottom of Bank		Master Post	
Bottom of Cuts		Metal Fence	
Bridge		Painted Steel	
Building		Pipe	
Cable Girth		Pipe	
Channel		Pylon	
Chain and Equipment		Ridge	
Chimney		Road and Gate Heights	
Coldwater Pipe		Road Barrier	
Communication Tower		Road Marking	
Concrete Column		Roof	
Concrete Base		RSJ Column	
Concrete Pillar		Rubble	
Concrete Lires		Sign	
Concrete-Normal			
Courtesy-Prominent			
Courtesy Beam			
Coverage Beam			
Culvert		Signal Light	
Ditch		Sign	
Eaves		Spot Level	
Edge of Concrete		Steel Column	
Edge of Glass		Steeple	
Edge of Road		Steps	
Edge of Terrace		Stoneware	
Edge of Trees		Stone Bollard	
Edging Inlet		Structure	
Electricity Pole		Trunking	
Blockade Box		Top of Bank	
Fence Color and Link		Temporary Fence	
Fence Post and Board		Top of Kerb	
Fence Post and Panel		Tree	
Fence Post and Wire		Tree Canopy	
Footpath		Tree Trunk	
Gate		Vegetation	
Gate opening		Walkway	
Gully		Wall	
Hedge		Window	

Rev. Suffix	Date	Details	
SITE			
Heath Road Leicester LE67 1DF			
TITLE			
Topographical Survey with 500mm contour interval and 15m spot levels To OS Grid and Datum			
DWG. No.		REV	
HR/DWD/HV/002			
SCALE	DATE		
1:1250	17/01/24		
DRAWN	STATUS		
H.Vaughan	Draft		
 AIMS REPAIR, INSPECTION & GRAPING SURVEYS LTD 3 The Bridge Business Centre, Beresford Way, Chesterfield, Derbyshire S41 9FG			



LEGEND

Approximate Water Level	Inspection Cover	
Banker	Inside Wall	
Barbed	Ladder	
Bottom of Bank	Lamp Post	
Block Path	Marker Post	
Bottom of Kerb	Metall Fence	
Skips	Painting Sides	
Building	Pegs	
Catch Pit	Post	
Channel	Pylon	
Cable Ray Equipment	Ridge	
Chimney	Ridge and Eave Heights	
Coloured Path	Road Barrier	
Column Base	Road Marking	
Communication Tower	Road	
Concrete Column	Rail Column	
Concrete Pole	Rails	
Conductor Lines	Sign	
ContoursNormal		
ContoursProminent		
Downy Beam		
Downy Beam		
Culvert	Signal Light	
Door	SM	
Drain	Spot Level	
Eaves	Stay	
Edge of Concrete	Steel Column	
Edge of Grass	Stockwork	
Edge of Road	Steps	
Edge of Tarmac	Stockpile	
Edge of Track	Stone Bollard	
Edging Wip	Structure	
Electric Box	Tank/Vale	
Electricity Pole	Top of Bank	
Fence Chain and Link	Temporary Fence	
Fence Post and Board	Top of Kerb	
Fence Post and Panel	Tree	
Fence Post and Wire	Tree Canopy	
Footpath	Tree Trunk	
Gate	Vegetation	
Gate opening	Walkway	
Gully	Wall	
Hedge	Wall	
	Window	

Notes

Survey related to "OS Net" using real time correction with Trimble VRS Now.

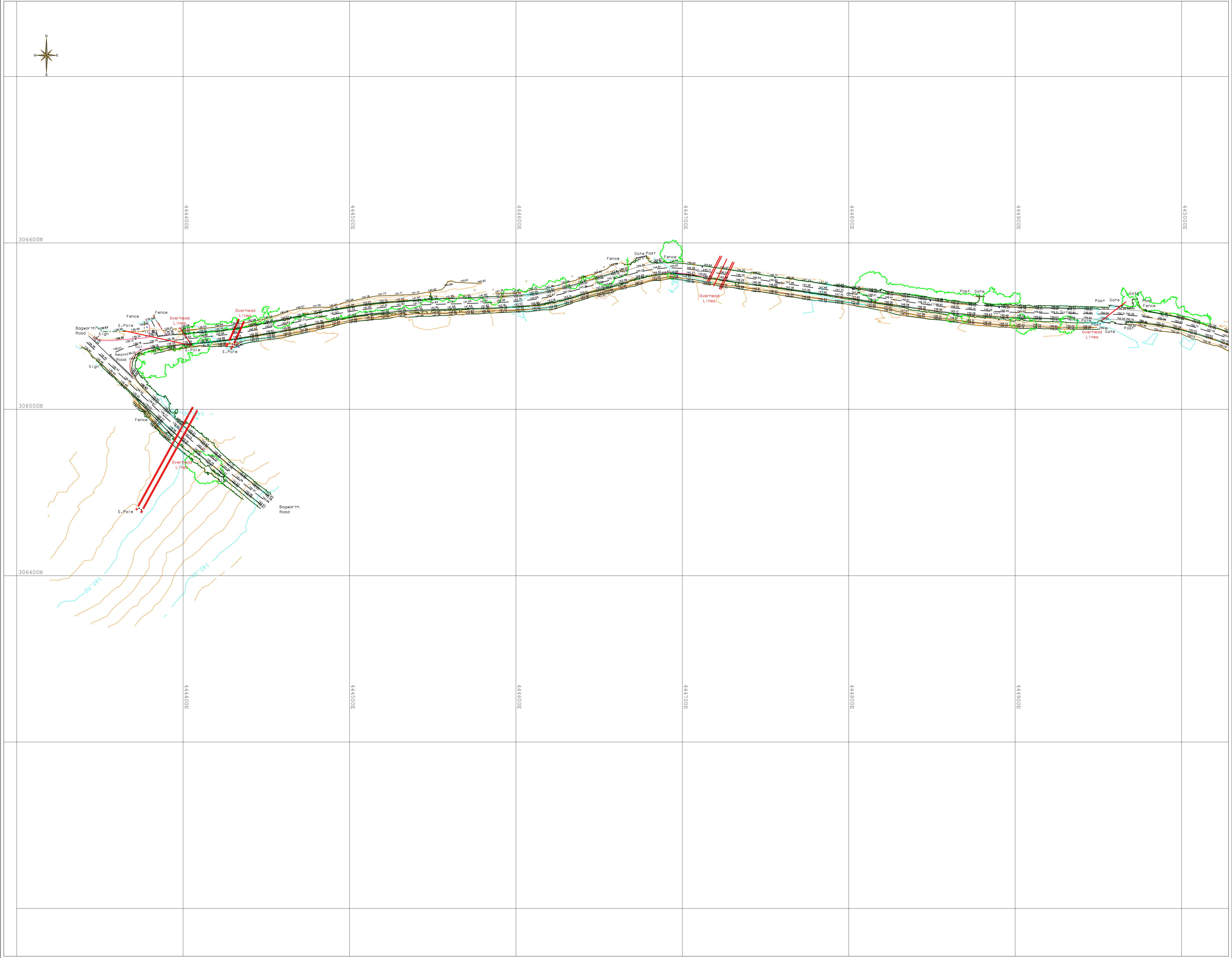
Levels related to GPS Orthometric height, converted to MSL (Newlyn) by OSGM02

Every effort has been made to identify all visible above ground features. However, bare in mind that at the time of survey, some features may have been obscured.

Treat levels in dense vegetation with caution. Treat levels in water with caution.

Visible features detailed on the survey may not represent the legal ownership boundaries.

Rev. Suffix	Date	Details
SITE		
Heath Road		
Leicester		
LE67 1DF		
TITLE		
Topographical Survey		
with 500mm contour interval		
and spot levels		
Road 1		
DWG. No.		REV
HR/DWD/HV/005		
SCALE	DATE	
1:1000	17/01/24	
DRAWN	STATUS	
H.Vaughan	Draft	
		
3 The Bridge Business Centre, Beresford Way, Chesterfield, Derbyshire S41 9FG		
Tel: 01246 288444		



LEGEND

- Approximate Water Level

Banker

Barbed

Bottom of Bank

Bottom of Kerb

Bridge Path

Building

Catch Pit

Channel

Crane/Rail Equipment

Chimney

Cobble Path

Column Base

Communication Tower

Concrete Column

Concrete Pole

Conductor Lines

ContoursNormal

ContoursProminent

Downy Beam

Downy Beam

Culvert

Door

Drain

Eaves

Edge of Concrete

Edge of Grass

Edge of Road

Edge of Tarmac

Edge of Track

Edging H/W

Electric Box

Electricity Pole

Fence Chain and Link

Fence Post and Board

Fence Post and Panel

Fence Post and Wire

Footpath

Gate

Gate opening

Gully

Hedge
- Insider Wall

Ladder

Lamp Post

Marker Post

Metall Fence

Plating Side

Post

Pylen

Ridge

Ridge and Eave Heights

Road Barrier

Road Marking

Road

RSL Column

Rules

Sign

Signal Light

SM

Spot Level

Stay

Steel Column

Stockwork

Steps

Stockpile

Stone Bollard

Structure

Tank/Store

Temporary Fence

Top of Kerb

Tree

Tree Canopy

Tree Trunk

Vegetation

Walkway

Wall

Wall

Window
- Insider Wall

Ladder

Lamp Post

Marker Post

Metall Fence

Plating Side

Post

Pylen

Ridge

Ridge and Eave Heights

Road Barrier

Road Marking

Road

RSL Column

Rules

Sign

Signal Light

SM

Spot Level

Stay

Steel Column

Stockwork

Steps

Stockpile

Stone Bollard

Structure

Tank/Store

Temporary Fence

Top of Kerb

Tree

Tree Canopy

Tree Trunk

Vegetation

Walkway

Wall

Wall

Window

Notes

Survey related to "OS Net" using real time correction with Trimble VRS Now.

Levels related to GPS Orthometric height, converted to MSL (Newlyn) by OSGM02

Every effort has been made to identify all visible above ground features. However, bare in mind that at the time of survey, some features may have been obscured

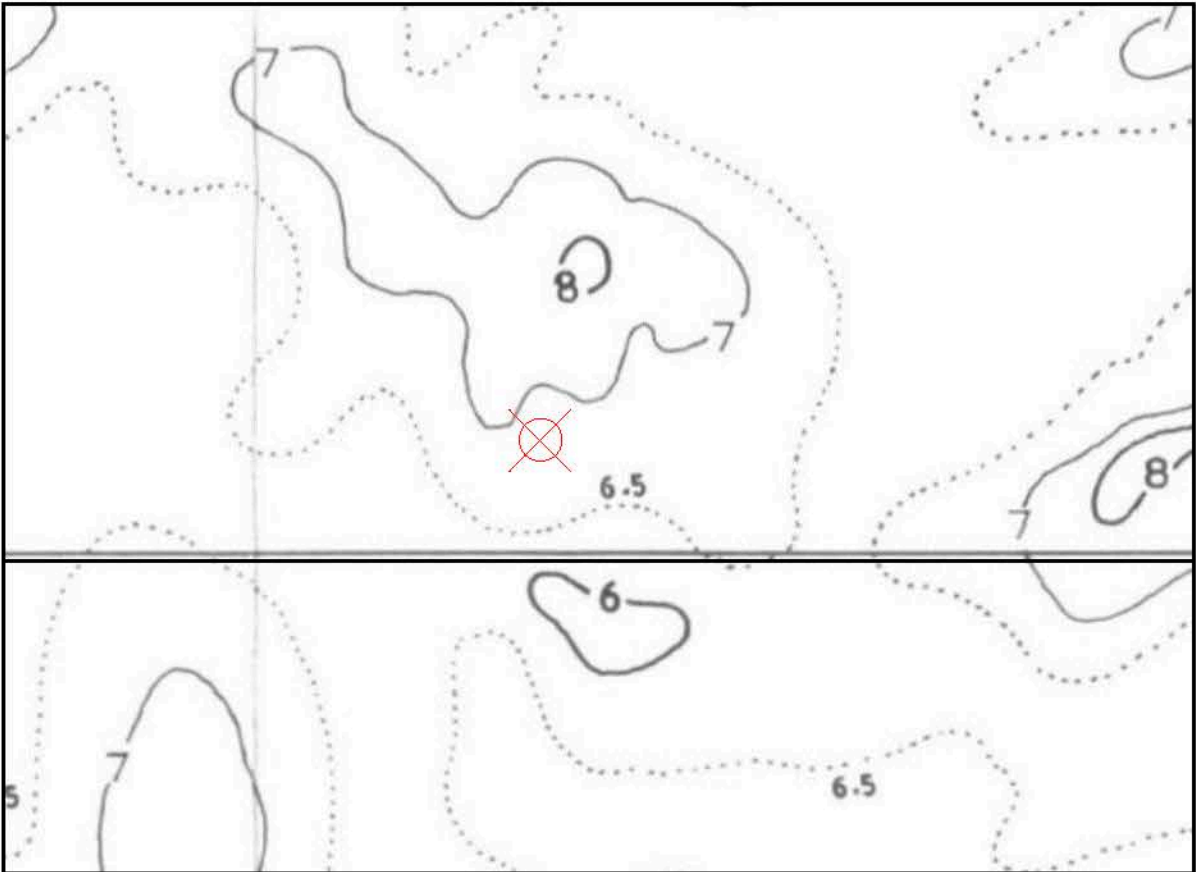
Treat levels in dense vegetation with caution
Treat levels in water with caution

Visible features detailed on the survey may not represent the legal ownership boundaries

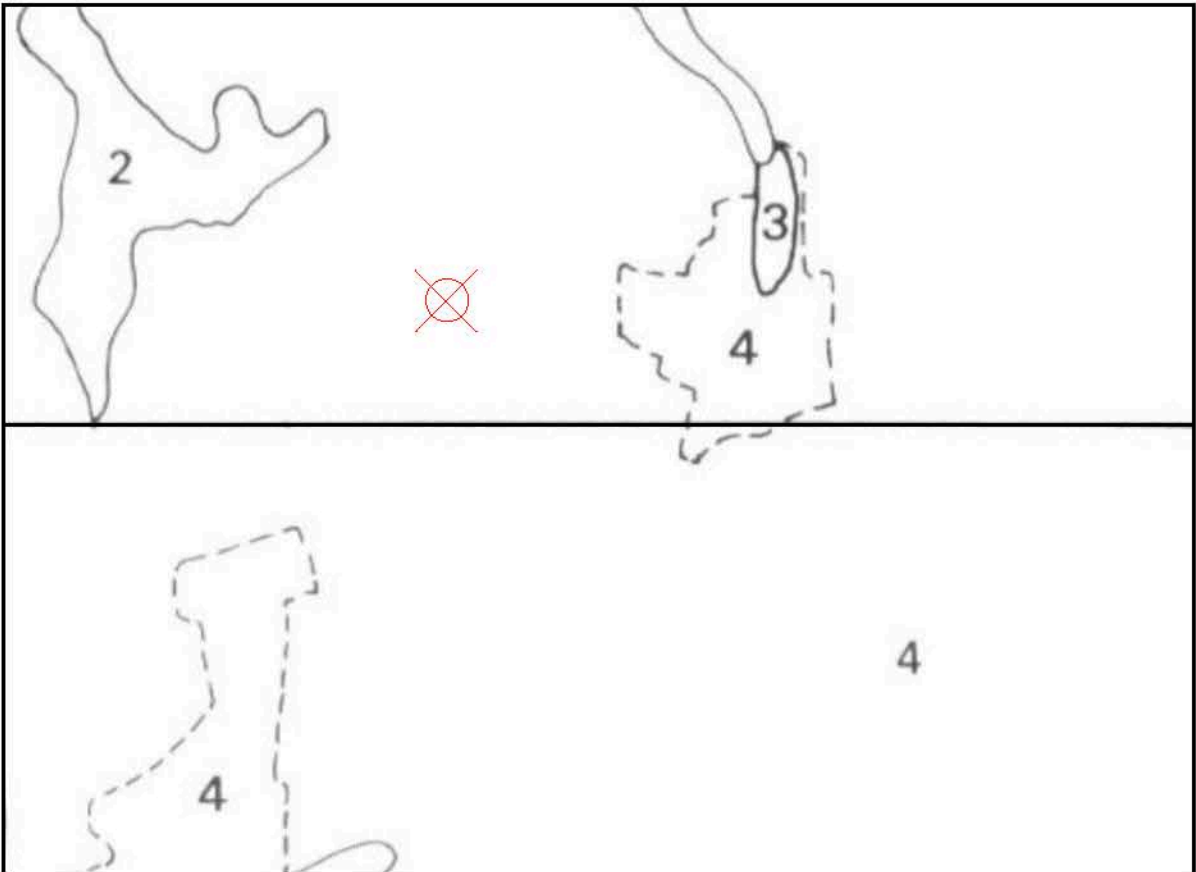
Rev. Suffix	Date	Details
SITE		
Heath Road		
Leicester		
LE67 1DF		
TITLE		
Topographical Survey		
with 500mm contour interval		
and spot levels		
Road 2		
DWG. No.		REV
HR/DWD/HV/006		
SCALE	DATE	
1:1000	17/01/24	
DRAWN	STATUS	
H.Vaughan	Draft	
		
3 The Bridge Business Centre, Beresford Way, Chesterfield, Derbyshire S41 9FG Tel: 01246 288444		



Location Plan



Standard Average Annual Rainfall (SAAR) (in hundreds of mm)



Winter Rain Acceptance Potential (WRAP)

Status

FOR PLANNING

This drawing is produced for the purposes of supporting a planning application and should not be relied upon for tender, pricing, or construction purposes.

NOT TO SCALE

NOTES

1. Standard Average Annual Rainfall (SAAR) and Winter Rain Acceptance Potential (WRAP) map extracts shown on this drawing are reproduced from the maps contained in Volume V of the Flood Studies Report - NERC:1975.

Soil Classification			
Soil Class (WRAP)	Soil Index (I ₀₁)	SPR (FEH)	SI (ADAS)
1	0.15	10	0.1
2	0.30	30	0.5
3	0.40	37	0.8
4	0.45	47	1.0
5	0.50	53	1.3

Rev	Date	Description	Drawn	Check
1	28.10.24	First Issue	RS	BF
A	04.06.25	Template updated	SLC	BF

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Client

Renewable Connections

Project

Heath Road Solar Farm

Drawing Title

SAAR and WRAP Maps

Sheet 1 of 1

Drawing No.	R444/03	Rev	A
E-Mail:	scosgrove@pfapl.com		A3